RESEARCH AND INDUSTRY

VOL-3 NO-1-3

Jan - May } 1958

Current Science

Vol. 3, No. 1, January 1958

COUNCIL OF SCIENTIFIC & INDUSTRIAL RESEARCH

NEW DELHI

VOL. 3, NO. 1,
JANUARY 1958

Research and Industry

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RESEARCH & INDUSTRY *is issued monthly.*

Communications regarding contributions for publication, books for review, subscriptions and advertisements should be addressed to the Editor, RESEARCH & INDUSTRY, COUNCIL OF SCIENTIFIC & INDUSTRIAL RESEARCH, *Old Mill Road, New Delhi*-2.

Editor : **B. N. Sastri** *Asst. Editor :* **R. D. Taneja**

Annual Subscription : Rs. 8 **Single Copy : Re. 1**

Project Costs: III— The Cottonseed Industry

K. S. CHARI, S. A. SALETORE & S. H. ZAHEER
Regional Research Laboratory, Hyderabad

The present position of the cottonseed industry in India is critically reviewed. It is pointed out that there is an immediate need for starting a number of composite units for the complete utilisation of cottonseed. The steps involved in processing the seed are detailed and the costing for processing 100 tons per day of American variety of seed has been worked out. The problems of cottonseed industry in India are examined and the steps taken to stimulate the development of the cottonseed oil industry in the country are enumerated.

INDIA is one of the oldest cotton growing countries in the world ; yet there hardly exists in the country a well-developed and organized cottonseed industry. Of the annual production of 1·7 million tons of cottonseed[1], barely 6 per cent is crushed ; the rest is used as cattle feed after setting aside a portion for sowing. In contrast to this, U.S.A. crushes 75 per cent of her annual produce of 6 million tons of the seed. The oil is used for edible purposes and the cake for cattle feed[2].

At a recent meeting of vanaspati manufacturers in New Delhi[3], it was agreed that cottonseed oil should be used in vanaspati manufacture to the extent of 10 per cent of the total oil requirements. There are 51 vanaspati factories in India with an installed capacity of 4,12,000 tons per year[4] though the actual production of vanaspati during 1955–56 was 2,75,599 tons only. It is proposed to step up the production to 4,00,000 tons by 1960–61. This would require about 4,50,000 tons of vegetable oils, of which 45,000 tons (10 per cent basis) would be cottonseed oil. The planned target for the production of cottonseed oil by 1960–61 is only 30,000 tons per annum[5] ; the balance will have to be either imported or made available by the installation of new units.

Only eight organized cottonseed crushers in India with a total annual capacity of 81,400 tons of seed[2], have machinery for delinting, hulling and crushing; other factories generally crush whole seed. Licenses have been recently granted for setting up seven additional plants with a total annual capacity of 1,33,500 tons[2]. Thus the total capacity for cottonseed crushing by the end of the second Five-Year Plan period would be 2,14,900 tons per annum. Even assuming that crushing is carried on throughout the year, the total production from the 15 units cannot exceed 25,000 tons of cottonseed oil ; the actual production will, however, be much lower because of seasonal crushing.

The estimated production of cottonseed in India[1] for 1956–57 was 1,723,000 tons (1,158,000 tons *desi* variety and 575,000 tons American variety). The *desi* seeds have an average linter content of 3·8 per cent ; the American type, about 13·3 per cent[6]. The latter does not find favour as cattle feed. Cottonseed crushers prefer the latter because of its higher yield of oil and of by-product linters.

For efficient utilisation, cottonseed should be properly cleaned, delinted, hulled and cleaned. The meats should be ground or flaked, cooked and the oil then expelled. The cake should be

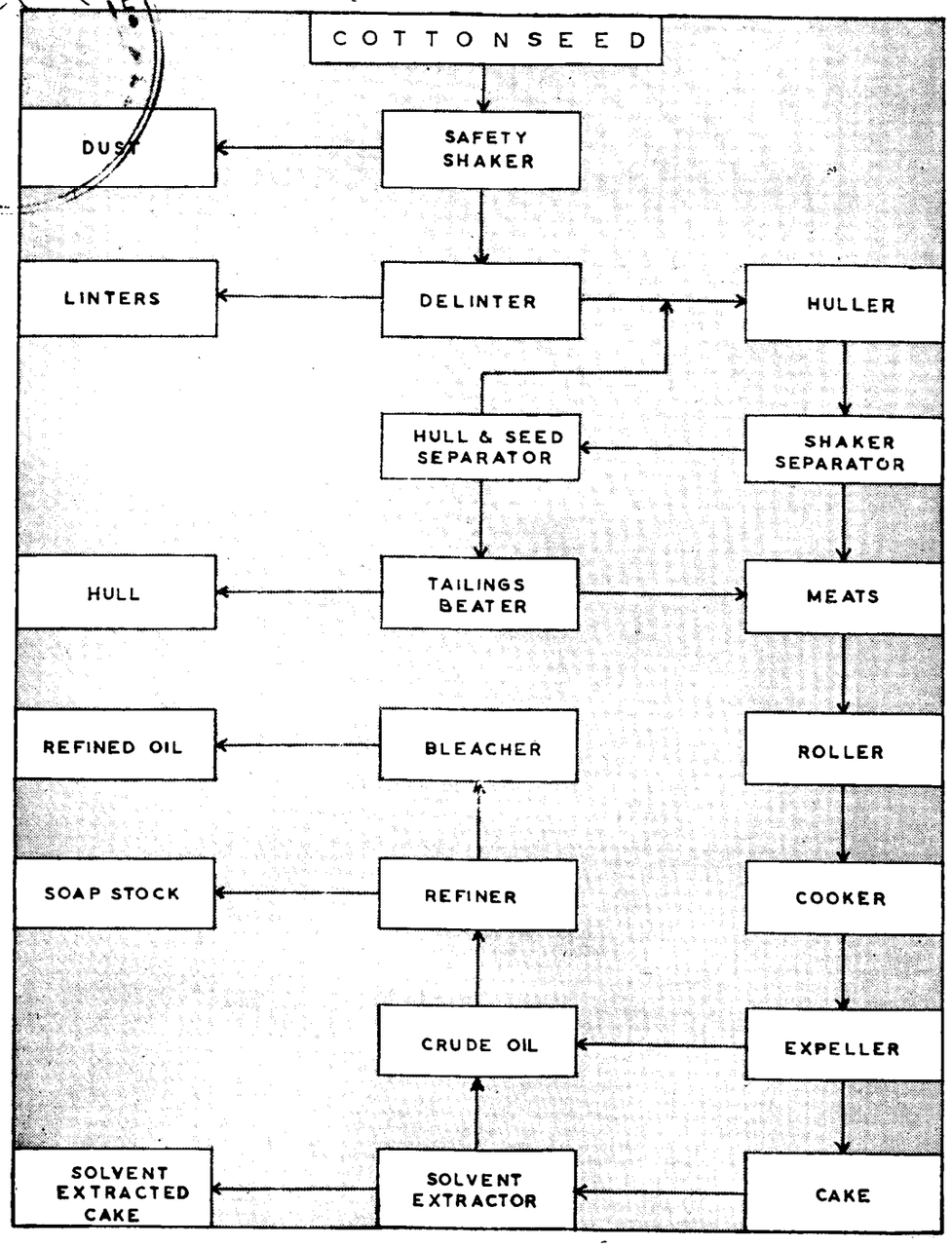

FIG. 1 — COTTONSEED PROCESSING: FLOWSHEET

ent-extracted for maximum oil recovery the oil should be refined to give edible oil. steps in the processing of cottonseed are n in Fig. 1.

oducts obtained by processing 100 tons onseed (American variety) are as fol- crude oil, 17 (refined oil, 16); de-oiled ·5; hulls, 27; linters, 6; and foots,

gives the break-up of costs for a ocessing 100 tons of the American per day.

BLE 1 — PROJECT COSTS OF OCESSING COTTONSEED

...is per day, 300 days per year)

Capital

Plant and Equipment	*Rs.*
Cleaning unit and accessories	30,000
Delinters (20) with accessories	2,50,000
Hulling units (2) with accessories	50,000
Separation units with accessories	65,000
Grinding unit	10,000
Expellers (6) with accessories	3,00,000
Refining plant (continuous)	1,25,000
Bleaching plant	50,000
Solvent extraction plant (50 tons)	8,00,000
Boiler and other accessories	70,000
Building and erection	2,50,000
TOTAL ...	20,00,000
Working capital	20,00,000
TOTAL INVESTMENT	40,00,000

Direct Cost *

Raw Materials	*Cost Per Day*
Cottonseed, 100 tons at Rs. 312/ton	31,200
Alkali, 200 kg. at Rs. 900/ton	180
Solvent 500 kg. at Rs. 1,120/ton	560
	31,940
Utilities	
Electricity, 13,000 kWh at Rs. 0·10 per kWh	1,300·00
Steam, 47 tons at Rs. 12/ton	564·00
Water, 33,500 gal. at Re. 1/100 gal.	33·50
	1,897·50
Supervision and Labour	
Plant Supdt., Rs. 1,000 p.m.	40·00
Shift and Chemical Engineers, 4 at Rs. 350 p.m.	56·00
Shift foreman, 4 at Rs. 200 p.m.	32·00
Mechanics, 4 at Rs. 150 p.m.	24·00
Skilled labour 24, at Rs. 3 per head per day	72·00
Unskilled labour 48, at Rs. 2 per head per day	96·00
	320·00

* Based on rates prevailing on 15 Sept. 1957

Maintenance	*Rs.*
Spares and replacements, 5% of plant cost	333·33
Maintenance, 5% of the plant cost	333·33
	666·66
Packing	1,800·00
TOTAL DIRECT COST	36,624·16
Indirect Cost	
Depreciation, 10% of plant cost	666·67
Interest, 5% on total investment	666·67
Insurance etc. 2% on plant cost	133·33
Establishments and sales (50% of labour and supervision charges)	160·00
TOTAL INDIRECT COST	1,626·67
TOTAL DIRECT AND INDIRECT COST	38,250·83
Returns *	
Refined cottonseed oil, 16 tons at Rs. 1,490/ton	23,840·00
Linters, 6 tons at Rs. 392/ton	2,352·00
De-oiled cake, 42·5 tons at Rs. 280/ton.	11,900·00
Hulls, 27 tons at Rs. 93/ton	2,511·00
Cottonseed foots, 2 tons at Rs. 500/ton.	1,000·00
	41,603·00
Profits	
Gross profit per day	3,352·17
Gross profit per year	10,05,651·00
Gross profit on investment	25·15%

Some Problems

The cottonseed industry stands apart from other vegetable oil industries. It requires high investment, because a number of complicated processes are involved. Unlike other vegetable oils, crude cottonseed oil (because of its dark colour) cannot be used for edible purposes without refining. Further, processing yields several by-products like linters, hulls, cake and soapstock and the economics of the industry depend on the price that these products fetch.

Most cottonseed plants in India sell 'mill-run' linters at the best obtainable price. Superior 'first cut' linters used for surgical cotton, paper, batting for mattresses, etc. are not in demand at present. 'Second cut' linters are specially suitable for chemical industries like rayon, plastics, gun cotton, etc. The present demand of 1,500 tons per year for rayon is likely to go up soon.

The sale of cottonseed hulls is a major problem. Sometimes they are used as fuel. The hulls could be better utilized as roughage in cattle feed, for soil conditioning, and as

raw material for furfural, active carbon, etc. There is a good demand for hulls abroad and some firms are exporting them.

The disposal of oil cake at a remunerative price also presents difficulty. Indian cattle owners, accustomed to feeding cattle with whole cottonseed or other oil cakes in the form produced by expellers, fight shy of accepting a powdery meal as it comes out of solvent extraction plants. The preparation of compound oil cake feed in cube form, where part of the hulls are added back, may be a good solution.

The biggest problem in the cottonseed industry is the disposal of the soapstock or ' foots ', a dark semi-viscous mass containing 8–20 per cent of neutral oil and 20–50 per cent of mixed fatty acids, mostly as soap. Some industries utilise a part of the foots for making cheap black soap; others stock the product in the hope of finding a good market. The common practice in other countries is to split the soapstock, and obtain by distillation, light coloured fatty acids for use in the manufacture of superior types of soaps.

The Government of India, realizing the difficulties of the industry, has recently taken a number of steps to stimulate the development of the cottonseed oil industry in the country : The excise duty on vegetable oils has been reduced by 50 per cent for cottonseed oil ; free export of both oil and cake has been permitted ; a crude fibre limit of 9 per cent in the cake has been fixed to prevent undecorticated cake being exported ; and while discouraging the establishment of new oil mills for crushing groundnut and other major oilseeds, licences are readily granted for installing cottonseed oil mills.

While these steps are to be welcomed, further action along the following lines is suggested to encourage the establishment of cottonseed crushing industry in the country : (1) The vanaspati manufacturers have agreed to incorporate cottonseed oil to the extent of 10 per cent in the oil used for hydrogenation ; this limit may be raised in due course. While export of cottonseed cake may continue for sometime, greater encouragement should be given for the export of de-oiled cake containing not more than one per cent oil ; this will give an incentive to the solvent extraction of oil cake. Licences for the import of cottonseed processing machinery should be liberally issued; preference should be given to composite oil mills which include solvent extraction plants. A fair price for linters (based on processing costs) should be fixed to avoid monopolistic control.

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Sodium Chloride A.R. & B.P. from Marine Salt

D. J. MEHTA, B. K. SHUKLA & M. C. VAIDYA

Central Salt Research Institute, Bhavnagar

A process is described for refining marine salt to A.R. and B.P. grades of sodium chloride. The bulk of soluble impurities, present in marine salt, are removed by washing. A saturated solution of the washed salt is then prepared and treated with calcium oxide and sodium carbonate to remove the residual impurities. Fractional crystallisation from purified solution yields salt of the required grade. Yield of A.R. Salt, 33 per cent ; cost per lb. ex-works, Rs. 1.75 (A.R.) ; Rs. 1.35 (B.P.).

THE major impurities in marine salt are magnesium sulphate, magnesium chloride and calcium sulphate. The manufacture of Analar and British Pharmacopoeia (B.P.) grade sodium chloride must involve the quantitative removal of all the impurities from salt. Various methods have been described for the removal of calcium, magnesium and sulphate ions. In one method[1], calcium and magnesium are removed by treatment with disodium hydrogen phosphate and sodium carbonate, followed by the elimination of sulphate ions by barium chloride. In another method[2], barium chloride is used to precipitate sulphate ions ; hydrogen peroxide is employed to oxidise iron, and sodium carbonate, to remove alkaline earth metals. The *p*H is then adjusted to 6·5 to remove aluminium, magnesium and silicon compounds, followed by fractional crystallisation to obtain pure sodium chloride. Pure sodium chloride[3] is also obtained by the treatment of saturated salt solution with chlorine, followed by two successive precipitations by hydrochloric acid, and fusion of air-dried product.

The process evolved in this Institute involves : (i) removal of the bulk of soluble impurities, in the first instance, by washing marine salt ; (ii) removal of residual soluble impurities from a saturated solution of the washed salt by treatment with calcium oxide and sodium carbonate ; and (iii) fractional crystallisation of sodium chloride from the purified saturated solution of the salt.

(i) *Washing* — Common sea salt (sodium chloride, 97·02 ; calcium sulphate, 0·314 ; magnesium sulphate, 0·65 ; and magnesium chloride, 0·964 per cent) is ground to pass through No. 16 British Standard Sieve (B.S.S.), made into a slurry with water, stirred mechanically for some time, and centrifuged. In a typical experiment, 45 lb. of ground salt was mixed with 9 litres of water, stirred mechanically for 30 min. at room temperature, and centrifuged. The residue was analysed for impurities. Seventy-six per cent of the magnesium, 65 per cent total sulphates and 44 per cent calcium originally present in the marine salt had been removed by washing; the loss of sodium chloride was 18 per cent.

(ii) *Precipitation* — The residual salt (38 lb.) was dissolved in water (42 litres) and heated to boiling. A slurry of calcium oxide (38 g.) was then added, the mixture stirred for 10 min., sodium carbonate (100 g.) in aqueous solution added, and the stirring continued for 10–15 min. The precipitated mass was allowed to settle and the clear brine decanted and filtered. The *p*H of the filtrate was adjusted to 6–7 by the addition of hydrochloric acid (sp. gr. 1·16 ; 70–75 ml.).

(iii) *Fractional Crystallisation* — The filtrate (45 litres) was charged into a double-jacketted, open, Monel metal evaporator, fitted with a stirrer and heated by steam. Crystallisation was carried out at 100–102°C. under constant stirring. The first fraction of sodium chloride was removed after 3 hr., when about 21 litres of brine had evaporated. The crystal mass was centrifuged and washed with distilled water (600–700 ml.) forced through a fine jet on the crystals. Traces of any sodium sulphate adhering to the sodium

chloride crystals were thereby removed. The crystal mass was taken out and dried at 120°C. Yield 33 per cent of the marine salt originally taken.

The mother liquor (24 litres) from the first fraction was charged into the evaporator and crystallisation continued for about 2 hr., when 15–16 litres of brine evaporated. The crystals were centrifuged and washed, as described previously, with distilled water.

The mother liquor can be evaporated further to crystallise out salt useful as table salt (sodium chloride content, 99·6%).

Analysis — The first fraction complies with the specifications for Analar sodium chloride. The second fraction complies with specifications for B.P. sodium chloride.

The ex-works cost of packed Analar and B.P. sodium chloride in 1 lb. packing, would be approximately Rs. 1·75 and Rs. 1.35 respectively. In view of their comparatively high current market prices, the production of A.R. and B.P. quality sodium chloride could be undertaken with a reasonable margin of profit.

The authors are thankful to Dr. A. N. Kappanna, Assistant Director-in-Charge, Central Salt Research Institute for encouragement and keen interest in the work.

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Adhesives from Acacia Cutch

D. NARAYANAMURTI, P. RAMACHANDRA RAO & RULIA RAM

Composite Wood Branch, Forest Research Institute, Dehra Dun

Cutch from the heartwood of *Acacia catechu*, which is obtained as a bye-product in the Indian *katha* industry, has been found to be useful as a raw material for plywood adhesives. A typical adhesive contains : cutch, 100 g.; water, 80 g.; paraformaldehyde, 10 g. ; alkali (NaOH), 1.5 g.; and wood flour, 5 g. Satisfactory results have been obtained with the glue under the following pressing conditions : temperature, 120°C.; pressure, 200 lb. sq. in. and time of pressing, 12 minutes. The adhesive compares favourably in cost with similar adhesives which are in use. Glue adhesion test results with different species of wood are given.

CUTCH is the major constituent of the water soluble portion of the heartwood of *Acacia catechu*, the other, minor but more valuable, component being *katha* (catechin). At present cutch is obtained as a bye-product in the *katha* industry which is mostly located in Bareilly, Gwalior and Bombay. Of the total water soluble extract from the heartwood (12 per cent), cutch forms more than 9 per cent on the weight of the heartwood. However, in the indigenous method of manufacturing *katha* employing a crude type of filtration through a sand bed, most of the cutch which remains in solution even in the cold is allowed to go waste with the mother liquor. This waste can be prevented and the cutch fully recovered by introducing certain modifications in the indigenous method. The acacia cutch sells at about Rs. 50 per md. (37·3 kg.).

Although cutch is produced in the country, its indigenous market is restricted, the chief industrial use being in dyeing cotton and silk and in calico printing. It has, therefore, been tried as a raw material for preparing adhesives for the plywood industry.

Commercial cutch contains 5–15 per cent catechin, 50–65 per cent catechu-tannic acid and 10–20 per cent non-tannins. On account of the high percentage of the tannin content and in view of the recent work done by the authors in developing adhesives from tamarind seed testa tannins, cutch becomes an important source for the preparation of tannin-formaldehyde adhesives[1].

TABLE 1 — ADHESION TESTS WITH ACACIA CUTCH GLUE

Glue	Dry			Hot Wet		
	Failing load Kg.	(lb.)	Glue failure %	Failing load Kg.	(lb.)	Glue failure %
Without alkali	151	(333)	20	142	(313)	92
With alkali	165	(364)	7	140	(308)	94

TABLE 2 — GLUE ADHESION TESTS AT DIFFERENT TEMPERATURES

Temperature °C.	Glue	Dry			Hot Wet		
		Failing load Kg.	(lb.)	Glue failure %	Failing load Kg.	(lb.)	Glue failure %
100	I	92	(202)	81	64	(141)	100
100	II	115	(254)	58	84	(185)	100
110	I	105	(232)	71	50	(110)	100
110	II	119	(262)	38	80	(176)	100
120	I	94	(208)	73	52	(115)	100
120	II	122	(269)	28	88	(195)	100

A glue from the solid cutch is prepared by dissolving the cutch in boiling water and mixing the cooled tannin solution with paraformaldehyde. The glue has the following composition : solid cutch powder, 100 g. ; water, 80 ml. ; paraformaldehyde, 5 g. ; alkali (NaOH), 0.5 g.

Adhesion Tests

The glue has been tested with and without addition of alkali. The veneer (*toon*) cores (1/16 × 6 × 6 in.) were painted with the glue and the veneer assembly pressed at 14 kg./sq. cm. (200 lb./sq. in.) at 145°C. for 20 minutes. The results are given in Table 1.

While preparing boards of commercial size at 145°C. it is necessary to pre-condition the veneers to a suitable moisture content before painting and pressing to avoid formation of steam pockets. Using the cutch adhesive, it is possible to get good boards at a considerably lower temperature (120°C.) thus eliminating this defect.

The above composition with the addition of wood flour (5% on the weight of cutch) as a filler was also tried with *toon* veneers at 100°, 110°, and 120°C., employing 14 kg./sq. cm. (200 lb./sq. in.) pressure for 20 minutes. This composition was labelled Glue I ; another variation (Glue II) was obtained by adding sodium hydroxide (1·5 g. on the weight of cutch) to Glue I.

The results of trials conducted with compositions I and II are given in Table 2.

The above experiments show that Glue II gives reasonably good results at 120°C., the failing load of 122 kg. (269 lb.) for plyboard pressed at 120°C. falls short of 165 kg. (364 lb.) which has been obtained with *toon* species pressed at 145°C. (Table 1). Consequently a composition with higher paraformaldehyde content (Glue III) was tried. This contained: cutch, 100 g. ; water, 80 g. ; paraformaldehyde, 10 g. ; alkali (NaOH), 1·5 g. ; woodflour, 5 g.

The results of trials with plyboards obtained from *toon* veneers (Table 3) show that Glue III gives better results.

With a view to shortening the duration of pressing without affecting the adhesive strength, experiments were done using Glue III and pressing the board at 120°C. for different periods using *toon* veneers. The results are given in Table 4.

TABLE 3 — GLUE ADHESION TESTS WITH TOON VENEERS

Glue	Dry: Failing load Kg. (lb.)	Dry: Glue failure %	Hot Wet: Failing load Kg. (lb.)	Hot Wet: Glue failure %
II	119 (262)	38	80 (176)	100
III	137 (303)	42	96 (212)	100

TABLE 4 — EFFECT OF DURATION OF PRESSING ON GLUE ADHESION

Pressing Time Min.	Dry: Failing load Kg. (lb.)	Dry: Glue failure %	Hot Wet: Failing load Kg. (lb.)	Hot Wet: Glue failure %
20	100 (220)	67	88 (194)	100
15	117 (257)	50	88 (194)	100
12	117 (258)	8	93 (206)	60
10	117 (258)	0	100 (220)	50
7	134 (295)	8	95 (210)	80
5	98 (216)	60	72 (158)	100

TABLE 5 — ADHESION TESTS WITH DIFFERENT WOOD SPECIES

Species	Glue	Pressing Time Min.	Dry: Failing load Kg. (lb.)	Dry: Glue failure %	Hot Wet: Failing load Kg. (lb.)	Hot Wet: Glue failure %
Cedrela toona (Toon)	III	12	120 (264)	0	115 (254)	20
		7	117 (258)	8	95 (210)	80
	II	7	107 (236)	50	79 (174)	100
Dipterocarpus sp. (*gurjan*)	III	12	132 (291)	100	93 (206)	100
		7	84 (186)	100	53 (116)	100
	II	7	87 (192)	100	43 (95)	100
Hardwickia pinnata (*anjan*)	III	12	99 (219)	0	93 (206)	40
		7	117 (258)	30	89 (196)	100
	II	7	100 (220)	100	53 (116)	100
Zanthoxylum rhetsa (*mullilam*)	III	12	116 (256)	30	91 (201)	90
		7	103 (226)	100	74 (164)	100
	II	7	80 (176)	100	34 (74)	100
Holoptelea integrifolia (*kanju*)	III	12	101 (222)	9	93 (206)	70
		7	100 (220)	100	72 (158)	100
	II	7	92 (202)	100	37 (82)	100
Bombax malabaricum (*Semul*)	III	12	86 (189)	0	72 (159)	56
		7	72 (202)	88	47 (104)	100
	II	7	96 (212)	100	23 (50)	100

TABLE 6—COST OF ADHESIVE FROM ACACIA CUTCH

Materials	Cost Rs.
Cutch, one md. at Rs. 50/md.	50·00
Paraformaldehyde, 8 lb. at Rs. 3/lb.	24·00
Sodium hydroxide, 2 lb. at 50 nP./lb.	1·00
Wood flour, 6 lb. at 50 nP/lb.	3·00
Cost of 96 lb.	78·00
Cost per lb.	81 nP.

Spread of glue per lb. is 40 sq. ft. Hence cost per sq. ft. of glue line is 2 nP.

It is seen that a pressing time of 7–12 minutes at 120°C. gives good results. The results with different species are given in Table 5. The temperature of pressing in all cases was 120°C.

It is seen that a pressing time of 12 minutes gives better results than pressing for 7 minutes in almost all the species tested. Glue III containing 10 per cent paraformaldehyde gives better results than the Glue II containing only 5 per cent paraformaldehyde.

The spread of the glue is about 40 sq. ft. (3·7 sq. m.) of glue line per pound (454 g.) of glue. Hence 1,000 sq. ft. of glue line would cost Rs. 20·25 which is about 2 nP. per sq.ft. (0·09 sq. m.) of glue line. (Table 6). Glue II which is slightly inferior, is comparatively cheaper and works out at Rs. 17·25 per 1,000 sq. ft. (92·9 sq.m.) of glue line which is about 1·75 nP. per sq. ft. of single glue line.

Laminated and compregnated boards have also been prepared using Glue III with encouraging results. Further work in this direction is in progress.

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Thermosetting Resin from Tar Acids

A. N. BASU, C. S. B. NAIR, V. N. BADAMI & A. LAHIRI

Central Fuel Research Institute, Jealgora

A water soluble thermosetting type of resin has been prepared from tar acids without the use of pure phenols. The resin can be impregnated on different fillers without the use of an organic solvent. Materials such as hard boards possessing insulation properties have been prepared by this process from fillers like saw dust, jute fibres, bamboo pulp, bagasse, glass wool, mica dust, etc.

SYNTHETIC resins are being increasingly used in moulding powders, surface coatings, laminated sheets, hard boards used for construction and insulation work, and for bonding of glass fibres to make light structures having high mechanical strength. The production of such resins in India is almost negligible and the bulk of the requirements are met by imports. The annual import of hard boards alone runs into about Rs. 85 lakhs, which barely meets 10 per cent of the actual demand.

Investigations have been conducted at this Institute to prepare a water soluble thermosetting type of resin from tar acids. The method developed (*Indian Pat.* No. 56581) does not involve the use of pure phenols normally required for preparing P.F. resins. Besides, the soluble thermosetting resin produced can be impregnated on different fillers without the use of an organic solvent.

The tar acids are recovered by extracting the distilled tar fractions with alkali. The crude alkali extracts are condensed with formaldehyde under controlled conditions to produce a water soluble resin. The alkali acts

FIG. 1 — HARD BOARDS MADE FROM RESIN IMPREGNATED FILLERS

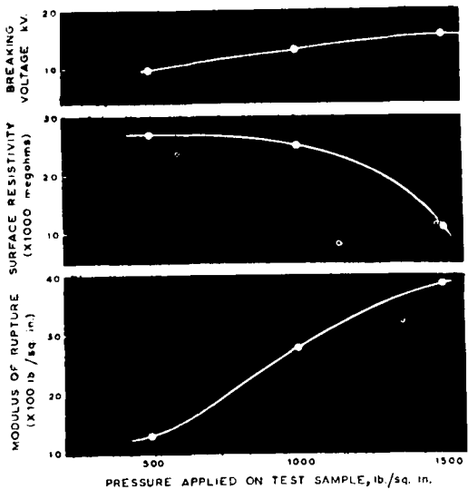

FIG. 2 — PHYSICAL PROPERTIES OF BOARDS

both as a catalyst for resinification and as a reagent for imparting water solubility. This step substantially reduces the cost by obviating the need for liberating the tar acids from alkali extract and also saves the cost of alkali in the resinification process.

For impregnation of the resin in various fillers, the resin is precipitated by controlling the *p*H of the solution. This method of impregnation (*Indian Patent* No. 56582) keeps the material free from any acid or alkali and results in better impregnation of the resin on the surface and in the interstices of the fillers which makes for better bond strength to the finished material.

It has been possible to produce by this process hard boards (Fig. 1) with fillers like sawdust, jute fibres, bamboo pulp, bagasse, glass wool, mica dust, asbestos, etc. Moulding powders have also been prepared for production of moulded articles. The materials produced are hard, possess insulation properties and can be machined. The properties of the products can be controlled within wide ranges by adjusting the percentage of resin impregnated, quality of the resin, pulp or filler used, treatment of the fillers, pressure and temperature employed, etc. Some of the physical properties of finished hard boards using sawdust as filler and resin at 10 per cent level are shown in Fig. 2.

Enquiries are invited from parties interested in the commercial exploitation of the process.

Wood and Bamboo Diapers

Diapers made from wood and bamboo find a number of applications in interior decoration and decorative construction work. Wood diapers are used for decorating walls and flooring of rooms and bamboo diapers for making attractive frames, boxes, ornamental furniture, panels for railway coaches, etc.

The article describes a simple method of gluing chips and veneers of different colours to produce diapers of several attractive designs and patterns. Pleasing patterns can be obtained by arranging undyed and dyed bamboo strips alternately, gluing them together in the desired pattern, followed by slicing the conditioned block and re-gluing suitably.

DIAPERS made from wood and bamboo are used for decorating walls and flooring of rooms. When formed into blocks, they can serve the purpose of tiles. Diapers from bamboo make attractive frames, boxes, ornamental furniture, railway coaches, etc. The Forest Research Institute, Dehra Dun have developed a simple method of gluing the chips and veneers of different colours to produce ornamental diaper patterns from mango and *shisham* woods and from bamboo (Fig. 1).

Wood Diaper — Mango and *shisham* veneers (1/16 in. and 1/10 in.) are soaked in water until the wood gets softened and the veneers can be easily bent to the desired shape. The water-soaked veneers are pressed in a suitable mould to remove the water absorbed by the wood and to get the required shape. After 1–2 days the veneers shaped in the mould are painted with a casein flouride glue and placed one over the other in the order required to obtain the desired pattern. The whole block is placed in a mould and subjected to a pressure of about 200 lb./sq. in. for 36–48 hours. The laminated, corrugated block is then removed from the press and the mould dried in the open. The block is planed on all sides so as to get a regular shape free from grooves or corrugations. A simple wave-like structure is now seen in the body of the block ; this is the first stage in the preparation of further patterns.

FIG. 1 — ASSEMBLING OF DIAPERS

FIG. 1—CENTRE TABLE WITH DIAPER PATTERN

The conditioned block is held in a vice with the chain structure uppermost and sawn along the grain into veneers of 1/16 or 1/8 in. thickness. These veneers are then arranged in reversed directions (180°) and again painted with casein flouride glue and subjected to a pressure of about 200 lb./sq. in. The chain pattern thus obtained is cut across the grain with a saw ; the sawn veneers are pasted on a plywood sheet or on of a plank of wood.

Slices of various thickness can be cut and fixed on tables to give various designs (Fig. 2). More designs can be developed from this two veneered block with the help of a mirror. When the mirror is placed on the pattern at various angles, it exhibits new forms and the worker can thus cut the block at the point indicated by the mirror and join the cut portions for getting different patterns.

If simple and plain designs are required for borders, etc. or for the outer face of boxes, a laminated block of different coloured veneers is made by applying glue and pressure to straight veneers without causing any corrugations.

Bamboo Diaper — Beautiful patterns can be produced using bamboo strips dyed in various colours. For colouring, the strips of bamboo are first boiled in 10 per cent aqueous caustic soda for 24 hours. The treated strips are washed in running water to remove the alkali and then air-dried. The dried strips are again boiled in a dye solution of the desired shade till the colour penetrates into the strips. The coloured strips are washed to remove the excess dye, dried and stored for use.

Seasoned, undyed and dyed strips of bamboo are arranged alternately and glued together in the desired pattern into a solid block using casein fluoride glue. The block is placed in the mould and subjected to a pressure of 200 lb./sq. in. for 12 hours. The block so obtained is dried for a few days and then softened by soaking for a few hours before cutting into strips to obtain various diaper patterns.

The block is now cut at an angle of 45° into slices of desired thickness, say $\frac{1}{2}$ in., to give a particular pattern. The slices are turned round, glued and kept under pressure overnight. The block so formed is then conditioned in air and again cut into slices. The slices thus obtained are again joined by means of glue in such a way that the direction of grain in adjoining blocks has the appearance of an object and its mirror image. This block is again pressed and dried. The block finally obtained will have the coloured patterns in the form of squares.

Innumerable designs and patterns can be obtained by varying the size of the strips initially taken, angle of cut, and arrangement of strips obtained at intermediate stages before gluing. The final pattern may be rectangular, rhombic, hexagonal or octagonal.

Decorative and ornamental diaper work of this type can be used in picture frames, boxes, ornamental furniture, special carvings, and panels for restaurants, railway coaches, libraries, etc.

Recent Applications of Infra-red Heating

Infra-red or radiant heating is finding increasing application in industry, particularly plastics, rubber and textiles, because of the many advantages it offers. For example, high rates of heating and short treatment times are two principal advantages of this type of heating. Materials such as paints which respond differently to different heat treatments can be satisfactorily handled by infra-red heating.

The article deals mainly with the application of infra-red heating to paint stoving, softening thermoplastic sheet, and curing plastic coatings and glass-reinforced resin structures. Practical details involved in various operations are described.

THE use of infra-red or radiant heating in manufacturing processes has expanded considerably within the last ten years. The stoving of paint — the process to which infra-red heating was first applied is still the most widespread application. Other applications of infra-red heating include softening of thermoplastic sheet, curing plastic coatings and glass-reinforced resin structures and testing of aircraft structures at elevated temperatures. The main advantages of this form of heating compared with other methods, which are used for similar processes, are that high rates of heating are obtained and treatment times are comparatively short.

Of the two sources commonly used for infra-red heating, one operates at about 700°C. and the other at 2200°C. The radiation from each is arranged to be comparable in intensity but there are important differences in the quality of radiation. Most of the energy radiated by the lower temperature source is in the wavelength band 2·5–7·0 microns whereas that from the higher temperature source is in the shorter wavelengths from 0·8–2·5 microns, with the peak emission at 1·1 microns. *G.E.C.J.*, **24** (1957), 37.

Paint Stoving — Ovens are employed to stove paint on a wide range of articles, varying from small components used in telephone selector racks to heavy tank parts. For stoving of paint on metal parts of different sections a paint material (based on styrenated alkyd resin) is applied after careful positioning of the article within the oven. A recent example of such application is in the finishing of agricultural machinery in which both heavy castings and light sheet metal components are used.

Softening of Plastic Sheet — Infra-red heating has been used for the softening of thermoplastic sheet such as *Perspex*, polystyrene, polythene and rigid P.V.C. As a result of the complete absorption of long wave radiation by the surface layers and the consequent tendency for sheets of 3/16 in. thickness and over to blister it has been found impractical to use low temperature radiant heaters for such thicknesses at a sufficiently high intensity to be economic. However, thermoplastic sheet, unless heavily pigmented, is semi-transparent to the short wave radiation emitted by infra-red lamps. A certain degree of through heating can be achieved and intensities up to 2 kW. sq. ft. may be used for softening sheets up to at least $\frac{1}{2}$ in. thick.

Another use of infra-red heating for the softening of thermoplastic sheet is in the manufacture of orthopaedic appliances such as limb supports and spinal jackets. The splints are made up of a laminate of polythene and foamed polyurethane, both of which are light, resistant to moisture and acids, and practically non-inflammable.

The method of manufacture is simple and quick. A sheet of foamed polyurethane is laid on the asbestos bedplate of an infra-red lamp oven. A sheet of cleaned polythene is then placed over this and the combination is heated, from above, by a horizontal bank of lamps. After 15–20 min., the temperature of the polythene reaches 130°C. when it becomes transparent and adheres firmly to the underlying sheet of polyurethane.

Curing of P.V.C. and Synthetic Rubber Coatings — Infra-red heating has been applied in the production of rubberised fabrics, P.V.C. belting for the coal-mining industry, needle

loom and other rubber or plastic backed carpeting. The gelling or curing of coatings of P.V.C. paste and synthetic rubber is done at 100–170°C. The paste is applied to the fabric by means of rollers or a doctor knife.

Another recent application of the gelling of P.V.C. by infra-red heating concerns the provision of protective coverings for machined components. The component is heated to 160–70°C. in an infra-red oven built up of sheathed wire element units. It is then dipped into a tank of P.V.C. paste for a predetermined period, depending on the coating thickness required, and replaced in the oven for the final curing operation. The process time on a small sample casting using infra-red heating was 30 min. compared with 2 hr. in a convection oven.

Treatment of Synthetic Fabrics — A suitable heat treatment (setting) to the finished fabric is essential to render the fabric dimensionally stable and resistant to permanent creasing during scouring and dyeing or hard washing of made-up garments. Two methods are used for dry heat setting, one using hot gas and the other using infra-red heat. In the former, the presence of even a small amount of oxygen in the gas at the high temperatures used, will cause oxidation. With infra-red heating on the other hand, the short process times and still air conditions in the oven reduce oxidation to the minimum. The ovens are light, compact and may be easily adapted to existing finishing lines. Another advantage is that the fabric may be set after being dyed.

Curing of Glass-reinforced Plastic Structures— The use of glass-reinforced plastics is becoming more widespread in the construction of boats up to 56 ft. in length, piping up to 6 in. diam., aircraft radomes and hot-air ducts, omnibus and caravan panels, complete motor car bodies and numerous components for use in the electrical industry. Infra-red heating is used in all these applications to reduce the curing time of the resin.

Many of the resins will cure at room temperatures by the addition of a catalyst. At these temperatures, however, the process may take some hours, and can be greatly accelerated by the application of heat in the form of hot air or infra-red lamp radiation. The latter is easily controlled, may be focused on a particular area and there is a through heating effect resulting from the penetrating power of the short wavelength radiation emitted by the lamps.

Technical Digest

Mangrove Bark Extract for Tanning

IN spite of the abundance of tannin-bearing plants in the Indian forests, the country imports large amounts of tan extracts and wattle bark, because none of the indigenous barks comes up to the performance of wattle bark. Investigations carried out at the Forest Research Institute, Dehra Dun have shown that mangrove bark in combination with myrobalans can be utilized for the production of tan blends suitable for the manufacture of crust leather which can be finished as a sole leather.

Crushed mangrove bark (10 md.) was extracted in a wooden leaching vat (3 ft. diam., 8 ft. high) provided with steam coils at the bottom, an outlet tap (to draw off the extract) and a perforated wooden disc to support the material to be extracted, at about one foot from the bottom. Crushed bark was divided into two portions, about 350 lb. each. One portion was transferred on to the perforated wooden disc of the vat and 130 gal. of distilled water poured into it. The water was heated by the steam coils to 80°C. and maintained thereat for 6 hr. The sp. gr. of the extract at the end of 1½ hr. of heating was 1°Be and it gradually rose to 2·2°Be during the course of 3–4 hr. and remained so for the rest of the period. The extract was drawn out from the vat through the tap and treated with sodium hydrosulphite (0·1% vol.). The spent bark, which still contained much tan, was discarded because its further extraction with fresh quantities of water would yield only liquors of lower strength, unsuitable for concentration in the triplex evaporators at a subsequent stage. A battery of leaching vats, which would fully recover all the available tannins in the bark, could not be employed on account of the small quantity of the raw material used in the experimental trial.

The vat was then charged with the second portion of the fresh bark (350 lb.) which was subsequently extracted with the sulphite treated tan liquor (2·2° Be) produced from the first batch. The temperature was raised to 80 C. and the extraction continued for 6 hr. as before. The leach liquor (5° Be) was drawn off from the vat.

The resulting leach liquor (100 gal.) was chilled to 20°C. by passing through a cooling column surrounded by ice to allow the insolubles to separate out in a coarse form. The extract was then passed into settling tanks and left overnight so that most of the insolubles settled down to the bottom as a cake. The supernatant liquor still contained some of the insolubles in a fine suspension which could be effectively removed in a centrifugal machine.

One hundred gal. of the extract thus prepared (5–6°Be) was mixed with 20 gal. of myrobalan extract (8°Be) and the mixture concentrated in a triplex evaporator (evaporating capacity 600 gal./hr.) to 23–25°Be. The concentrate was then passed into the spray-drying unit maintained at 200°C. at the inlet and 100°C. at the outlet. The extract collected at the bottom of the unit as a fine light-coloured powder, analysed : moisture 2·9, tannin 65·0, soluble non-tannin 25·4, insolubles 6·8, red units of 0·5% solution in ½ in. cell in a lovibond tintometer 5·5 per cent.

Trials have been conducted with the above blend at a leading tannery in Kanpur. The crust leather obtained has been found to be suitable for finishing as sole leather.— P. Ramachandra Rao, *Indian Forester*, **83** (1957), 565.

Electrolytic Preparation of Perchlorates

INVESTIGATIONS have been carried out at the Central Electrochemical Research Institute, Karaikudi for designing a large scale unit for the production of ammonium and potassium perchlorates. Optimum working conditions have been formulated and a 2 litre cell capable of producing 3 lb. of potassium perchlorate per batch has been fabricated at the Institute.

Current efficiencies of the order of 96 per cent have been achieved in an experimental cell (7·5 × 4·0 × 7·0 cm.) under the following conditions : electrolyte composition (g./litre, $NaClO_3$) 600 ; $K_2Cr_2O_7$, 0·6 ; K_2CrO_4, 0·6 ; and $MgCl_2$, 1·0 : voltage, 5·0–5·5 ; current density, 40 amp./sq.dm. ; *p*H, 6·0–7·0 ; temperature 30–35° C. The current efficiency dropped to 85 per cent when a larger cell (16 × 10 × 16 cm.) was employed.

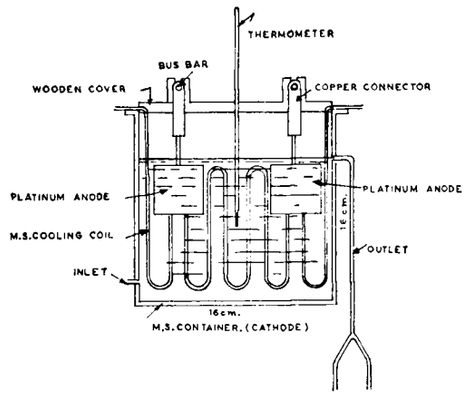

FIG. 1—ELECTROLYTIC CELL

A mild steel cell fitted with M.S. cooling coils acts as the container and the cathode. Four platinum foil anodes (5 × 5 cm.), a wooden cell cover and stirrer complete the cell assembly (Fig. 1). An outer cooling jacket is provided for maintaining the temperature of the electrolyte at 30–35° C.

Small platinum foils (1 × 4 cm.) were forged to the platinum anodes on one side and a terminal for the connecting platinum strips was made by sandwiching a portion of the length of the strip (1–1·5 cm.) between two 1/32 in. copper plates. To avoid corrosion by chlorine or ozone formed during the electrolysis, the junction was painted with chlorinated rubber paint ; a plastic coating would, however, be more suitable. The four anodes were connected by means of bus-bars. Glass rods suspended from the cell cover served as separators. The electrolysis was carried out as a batch process. The electrolyte (2 litres) contained $NaClO_3$ 1200 g., K_2CrO_4 1·2 g., $K_2Cr_2O_7$ 1·2 g. and $MgCl_2$ 2·0 g. The results are given in Tables 1 and 2.

Experiments were also conducted to operate the process as a continuous one. The electrolyte was circulated at the rate of 5 litres/hr. Employing the optimum experimental conditions found from batch experiments (Tables 1 and 2), namely, voltage 5·1–5·3, current density 37·5 amp./sq.dm., temperature 35° C., and *p*H 6·2–6·4, 5 litres of electrolyte, containing 3000 g. of $NaClO_3$, were electrolysed for 20 hr. 26 min. The results obtained were identical with those of the batch experiments, the current efficiency being 85·2 per cent.

In large scale operation, the current efficiency obtained was of the order of 85 per cent compared to 96 per cent in laboratory scale experiments carried out under similar conditions. Energy consumption in the larger cell was 1·23 kWh./lb. of sodium perchlorate.—K. C. NARASIMHAN, A. NARAYANASWAMI & B. B. DEY.—*J. sci. industr. Res.*, **16A** (1957) 512.

TABLE 1—EFFECT OF BATH VOLTAGE ON CURRENT EFFICIENCY

(Current density, 37·40 amp./sq.dm. ; pH 6·2–6·6 ; temp. 35° C.)

Bath Voltage *V.*	Current Passed *amp.*	Duration of Electrolysis *hr.*	*min.*	Analysis of Liquor after Electrolysis: Chlorate *g. moles/litre*	Chloride *g. moles/litre*	Perchlorate *g. moles/litre*	Current Efficiency %
5·2	80	7	28	1·02	0·134	4·29	82·1
5·5–5·7	72-77	8	9	0·98	0·047	4·74	83·9
6·0	80-85	7	6	0·84	0·048	4·57	84·9
6·5	80-85	7	19	0·95	0·059	4·63	83·4

TABLE 2—EFFECT OF CURRENT DENSITY ON CURRENT EFFICIENCY IN A 2-LITRE CELL

(Bath voltage, 5·0–5·4 V. ; pH 6·2–6·6 ; temp. 35° C.)

Anode Current Density *amp./sq.dm.*	Current Passed *amp.*	Duration of Electrolysis *hr.*	*min.*	Analysis of Liquor after Electrolysis: Chloride *g. moles/litre*	Chlorate *g. moles/litre*	Perchlorate *g. moles/litre*	Current Efficiency %
25·9	49·5–53·5	11	33	1·28	0·076	4·31	77·3
30·2	56·0–62·5	10	2	1·20	0·048	4·51	79·8
34·1	68-80	8	51	1·09	0·029	4·88	86·6
37·1	72-75	8	11	1·00	0·046	4·75	84·1

Industrial Productivity

THE need for improving industrial productivity has always existed ; it has now acquired urgency. We have hitherto sought inspiration from outside. We have imported plant and machinery, know-how and expert assistance. Perhaps this has been necessary in the circumstances. The result has been that the larger mechanized industries of India are, by and large, those which have been developed in other countries. Those based on indigenous inventions are few and far between. In the context of the new socialistic trends which permeate western technology, a liberal amount of assistance may be forthcoming. We, no doubt, seek knowledge, wisdom and friendship from whatever source they are to be had, but like the bee gathering nectar from whichever flower it is available, and transforming it into honey which is entirely its own, we should adapt such assistance to our own needs and requirements, and evolve a pattern of industrialization which we can call our very own. This will be possible only if we succeed in developing science and technology. Scientists and technologists have thus a responsibility, challenging but meaningful and with potentialities of a great achievement.—PROF. M. S. THACKER, Presidential Address, Indian Science Congress, Madras, 1958.

Patents & Processes

Sealing Device for Containers

Patent No. 58085 and 58382.
National Physical Laboratory, New Delhi

DRUMS and containers are extensively used for storage and transportation in petroleum, vegetable oil, chemical, pharmaceutical and other industries. Usually a set of two closures at the feed and discharge openings is used for sealing each container. Nearly 6 lakh sets of sealing closures are required for new drums or barrels and approximately 25% more are required for replacement. The annual demand of the sealing devices may, therefore, be placed at about 8 lakh sets. There is at present only one firm engaged in the production of sealing devices and the production falls considerably short of the demand. The bulk of the present demand is, therefore, met from imports.

The sealing device at present in use cannot be detached from the drums and as such becomes useless once a drum is discarded. It is also liable to leak in the event of the packing ring getting damaged or being not properly pressed between the nut and the container top.

New sealing devices, which are economical and easy to manufacture, have been designed and developed at the Laboratory. These devices can be easily fixed to the drum and can be removed from the drum for re-use when the drum is discarded. The device consists of a set of couplings, a suitable packing, primary and secondary sealing arrangements, etc. and can be made in different sizes varying from $\frac{3}{4}$ in. to 2 in. It can be attached to the container or drum by welding, soldering or by packing through nuts.

Details may be obtained from the Secretary, National Research Development Corporation, Mandi House, New Delhi.

Portable Under-reaming Tool

Patent No. 54907
Central Building Research Institute, Roorkee

A PORTABLE, hand-operated tool has been developed for widening (under-reaming) the bottom of a cast-in-place concrete pile. Such piles are used with advantage in foundations for building, in black cotton soil and similar highly expansive clays. The under-reamed portion at the bottom acts as an anchor and prevents uplift of the footing when the soil swells with the increase in moisture. It also provides a greater bearing area resulting in economy in materials.

The tool consists of simple structural steel sections. It has a central square guide rod with flats fixed at the upper end. The flats hold the cutting blades which can be widened out to the desired diameter by pressing the guide rod. When the rod is rotated, the blades also rotate. With the rotational effect of the blades the bottom of the pile hole widens out. At the lower end of the rod is fixed a cylinderical container for removing the soil cut out by the blades.

The usual method of making cast-in-place concrete piles is by boring a hole of uniform diameter with a post hole auger. The under-reamer is next lowered in the hole and rotated, maintaining a uniform pressure on the handle thus widening the bottom of the hole. The desired diameter of the hole is obtained by pushing down the tool by a pre-determined distance.

The tool has been extensively tried at Poona, Powerkhera and Jabalpur in putting down under-reamed foundations. It can be fabricated in a light engineering workshop.

Details may be obtained from the Secretary, National Research Development Corporation, Mandi House, New Delhi.

Fatliquor

Patent Appln No. 62348.
Central Leather Research Institute, Madras.

FATLIQUORS are oil-based products which emulsify easily with water to produce stable oil-in-water-type emulsions for use in leather processing. They impart softness, pliability, tensile strength and other desirable physical properties to leather. They are particularly used in production of chrome-tanned leathers and box and willow sides for shoe uppers.

At present, fatliquors based on neatsfoot oil, fish oil or mineral oils, employed by the Indian leather industry, are imported under various trade names. Indigenous production is small. The present requirements, estimated at nearly 200–300 tons per annum, valued at Rs. 15 lakhs are expected to rise to nearly 600 tons per annum during the Second Plan period.

A process for making fatliquors has been developed in which pongam oil — a non-edible oil available in abundance in South India — or sardine fish oil, forms the basic raw material. Fatliquors made in the laboratory have been successfully tried in the model tannery of the Institute and also by several leather manufacturers for processing of shoe upper leathers, box and willow sides, full chrome or chrome retanned leathers.

The process consists in sulphonating the oil under optimum conditions to obtain a product which can be employed to produce emulsions.

Several batches of nearly 100 lb. each have been processed and conditions for large scale production have been standardised.

The equipment required — jacketed lead-lined vessel fitted with stirrers, cooling arrangements, wooden vats, etc. can be easily fabricated in the country.

Details may be obtained from the Secretary, National Research Development Corporation, Mandi House, New Delhi.

Brass Plating from a Non-cyanide Bath

Patent No. 45565.
National Metallurgical Laboratory, Jamshedpur.

BRASS is commonly electroplated from a cyanide bath, which is not safe to operate with. The process developed in this laboratory replaces the cyanide bath with a mixture of copper tartarate and zinc oxide dissolved in caustic soda. Copper tartarate is obtained as an insoluble precipitate by adding sodium potassium tartarate (Rochelle salt) to copper sulphate solution. The plating solution contains copper and zinc in the ratio of 3 : 1, has a *p*H range between 9 and 12 and can be operated at current densities of 6–20 amp./sq. dm. The coatings obtained are 0·00015–0·0002 in. thick, corresponding to standard specifications. Deposits on brass (copper, zinc : 70, 30) are highly lustrous and adhesive, and are comparable to those obtained from cyanide baths.

The composition developed is superior to cyanide bath in respect of cost, and ease of control and maintenance.

In addition to lowering the plating costs to a considerable extent, adoption of this method will help in cutting down the import of proprietary salts used for plating brass resulting in the saving of foreign exchange.

No addition or alteration in the existing plating equipment is required to change over to the non-cyanide bath.

Details may be obtained from the Director, National Metallurgical Laboratory, Jamshedpur.

Indian Patents

A few of the Patent Applications notified as accepted in the *Gazette of India*, Part III, Section 2, 16 November — 7 December 1957 are listed below :

Plant and Equipment

57958 A primary wet cell : *Ferric chloride used as polariser in two fluid primary porous pot wet cells* — COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH

57328 Fused bath electrical furnace : *Electrode extending below bath surface with means to advance the same as the end is used up* — UPTON ELECTRIC FURNACE CO.

57358 Device for regulating gas-liquid contacting processes : *Comprising feed lines for gas, liquid aspirator and flow meter for gas and controller to determine maximum gas flow* — SHRI RAM INSTITUTE FOR INDUSTRIAL RESEARCH

59227 Improvements in apparatus for feeding liquids at slow rate : *Comprising a closed chamber with an inlet and the outlet for liquid is led upwards to a fine control needle valve and an indicating flow meter and a chamber* — WILD-BARFIELD ELECTRIC FURNACES LTD.

59078 Electrical vapour detector : *Comprising a housing containing an emitter electrode supported on a core, an ion emitting material containing an alkali metal, glass interposed between the core and emitter electrode and means for heating the emitter electrode and the ion emitting material* — GENERAL ELECTRIC CO.

59712 A controllable feeding device for feeding in liquified fluid from one container to another : *Comprising a tubular valve housing with a threaded nipple, a second connecting nipple threaded as well and radially protruding adjacent the opposite end of the valve housing a valve member disposed in the valve housing and biased into its closing position by spring* — AKTIEBOLAGET BAHCO

67296 Improvements in apparatus for producing high temperatures : *Comprising means for developing concentrated magnetic field encompassing a reaction space and means for producing a cloud or plasma of ions in said reaction space in the presence of said magnetic field* — ZENITH RADIO CORP.

60857 Tea rolling machines : *One rolling member providing reciprocatable rotation to the other ; both members provided with co-operating leaf-rolling and leaf-progressing surfaces ; on reciprocation of the first member tea leaf rolled between the surfaces and progressed forward intermittently from the feed to a discharge point* — CHAIRMAN, INDIAN TEA ASSOCIATION

59086 Improvements in Valves for controlling the flow of fluid : *Of the kind comprising a piston which is housed and is axially displaceable within the valve body so as to open and/or close one or more ports* — SPIRAX-SARCO LTD.

60253 Improvements in agricultural spraying machines : *Container for the liquid to be sprayed and a rotor mounted upon a tractor and the rotor is driven at a high speed from the tractor power take off* — JONES

Fine Chemicals, Pharmaceuticals & Perfumes

57671 Method for preparing tablet granulations : *Wherein a mixture, containing a therapeutically active compound, and an excipient is mixed with a lubricating agent, moistened with a solvent containing a binding agent, and formed into granules* — CIBA LTD.

57796 Therapeutic composition for the treatment of ulcers and infected wounds and process for preparing the same : *Comprises an antibiotic, an enzyme and a diluent and film-forming agent* — AMERICAN HOME PRODUCTS CORP.

57952 Process for producing polyalcohols, particularly sorbitol, by hydrogenation of sugars : *By hydrogenating the corresponding sugars, in the presence of lower aliphatic alcohols* — LES USINES DE MELLE

58756 Improvements in the manufacture of maleic anhydride : *Wherein the catalyst is prepared by fusing alundum, treating it with HCl and impregnating it with aqueous solution of vanadium and molybdenum salts* — COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH

59989 & 59995 Process for the manufacture of polyhydric alcohols : *Cracking hexitols by catalytic hydrogenation in the presence of a mixed catalyst containing two or more elements of the group nickel, copper, cobalt, chromium, silver.*

Hydrogenating polyhydroxy compounds in two distinct stages — INVENTA A. G. FUR FORSCHUNG UND PATENTVERWERTUNG

57331 New isoquinoline pharmaceutical preparations and process for their manufacture : *Reacting isoquinoline containing in 1-position exchangeable substituent with polyethylene glycol or their mono-lower alkyl either in presence of condensing agents* — CIBA LTD.

57343 Process for fermentative production of antibiotics : *The fermentation is carried out without maintenance of aseptic conditions in a medium containing at least 0.1 gama/ml. of antibiotically active substances inhibiting the growth of*

microbial contaminants — BELIK, HAROLD AND DOSKOCIL

61213 Process for increasing the stability of ascorbic acid : *Coating with high primary alcohol containing 12-18 carbon atoms* — E. MERCK AKTIENGESELLSCHAFT

58203 Improvements in the preparation of ethyl ester of musk acid, 2-methyltridecane-1 : 13-dicarboxylic acid : *Dehydrating β-hydroxy ester and hydrogenating dehydromusk ester thus obtained* — COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH

Foods

57437 A process for the production of a mineral supplement for the cattle : *The supplement is formed by bone meal chalk, dicalcium phosphate and common salt* — PAL, SAHAI AND SEN

Fertilizers

60269 Process for the production of mixed fertilizers : *Ammonium sulphate is added to solutions which contain monocalcium phosphate* — ERDELY

Pesticides and Crop-control Agents

58703 Insecticidal compositions : *Consisting of DDT and as synergist P-chlorobenzene sulphonic acid-N-diethylamide* — STATE OF ISRAEL AND NEEMAN

57286 Improved fungicidal preparations containing a basic copper salt : *Alkaline earth metal carbonate particles coated with a basic copper salt film* — FISONS PEST CONTROL LTD.

Glass and Ceramics

60524 Improved process for the treatment of mica : *Grinding mica in presence of a solution of alkali salts of fatty acids* — MAJUMDAR

58553 Improvements in mullite refractories from kyanite : *Producing mullite refractories by mullitisation of a mullite forming constituent characterised in that the mullite forming constituent consists partly or wholly of uncalcined kyanite* — COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH

Building Materials

60959 Improvements in a process for rendering cement slabs, brick plaster work and like articles waterproof : *Coating with sodium silicate and aluminium sulphate* — MEHTA & CO.

57515 Improvements in pre-fabricated buildings blocks and walls and like structures built therewith : *Having a continuous groove at least on one of its end or side faces for binding agent* — BLACHE

58702 Twisted armature bar for reinforced concrete structure : *Having constant area of cross-section over its whole length and means to prevent it helicoidal displacement* — SARRASIN AND SARRASIN

Fuels, Coal Products and Lubricants

60713 Improvements in control devices for gaseous fuel burning appliances : *Having an abutment carried by a spring loaded plunger axially movable and rotatable in a cylinder and adapted for axial movement in relation to plunger* — AKTIEBOLAGET BAHCO

60760 Fuel and fuel additive for spark ignition internal combustion engines : *High octane gasoline, tetraethyl lead and 0·2-1·0 ml. per gallon of one or more trialkyl phosphines, alkyl groups being selected from C_1 to C_3 and primary and secondary C_4 and C_5 alkyl groups* — SINCLAIR REFINING CO.

Fibres, Textiles and Dyestuffs

56480 Improvements in spinning wheels : *Upper drafting roller comprising metal spindle with ferrules of wood or plastic mounted at ends, rubber sleeves fitted on ferrules and metal sleeve mounted at central portion of spindle holding in place balls placed in grooves on spindle* — RUNCHHODDAS

57216-7 Improvements in the dyeing of fabrics, yarns and the like : *Passing material under treatment into dyebath containing dyeing assistant and dye and heating the material to fix the dye.*

Passing filaments through bed of hot solid discrete particles while the bed is subjected to an upward gaseous current — BRITISH RAYON RESEARCH ASSOCIATION

57534 Method of bleaching cellulosic fibres : *Bleaching cotton textiles with hydrogen peroxide, polyphosphates and ethylene diamine tetraacetic acid* — FOOD MACHINERY AND CHEMICAL CORP.

57892 Improvements in bobbins : *Comprising an aluminium barrel, plastic top end piece held at the upper end of the barrel by a hollow flanged bakelite barrel and a lower disc* — SWADESHI INDUSTRIES

57533 Method of bleaching cotton fabric : *The sodium silicate being completely eliminated by adding to the bleaching solution at least about 0·3 per cent of a water soluble orthophosphate and a buffer such as an alkali borate* — FOOD MACHINERY AND CHEMICAL CORP.

58577 Improved method and means for treating cotton fibres and yarn : *Impregnating cotton fibres with an oil emulsion or composition by means of a wick which transfers the said composition or emulsion from a tank* — CHAUDHARY

60971 Process for the production of threads, fibres, films and analogous articles : *The extruded thread, fibre or film is treated in a heated zone (about 90 °C.), while the fluid material is removed from the heated zone* — SOCIETE RHODIACETA

57536 Process and apparatus for simultaneously drying and cooling white sugar coming from a centrifuging station : *Wherein some of the exhaust air of the annular disc drier is led into the preliminary drier and returned* — BUTTNER-WERKE AKTIENGESELLSCHAFT

Rubbers, Resins and Plastics

59088 Production of delta 3-carene Polymers : *By heating solution of 3-carene with catalyst like anhydrous aluminium chloride or boron trifluoride*

— COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH

58939 Improvements in method and apparatus for producing plastic lenses : *By mixing a monomeric resin of di-ethylene glycol bis (allyl carbonate) with a catalyst and polymerize it by heat in a mould* — PARMELEE PLASTICS CO.

Metals and Metal Products

57942 Improvements in method of making magnesium-base alloy ingot : *Comprises dispersing in a first batch of molten magnesium an amount of zirconium equal to between 0·3 and 0·6 percent of the weight of magnesium followed by dispersing in the resulting melt an amount of aluminium equal to from about 3 to 5 percent of the weight of zirconium* — DOW CHEMICAL CO.

58159 A method of aluminothermically welding : *Workpieces ends enclosed in the casting moulds are first preheated by flames projected down the riser in the mould from above* — HAGENUK, VORMALS NEUFELDT & KUHNKE G.M.B.H.

59039 Improvements relating to an apparatus for producing metal strip from metal powder : *Metal powder is so fed to the compacting rolls that the amount delivered to them to form the centre of strip is greater than at the sides* — MOND NICKEL CO. LTD.

61214 A coated electrode for welding aluminium : *Comprises a core having by weight 80–92 per cent aluminium 7–15 per cent silicon, 2–5 per cent copper and a coating compound of fluoride of one of sodium, lithium, potassium, barium, calcium, zinc, tin and cadmium* — EUTECTIC WELDING ALLOYS CORP.

57491 Improvements relating to the continuous casting of metals : *Metal continuously cast into an open ended and externally cooled mould and withdrawn for the lower end of the mould with at least an outer solid skin in which the descending liquid metal stream is subjected to cooling* — UNITED STEEL COS. LTD.

57483 Method and apparatus for reduction of metal oxides : *Continuously feeding oxide to be reduced of a particle size within 100–500 mesh in the upper part of a vertical reaction zone, maintaining atmospheric pressure a turbulent upward flow of gases containing at least a stoichiometric amount of free hydrogen introduced into the reaction zone* — TAYLOR

58299 Improvements in baths for the electrolytic deposition of metals : *One or more sulphonated quaternary ammonium compound is included in electrolytic bath* — RIEDEL & CO.

58352 Electrolytic preparation of cuprous oxide from brass : *Brass is used as an anode in alkaline sodium chloride solution* — COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH

Engineering

56664 Process for the catalytic refining of benzene hydrocarbons under pressure : *Characterised in that benzene hydrocarbons are evaporated from mixture thereof with polymerisation products in separating column by heating mixture before it enters the column* — STILL

58602 Method of reducing the content of non-metallic hydrides in a gas or gas mixture : *Contacting with aqueous solution containing ferric and ferrous salts, heavy metal salts, phosphoric or acetic acid and mineral acid* — INDIAN OXYGEN AND ACETYLENE CO. (P). LTD.

58058 Improvements in the purification of sewage and industrial effluents : *The liquid to be purified is passed through a blanket of coagulating agents suspended undisturbed in the tank, the blanket being prepared before exposure of the coherent mass to flowing liquid* — GRIFFIN

60942 Removal of fume from gases : *Intimately mixing a magnetised powder with the fume containing gas and then removing the fume by conventional methods* — INDIAN OXYGEN AND ACETYLENE CO. LTD.

60325 Means for preventing evaporation of water from dams or the like : *Raft with buoyance chambers and channel between there open at each side and containing solid evaporation control material and feed film of the material to water surface, screens covering channel openings allows water flow through it but retains the material* — TRELOAR

Miscellaneous

57501 Improvements in automatic brake adjustment : *Friction gripping means within the brake piston holds a pin member against relative axial movement excepting when wear occurs on the brake* — GOODYEAR TIRE AND RUBBER CO.

60022 Device for automatic stopping of railway trains : *In series with winding maintaining relay armature in its working position, there is an induction coil with open core which cuts magnetic field of a magnetic transmitter when the engine passes over said transmitter arranged on the track, whereas in series with second winding of polarised relay there is connected an actuating relay* — TESLA NARODNI PODNIK

57613 Improvements in method of printing and rotary duplicating machines for performing such method : *Portions or lines of text for printing selected by operating electric switching contacts allocates to each portion or line : printing effected through electrical control of co-operation of two printing elements dependent on the setting of the contacts* — RITZERFELD RITZERFELD

Indian Standards

The Indian Standards Institution (Manak Bhawan, 9, Mathura Road, New Delhi-1) announces the publication of the following standards:

Rolled Steel Beam, Channel and Angle Sections — IS : 808-1957 lays down the nominal dimensions, weights and basic geometrical properties of rolled steel beam, channel and angle sections.

Rolled steel beam, channel and angle sections produced in India prior to 1954 were based almost entirely on British Standard Specifications. As a part of the Steel Economy Programme, the Indian Standards Institution undertook a detailed programme of study of sections produced in India and abroad to determine whether more efficient and economical sections could be evolved. As a result of this study rational sections have been evolved which would effect considerable savings in steel used for construction purposes. These sections compare very favourably with sections produced in other countries and would have an advantage over them, both from the point of view of competition in the export market and for competition with reinforced and pre-stressed concrete or other types of construction in the home market.

All values appearing in the standard are given in metric units only. Price Rs. 4·00.

Code of Practice for General Construction of Plain and Reinforced Concrete for Dams and other Massive Structures — IS: 457-1957 is an adjunct to the Indian Standard Code of Practice for Plain and Reinforced Concrete for General Building Construction (Revised) IS : 456-1957 which was issued recently. The new code aims at control of mass concrete work with a view to ensuring durability, strength, impermeability and uniformity.

The Code covers specification for materials, design of concrete mixes, detailed instructions regarding mixing, handling, conveying and placing of concrete. Requirements regarding compaction and finishing of concrete are also included in the Code. Price Rs. 3·50.

Low Frequency Chokes — IS: 1037-1957 is the seventh in a series of standards for radio components, covering capacitors and transformers and climatic tests for components which have already been published.

This standard prescribes the requirements of general purpose low frequency chokes with one or more windings suitable for use in radio receivers, amplifiers, small transmitters and other similar electronic devices. It covers chokes up to 250 milliamperes direct current and with voltages not exceeding 1,500 volts a.c. (rms) or d.c. to ground used mainly in filter circuits, including what are known as 'swinging chokes'. The requirements and climatic tests for ensuring suitability for use in tropical conditions. The dimensional requirements of chokes are, however, not covered in this standard. Price Rs. 2·00.

Estimation of Metals in Proofed Cotton Fabrics — IS : 1039-1956 prescribes methods for estimating metals when present individually or in combination. Even when present in small quantities in rubberized, oil-coated or similarly proofed cotton fabrics (or in basic fabric intended to be proofed), metals, such as copper, iron, manganese, chromium and zinc tender the fabric on reaction with cellulose or otherwise deteriorate it. General precautions recommended to be taken in conducting the tests are given in an Appendix. Price Rs. 2.

Maize Starch — IS : 1005-1957 (Edible Maize Starch) and IS : 1007-1957 (Custard Powder) specify requirements for moisture, total ash, acid insoluble ash, etc., and the methods for packing and making.

Forks (Table, Fish and Serving), Brass and Nickel Silver — IS : 993-1957 covers six types of forks and includes details of their shapes and dimensions, the Composition of the materials to be used in their manufacture and also requirements in regard to the plating finishes. Price Rs. 1·50.

Copper Naphthenate — IS : 1078-1957 prescribes requirements and methods of test for copper content, acid value, matter insoluble in acetone, mineral acidity, etc. It is expected that the material conforming to this specification will be suitable for use in the rot-proofing of various textile fabrics including sand bags and for fungicidal treatment of timbers. The material can also be used as a drier in the paint industry. Price Rs. 1·50.

China Clay for Textile and Paper Industries — IS : 1092-1957 prescribes the requirements and methods of test, such as, particle size, loss on ignition, moisture, grit, colour reflectance, etc. The standard prescribes two grades of the material, Grade 1 is intended for use as a filler and sizing material in the textile industry, and for coating purposes in the paper industry. Special requirements for Grade 1 have also been specified to cover material suitable for use in the textile industry. Grade 2 is intended for use as a filler in the paper industry. Price Rs. 1·50.

Limestone for the Glass Industry — IS : 997-1957 prescribes requirements and methods of test for moisture content, total non-volatile matter, lime, total lime and magnesia, etc. Since dolomitic limestones are also used in glass making, special requirements for this quality of limestone have also been prescribed in the standard.

The material conforming to this standard will be suitable for the glass industry for making colourless glass. Inferior grades of limestone containing higher

percentages of iron, which are used for making certain types of coloured glass, are not covered by this standard.

Aerated Water Glass Bottles — IS : 1107-1957 prescribes the requirements and methods of test for aerated water glass bottles of crown-cork pattern with normal capacity of 170-340 ml. (6-12 oz.). Price Rs. 1·50.

Distilled Water Glass Bottles — IS : 1106-1957 prescribes the requirements for quality of glass, workmanship, tolerance on capacity and method of test for limit of alkalinity. Price Rs. 1·50.

Oil, Clocks and Watch — IS : 1088-1957 prescribes the requirements for oil intended for the lubrication of bearings and other mechanisms of clocks and watches and other delicate instruments between the temperature range of 60 and — 30 C. Price Rs. 1·50.

Method of Sampling and Test for Bleaching Earths used for Decolourising Vegetable Oils — IS : 1035-1957 covers methods for determining moisture, bulk density, screen analysis and acidity or alkalinity. Tentative methods for determining decolourizing power, filtrability and oil retention have also been prescribed. Price Rs. 1·50.

The products of the pharmaceutical industry packed in glass containers vary widely in their physical and chemical properties, and the stability of these products depends, to a large extent, on the nature and characteristics of the glass of the containers. The Pharmaceutical Enquiry Committee of the Government of India felt that the quality of glass bottles and other glass containers for the pharmaceutical industry and for dispensing drugs and medicines should conform to varying requirements depending on the nature of products to be stored in them. The Committee, therefore, recommended that the ISI should, in consultation with the Central Glass and Ceramic Research Institute, formulate standards for glass containers for the pharmaceutical industry.

Tincture Glass Bottles — IS : 1108-1957 prescribes the requirements of quality of glass, workmanship, tolerance on capacity, and methods of test for limit of alkalinity. Price Rs. 1·50.

Sampling and Test for Paper and Allied Products — IS : 1060 (Part I)-1956 prescribes the methods of sampling and test which are common to several detailed Indian Standards on the subject. Definitions of terms used in trade and industry, methods of sampling and test procedures for determining physical, mechanical, and strength characteristics, and chemical characteristics such as substance, ream weight, thickness, bulk, *p*H value, sizing etc. have been included in the standard. Price Rs. 2·50.

Oleum (20 *per cent*), *Technical* — IS : 1089-1957 prescribes the requirements and methods of test for specific gravity, total sulphur trioxide, free sulphur trioxide, residue on ignition, etc. The standard has been prepared with a view to helping the producers to manufacture quality product and the consumer in obtaining a material of assured quality. It is also proposed to formulate, in due course, separate Indian Standards for Oleum (20 per cent), pure and for higher concentrations of volume. Price Rs. 1·50.

Marine Plywood — IS : 710-1957 specifies the timber species to be used in the manufacture of plywood and the methods to be followed in the manufacture. The dimensions of boards, tests and marking have also been specified in the standard.

The adhesives used in the manufacture of plywood have specifically been stated so that the resulting plywood is of the required strength capable to stand the rigorous conditions.

Common Burnt Clay Building Bricks — IS : 1077-1957 provides a guide for obtaining a uniform quality in the manufacture of brick, both in regard to its strength as well as dimensions. The standard specifies the general quality of bricks, dimensions and tolerances and compressive strength and takes note of the principles of modular co-ordination as specified brick dimension conforming to a module of 10 cm. The adoption of a 10 cm. module for dimensions of bricks is also in conformity with the decision of the Government of India to adopt a uniform system of weights and measures based on the metric system in the country.

Oil, Cutting, Soluble — IS : 1115-1957 prescribes the requirements for ash, water emulsification and frothing, cast iron corrosion test, copper corrosion test, low temperature stability, etc.

The oil is intended for use in machines where the use of a suitable cutting oil giving a non-transparent aqueous emulsion is permissible as coolant and lubricant for cutting tools.

Notes & News

Pickling and Degreasing of Enamelling Sheets

The preliminary treatment of rolled sheets prior to enamelling comprises several operations. The sheets as supplied by the manufacturer undergo consecutive degreasing, pickling or descaling, neutralizing and, if necessary, passivation. Bright sheets are usually degreased by boiling in inorganic salt solution or by means of solvents. In both cases several baths have to be used consecutively. By the application of a new process developed by the Austrian firm of Galvopol, cleaning becomes unnecessary and it is possible to save the space formerly required for this operation. The process uses phosphoric acid as a pickling fluid. Tests have shown that phosphoric acid — in spite of its higher cost as compared with hydrochloric or sulphuric acid — permits more economic operation on account of its inherent advantages (prevention of subsequent rusting of the pickled iron parts and possibility of regeneration with cation exchangers).

The Galvopol method consists in dipping the iron sheets for 5-10 min. in the pickling bath containing phosphoric acid (10-20 per cent). The pickling solution attacks the iron beneath the grease and scale coating and produces hydrogen which cracks off the scale as well as grease and oil. The process is accelerated by raising the temperature to 60°C. and by addition of wetting agents.

More effective cleaning is obtained if the scale is peeled off first and dissolved afterwards, so that even the thickest scale layers are completely removed. The oil accumulated on the surface of the bath is removed by a circulation process so that the workpiece does not become greasy again while being removed from the bath. Phosphoric acid consumption is negligible since the mild acid attacks the iron only slightly ; thi- acid can be removed either intermittently or continuously.

The sheets are removed from the pickling bath, flushed with cold running water with air injection for 10 min., neutralized at 60°C. with soda and wetting agents and flushed again with water. Neutralization provides an additional and final degreasing of the pickled material. The neutralization deposits produced by the Galvopol process consist of mixed basic iron phosphates and can be readily incorporated in the enamel primer as certain types of enamels contain as much as 14 *per cent phosphoric* acid and 4 per cent iron oxide.

In the plant in operation the pickling baskets loaded with material for pickling are passed through these stages at the rate of 10 min. each. Servicing is restricted to emptying and loading the pickling baskets and determining the amount of phosphoric acid and/or iron contained in the bath. The capacity of the bath is 2,500 litres. With a daily through out of 3 tons the consumption of phosphoric acid amounts to approximately 10 kg. — *European Tech. Digests*, **8** (1957), 817.

Efficacy of Pyrethrins against Flies and Mosquitoes

Investigations on the comparative efficacy and economics of using pyrethrins alone or a mixture of pyrethrins and piperonyl butoxides in killing flies and mosquitoes have been carried out at the Technical Development Establishment Laboratories, Kanpur. The results obtained show that pyrethrins when used as space sprays against flies and mosquitoes show rapid knockdown and high killing power. Piperonyl butoxide enhances the killing power but slows down the rate of knockdown. Since in space sprays and in aerosols the rate of knockdown is vitally important, the pyrethrins are more economical than the mixtures of pyrethrins with piperonyl butoxide against both flies and mosquitoes. Against mosquitoes a dosage of 0·5 ml. of spray mixture containing 0·05 per cent pyrethrins and 0·4 per cent piperonyl butoxide produces the same rate of knockdown as produced by 0·25 ml. of 0·1 per cent pyrethrins. It is estimated that 2 gal. of pyrethrin-piperonyl butoxide will be required to produce the same effect as that produced by 1 gal. of pyrethrins.—*J. sci. industr. Res.*, **16A** (1957), 469.

Chemical Damage in Wool

Damage caused to wool materials as a result of oxidation or alkaline hydrolysis during processing or in everyday use can be estimated by a new method developed recently.— *Fibres*, **18** (1957), 74.

The weak point in the wool molecule is the disulphide or cystine cross-link. As a result of damage by oxidation or treatment with alkalies, this cross link is broken with formation of cysteic acid or lanthionine respectively.

When the damaged wool is hydrolysed with conc. hydrochloric acid for 5 hr. in a closed Pyrex glass tube at 120°C., a hydrolysate is obtained containing the cysteic acid or lanthionine in proportion to the amount of wool damage. Cysteic acid and/or lanthionine content of the wool hydrolysate are estimated by paper chromatography.

By operating with pure wools damaged by graded chlorination and caustic alkali it has been possible to correlate the proportion of cystine cross links broken due to the changed physical properties of the wool. An advantage of this new method is that it is usually possible to carry it out quite independently of any cellulose fibres which may be present in the wool.

Protection of Wool during Processing

A method for the prevention of damage caused to wool during carbonisation has been developed by the Commonwealth Scientific and Industrial Research Organization, Australia. The process requires the addition of a non-ionic wetting agent *Lissapol NX* (0·03 per cent) to the sulphuric acid bath used in carbonisation. The wetting agent protects the wool from acid attack. One pound of the substance is sufficient for 200 lb. of greasy wool.— *IWS News*, No. 51 (1957), 2.

Production of Patchouli Oil

In order to popularise the cultivation of patchouli as a cash crop in India, the Council of Scientific and Industrial Research have sponsored a scheme on cultural trials on patchouli. The aim is to compile dependable data on the means of obtaining the best yields of high quality oil. Work on the scheme is being carried out in the Indian Institute of Science, Bangalore. Experiments conducted so far have indicated that the patchouli plant can be grown successfully in different parts of India.

Yield and Quality of Oil.—The oil obtained from the plants grown at Bangalore (yield 2·0-3·5 per cent on dry leaves) has been found to be of good quality. The quality depends upon on several factors, an important criterion being the strain of the foundation material. For instance, plants originating from the States of Johore generally yield better quality of oil than those from Indonesia. Plants cultivated on rich soil generally give oil of good quality. The oil obtained from mature leaves is better than that from tender leaves. The first two or three cuttings of a newly started plantation give good yield of high quality oil, which may decline with subsequent cuttings. If the leaves are allowed to ferment during drying, the oil may have an objectionable mouldy odour. Storage of leaves appears to improve the quality of the oil, but if stored loosely for very long periods, the leaves become powdery and difficult to distil ; the yield is also reduced considerably. Aging of patchouli oil considerably improves the quality ; oil matured for several years possesses a much finer and fuller odour than freshly distilled oil and is highly esteemed by perfumers.

A good quality oil is characterised by high specific gravity, laevorotation, refractive index and good solubility.

The physico-chemical properties of oil samples from Singapore patchouli and from plants raised in the Indian Institute of Science, Bangalore are given in Table 1.—M. C. CHACO, Indian Institute of Science, Bangalore.

TABLE 1 — CHARACTERISTICS OF PATCHOULI OIL

	Singapore Sample	Bangalore Sample
Sp. gr. $^{15}/_{15}$°	0.967 - 0.986	0.9620 - 0.9792
Optical Rotation	−49°41′ to −55°41′	−50° to −62°2′
Ref. Index ^{20}°	1.5090 - 1.5100	1.5080 - 1.5119
Acid No.	5.0	0.40-5.7
Ester No.	5.6 - 10.7	2.1 - 7.0
Ester No. after Acetylation	16.8 - 21.5	10.7 - 24.8
Solubility	Soluble in 6.5 to 7 vol. of 90% alcohol; clear to cloudy with more than 7 vol.	Soluble in 0.3 to 6 vol. of 90% alcohol; clear to cloudy with more than 6 vol.

Separation of Foreign Matter from Powdered Material

In plants handling pulverised or granulated material, (cement, lime, gypsum, coal, sand, wheat, etc.) it is important to remove foreign matter such as stones, pieces of wood or even metallic fragments torn from the machinery. If these hard foreign bodies enter the pneumatic conveyors, or the packing machines, they may cause serious interruptions or breakage of machinery.

A method developed in Austria (*Austrian Pat. No.* 184,811) makes use of the fluidization technique to effect the separation. The powdered material is mixed with air, fed into a container with a porous bottom through which compressed air is passed. Cleaned material flows over the top edge of the container, the foreign matter collecting at the bottom. Even pieces of wood can be separated by correct choice of the dust-air proportion.

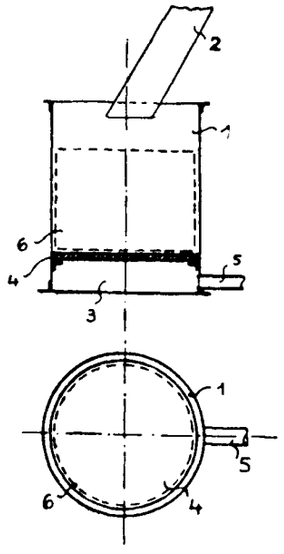

FIG. 1 — SEPARATOR FOR REMOVING FOREIGN MATTER FROM POWDERED MATERIAL

The operation is carried out in a container *1* of the type shown in Fig. 1. It is equipped with a porous double bottom *4*. Air is admitted under pressure into space *3* by a pipe *5*. Inside the container is placed a wire mesh basket *6*. The product fed from above by the tube *2* mixes with the air and the heavier fragments sink to the bottom, the purified powder flowing over the upper edge of the container. The wire mesh basket can be taken out periodically to clean off the accumulated impurities—*European Tech. Digests*, **8** (1957), 835.

2 : 4-Dinitrochlorobenzene

An improved and simplified method for the manufacture of 2 : 4 -dinitrochlorobenzene, developed at the Institute of Science, Bombay, consists in adding to an ice-cooled mixture of chlorobenzene (56 g.) and conc. sulphuric acid (200 ml.), sodium nitrate (156 g.) The reaction is carried out in a three necked flask provided with a mechanical stirrer. The temperature of the mixture during addition is kept below 50°C. ; it is then slowly raised to to 95°C. and maintained at this level for 6 hr., stirring being continued. The acid mixture is poured over ice, the yellow solid filtered, washed free from acid and dried. Yield 98 g.—*Curr. Sci.*, **26** (1957), 318.

The demand for 2 : 4-dinitrochlorobenzene is increasing due to its use in the manufacture of sulphur black.

Carbon-bonded Graphite Crucibles

A process for the production of carbon-bonded graphite crucibles has been developed at the National Metallurgical Laboratory, Jamshedpur (*Indian Pat.* No. 58869). Carbon-bonded crucibles offer several advantages over clay-bonded crucibles ; they can withstand more rigorous operating conditions and give larger number of melts.

Carbon-bonded crucibles consist of graphite and silicon carbide embedded in a matrix of carbon-residue formed by the carbonization of pitch and tar. They are rendered self-glazing by incorporating certain ingredients in the body of the crucible itself. When subjected to high temperature, the exposed particles of these ingredients melt into a glaze forming a protective coat on the graphite grains. Crucibles of commercial size produced at the laboratory have been found to be economical and more heat resistant than some of the imported graphite crucibles. One indigenous specimen withstood 21 heats as against 4 heats withstood by an imported variety.

All the raw materials except silicon carbide required for the production of carbon-bonded graphite crucibles are available in India. The equipment needed for the production of these crucibles is of the conventional type, only a high pressure crucible press being required in addition. The cost of a plant (including housing) producing 200 tons of crucibles per year will be of the order of Rs. 10 lakh.

Wire Testing Machine

A machine for fatigue-testing of spring wire recently developed at the U.S. National Bureau of Standards eliminates the need of coiling wire into springs, thus considerably reducing the set-up time. The machine stresses the straight wire sample in reversed torsion, simulating the stresses in a coiled spring under fluctuating tension or compression load. The results obtained in this way show good correlation with the results of fatigue tests on compression springs coiled from similar wire.

The machine consists essentially of two aligned grip heads that hold the wire specimen while they oscillate individually through an angle of about 120°. The amplitude of deflection in the specimen is set by means of an adjustable coupling that shifts the phase relation between the oscillating grips.

The torsional strain for various settings of the adjustable coupling is determined by means of a clip-on dialand-pointer combination. The dial and pointer are clipped on to the test wire with a predetermined separation (usually 1 in.). Thus, when the two heads rotate relative to each other, the pointer gives a dial reading of twist per unit length of test specimen.

A rubber coupling in series with one of the heads provides a small amount of tension on the specimen. When the specimen fails, the rubber coupling retracts the head and thus opens a switch that stops the machine. The number of oscillations at failure is then given by a counter which is driven through a reducing gear assembly attached directly to the motor shaft.

Power is provided by a 1/20 h.p. electric motor. *J. Franklin Inst.*, **282** (1957), 544.

Lisasorb

A firm in USA has reported on the performance of Lisasorb — an absorbent for carbon dioxide (CFRI Patent No. 53607). Lisasorb has been found to compare favourably with an absorbent being used by the firm at present. Lisasorb takes almost the same time for reducing the concentration of carbon dioxide to 1 per cent level. The performance is even superior when air containing 0·4 per cent of carbon dioxide is required.

Lisasorb is suitable for use in respiratory protective devices. A commercial plant for its production is being set up at Ahmedabad by *Newmac Industries*. This plant is expected to go into production shortly.

Chemical Porcelain

Commercial production of chemical porcelain according to the process developed at Central Glass and Ceramic Research Institute, Calcutta, has been started by *Bengal Porcelain Co. Ltd.*, Calcutta.

Chemical porcelain is a special variety of porcelain used for the manufacture of laboratory ware (*Res. and Industr.*, **2** (1957), 326). The present requirements are met entirely through imports.

Tata Chemicals Ltd.
Progress During 1957

During the year 1957 the *Tata Chemicals Ltd.* made substantial progress with the scheme for modernisation and modification of existing plant. The capacity of the soda ash plant has been raised to 400 tons per day by making substantial additions to the existing plant. The design and development work, completed recently, was carried out by the Development and Process Control Department of the Company at Mithapur.

Among the new lines taken up by the Company during the year is the production of a wide range of pesticides, fungicides and insecticides in association with Messrs. Fisons Ltd. ; a new Company — Tata Fisons Ltd., was incorporated for this purpose in June 1957 and went into operation recently. Two formulating units have been set up by this Company in Bombay and Cochin respectively. Benzene hexachloride and ethylene dibromide required for the plants are being supplied by the Mithapur Works.

The Company designed and fabricated a plant during the year for production of copper oxychloride, a fungicide used in coffee, tea and rubber plantations. The material has hitherto been imported. The plant, which has a capacity of 500 tons per year, went into operation in November 1957. The entire production will be taken up by *Tata-Fisons Ltd.* for formulation purposes.

Sindri Fertilizers and Chemicals

During the year ended March 1957, the Sindri Fertilizers and Chemicals made a gross profit of Rs. 4,09,59.873 showing an increase of Rs. 34,42.095 over the preceding year. The production of ammonium sulphate was 333,705 tons as against 3,26,062 tons in the previous year.

Substantial progress has been made in Sindri's expansion schemes which involve an outlay of Rs. 11 crores. The construction of the buildings and installation of equipment by the Italian firms of Messrs *Montecatini* and *Ansaldo* continued to progress throughout the year. Considerable amount of equipment has been received and installed.

Production of Mica

The production of crude mica in India during the period January-June 1957 increased to 305,811 cwt. as against 298,890 cwt. in the corresponding period of the previous year, according to Indian Bureau of Mines.

Bihar, which is the leading producing State accounted for 169,801 cwt. The output from Rajasthan and Andhra — the other major producing States — was 79,335 cwt. and 51,831 cwt. respectively.

The production of crude mica in the first half of 1957 was higher by about 7,000 cwt. compared with the production in the first half of 1956.

As a result of dressing 53,750 cwt. of sickle-dressed blocks and 4,302 cwt. of chillas were recovered by the mine-owners in the half year ending June 1957 as compared with 62,497 cwt. of sickle-dressed blocks and 5,090 cwt. of chillas during the same period last year.

Inquiry into Oilseeds Power Crushing Industry

An expert body of the Indian Central Oilseeds Committee has issued a ten-point questionnaire relating to the oilseed power crushing industry.

The Committee was asked to study the conditions in the power-crushing industry and to recommend measures to the Government of India for putting it on a sounder basis. The committee has set up a five-member team of experts to study various aspects of the industry.

The questionnaire calls for information on the number of oil mills in each State on 1st April 1956, and 1st September 1957, the extent to which the installed capacity is being worked, and possible reasons and remedies for idle capacity.

Referring to the recommendations of the Oilseeds Crushing Industry Enquiry Committee (1956), which recommended the setting up of more power-driven mills in the country, the questionnaire asks what measures should be adopted for effectively enforcing it.

ISI Certification Mark for Wrought Aluminium Utensils

The Indian Standards Institution has granted one more licence to the *Aluminium Manufacturing Co. Private Ltd.*, Calcutta, for the use of its Certification Mark on wrought aluminium utensils. This brings the number of such licences granted to aluminium industry to 15.

In Parliament

Second D.D.T. Factory — The erection of plant and machinery in the D.D.T. Factory at Alwaye in Kerala has already been completed.

Production trials are being carried out and regular production would commence after the guarantee tests. have been completed and sufficient quantity of liquid chlorine is available from an adjoining chemical works.

Industries at Steel Plants Sites — A by-product plant is being put up as a part of the steel works at Bhilai to process tar and benzol for removing such of the valuables as are not required for heating furnaces in the steel plant. Provision has also been made in the layout for a slag granulation plant. There is provision in the Second Five-Year Plan for a number of industries to come up in the vicinity of steel plants both in the public and in the private sectors.

Geological Survey of Garhwal for Sulphur Deposits — The Geological Survey of India has carried out preliminary investigation of the sulphur deposits near Sutol village in the valley of Rup Ganga, Dt. Garhwal (U.P.).

The sulphur occurs as a yellow sublimate mixed with soil in a gulley, about two miles North-East of the village. The area is characterised by the oozing of sulphuretted hydrogen from which sulphur is being deposited in small quantities. The gas is possibly being given out from some sulphurous springs, the site of which is not exposed.

The deposit does not appear to be of any economic importance, but in view of the great shortage of native sulphur in the country, the Geological Survey of India proposes to carry out detailed investigations in the field season 1957-58.

Limestone Deposits — Reserves of important deposits of limestone, suitable for cement manufacture, are estimated to be 7551·3 million tons.

The annual productions of limestone for cement manufacture and other purposes for the years 1955–1956 was 7,366,309 and 8,193,554 tons respectively.

Exploitation of Assam Oil Reserves — The negotiations which were being conducted with the *Burmah Oil Company/Assam Oil Company* for the formation of a Rupee Company to exploit the oil reserves discovered in Nahorkatiya, Hugrijan and Moran areas have now been concluded. An agreement between the Government of India and the Burmah Oil Company/Assam Oil Company will be executed shortly. The broad features of the agreement proposed to be executed are : (1) The Rupee Company will undertake production of oil and will also arrange for the construction in two stages, and operation of a pipeline or such other related facilities as may be considered necessary for the transport of the crude oil up to Barauni. (2) The oil produced by the Rupee Company will be sold to two refineries sponsored by the Government of India and to be established in the public sector.

The Burmah Oil Company have offered to advance a sterling loan to the extent of 10 million pounds to the Rupee Company to meet the foreign exchange content of the cost of the first stage of construction of the pipeline and other related facilities. In the context of this firm commitment given by the Burmah Oil Company, it is proposed to have a refinery located at the intermediate stage between the oilfields and Barauni in addition to having a refinery at Barauni. Government have already appointed Messrs *Foster Wheeler Corporation* of U.S.A. as Consultants to undertake the pipeline survey from the oilfields to the refinery sites and also for the refinery project studies. The sizes, actual locations and the patterns of production to be adopted for the two refineries now proposed to be established in the public sector will be determined after examination of the project reports. The first of the two refineries is likely to be located somewhere in Assam and it is possible that this refinery will be on stream within about 3 years.

PRINTED BY A. SENDALE AT THE ASSOCIATED PRINTERS (MADRAS) PRIVATE LTD., MADRAS AND BANGALORE

Regd. No. M-6958

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Vol. 3, No. 2, February 1958

COUNCIL OF SCIENTIFIC & INDUSTRIAL RESEARCH

NEW DELHI

VOL. 3, NO. 2,
FEBRUARY 1958

Research and Industry

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RESEARCH & INDUSTRY *is issued monthly.*

Communications regarding contributions for publication, books for review, subscriptions and advertisements should be addressed to the Editor, RESEARCH & INDUSTRY, COUNCIL OF SCIENTIFIC & INDUSTRIAL RESEARCH, *Old Mill Road, New Delhi* 2.

Editor : **B. N. Sastri** *Asst. Editor :* **R. D. Taneja**

Annual Subscription : Rs. 8 **Single Copy Re 1**

Utilization of Wastes from Vanaspati Factories: Part I—Reclamation of Oil, Nickel and Filter Aids from Spent Catalyst

B. G. SHARMA, R. K. BHATNAGAR AND N. R. KULOOR

Shri Ram Institute for Industrial Research, Delhi

The demand for nickel by the vanaspati, electroplating and metal finishing industries is steadily increasing ; vanaspati industry alone consumes 275 tons of nickel formate annually. In view of the fact that India has no nickel resources of her own and there is at present an acute shortage of the metal in the country, it is important that nickel should be recovered from waste catalysts, electrolytic baths, etc. and re-used.

In this article an efficient and economic method is described for the recovery of nickel, oil and filter aids from spent catalyst in the vanaspati factories. The recovery of oil is effected by extracting the spent catalyst with benzene-ethanol mixture. Nickel is recovered by extraction of oil-free residue with dilute sulphuric acid. The residue after the extraction of nickel salts consists mainly of filter aids, which after washing and drying, can be re-used. Nickel salts obtained can be put to many commercial applications without further chemical treatment.

THE vanaspati manufacturing industry in India, which produces annually 270,000 tons of hydrogenated vegetable oils, consumes nearly 275 tons of nickel formate for the preparation of the catalyst. The industry's demand for nickel formate is likely to exceed 400 tons, valued at Rs. 27 lakh by 1960–61[1].

The nickel catalyst, once used, cannot be revived or re-utilized and has therefore to be discarded as waste. Some of the vanaspati factories, however, are known to sell or export a calcined mass, obtained by heating the spent nickel catalyst. This results not only in the loss of the entire quantity of oil, but also considerable quantities of nickel on account of the formation of volatile nickel carbony during slow ignition of the oil. The remaining nickel particles are normally oxidized with the result that acid digestion of the calcined mass to recover nickel salts becomes a tedious and time-consuming process. The nickel salts, ultimately obtained are further contaminated with aluminium and iron salts from filter aids rendering them unfit for use for high class nickel plating. On the basis of 20 per cent nickel, 50 per cent oil and 30 per cent filter aids, the total quantity of waste catalyst mud available from the vanaspati industry may exceed 625 tons per annum.

In view of the non-availability of nickel or nickel formate in the country, nickel salts required for the vanaspati industry or for electroplating and metal finishing have to be imported at high cost. Owing to acute world shortage of nickel salvage of the metal from the spent catalyst, therefore, assumes considerable importance. Due to non-availability of a practical process for recovering nickel from the spent catalyst, investigations on the problem were recently undertaken at this Institute. The work has resulted in the development of an efficient and economical process for the reclamation of nickel, oil and filter aids from the spent catalyst.

It has been found that practically complete extraction of oil from the spent catalyst could be effected with ethanol provided extraction

and filtration are carried out under high pressure. When ethanol is mixed with an organic solvent like ethylene dichloride, trichloroethylene, benzene, hexane, etc., the solubility of oil in ethanol under atmospheric pressures is considerably increased and the miscella obtained is not in the form of stable suspension. Consequently the fine particles of insoluble nickel and the filter aids can easily be separated by settling, filtration or centrifuging from the solvent. A study of comparative rate of settling of solids in benzene-alcohol mixture and in another typical solvent showed that nearly complete settling occurred within 2 hr. in benzene-alcohol mixture whereas practically no separation occurred in the other suspension.

Compositions of some of the mixtures recommended for extraction of oil from spent catalyst are given in Table 1.

Since both benzene and alcohol are abundantly available in India and involve no corrosion problems, a mixture of these was

TABLE 1 — AZEOTROPIC MIXTURES RECOMMENDED FOR OIL EXTRACTION

Composition		B.P. °C.
Trichloroethylene 73%, ethanol 27%	...	70·9
Ethylene dichloride 63%, ethanol 37%	...	70·5
Benzene 67·6%, ethanol 32·4%	...	68·4

preferred, even though it is more inflammable and has a low vapour density. Some of its other characteristics are : sp. heat (15 C.), 0·5065 cal. g., (135 C.), 0·8817 cal./g., density, 551 lb. cu.ft. ; latent heat of vaporization, 169·55 cal. g.

The flowsheet of the process developed[2] is given in Fig. 1.

Results of some oil extraction trials are given in Table 2. The physical and chemical characteristics of the extracted oil were as follows : F.F.A. (as oleic acid), 1·374 ; sp.gr., 0·9101 ; sap. val., 198·5 ; iodine value, 59·36 ; ref. index, 1·4611 ; colour, dark brown. The oil recovered can be used for soap manufacture.

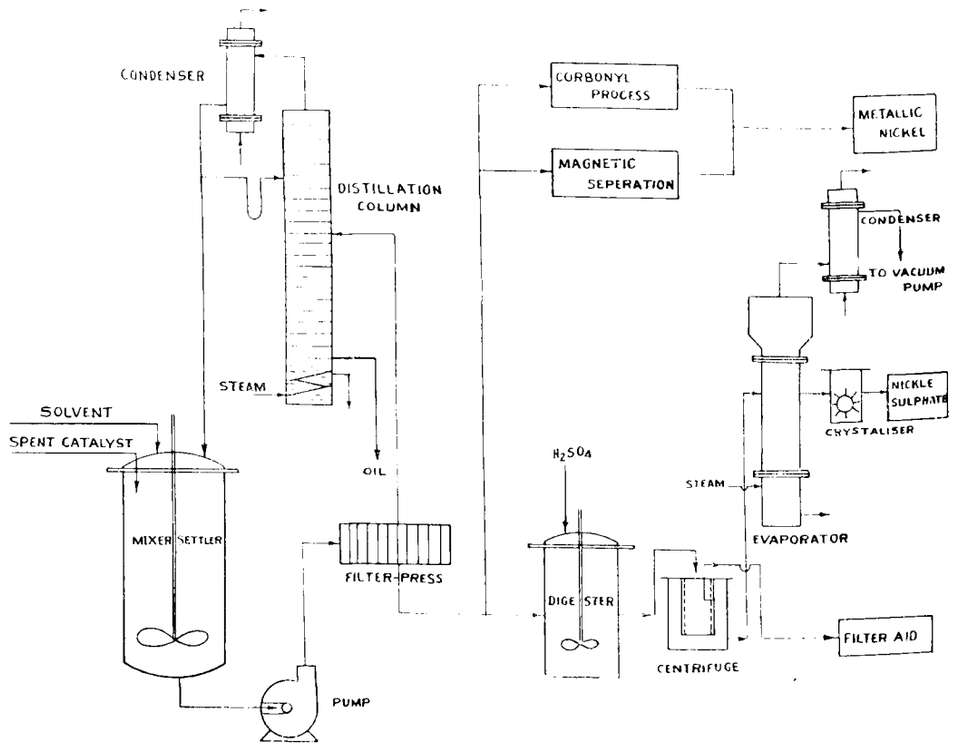

FIG. 1 — FLOWSHEET OF THE PROCESS FOR RECOVERY OF NICKEL FROM NICKEL CATALYST MUD*

Beneficiation of oil-free residue The residue consists mainly of nickel and filter aids. The latter may differ widely from factory to factory, but usually they consist of active carbon, keisulguhr, bentonite etc., and form about 40–50 per cent of the oil-free residue. The rest consists of the fine particles of nickel (finer than 300–400 B.S.S. mesh.)

On account of its fine particle size, recovery of nickel can be easily effected by magnetic separation, Mond's carbonyl process, or by flotation. The nickel can also be easily extracted by digestion with any inorganic acid. The period of digestion and the strength of acid employed are so adjusted as to preferentially extract all the nickel without affecting the filter aids. This prevents excessive contamination of nickel salts.

Table 3 gives data for acid digestion of the oil-free residue. It is seen that digestion of the residue with 9 per cent sulphuric acid for 4 hr. gives a recovery of nickel as high as 98 per cent.

TABLE 2 — EXTRACTION OF OIL FROM SPENT NICKEL CATALYST

Solvent	Spent catalyst g.	Oil extracted g.	Yield %	Remarks
Ethylene dichloride alcohol	10	3·47	34·7	Oil underwent some alcoholysis
Trichloroethylene-alcohol	10	3·72	37·2	do.
Benzene-alcohol	20	9·00	45·0	Solution was clear and no alcoholysis of oil occurred
do.	250	122·00	48·9	do.
do.	400	208·00	52·0	do.

TABLE 3 — NICKEL RECOVERY BY ACID DIGESTION OF OIL-FREE RESIDUE

No.	Sample	Acid vol. ml.	Acid strength (H_2SO_4) %	Digestion time hr.	Nickel recovery %	Remarks
1.	Calcined catalyst, 50 g.	350	14·3	3	34·80	Extracted in two stages under reflux
2.	Insoluble residue from No. 1	100	14·3	3	17·50	
3.	Oil-free residue, 50 g.	492	23·7	3½	76·58	Boiled under reflux
4.	do.	400	23·7	13½	71·54	do.
5.	do.	300	23·7	12	63·34	Cold digestion
6.	do.	400	14·3	4	93·30	Boiled under reflux
7.	Oil free residue, 25 g.	400	9·0	3	84·80	do.
8.	do.	400	9·0*	3	93·60	do.
9.	Oil-free residue, 50 g.	765	9·0	3	87·68	Extracted under reflux in two stages
10.	Insoluble residue from No. 9	100	9·0	3	10·60	
11.	Oil-free residue, 500 g.	3,350	9·0	4	98·0	Boiled under reflux

* H_2SO_4 with 1 per cent HNO_3.

TABLE 4 PROJECT COSTS FOR UTILISATION OF SPENT NICKEL CATALYST

(Basis : ½ ton per day, 300 days per year)

		Rs.
Capital		
1.	Plant and Machinery ...	64,500
2.	Installation cost including cost of foundation, supports, erection @ 50% of equipment ...	32,250
3.	Piping and Instrumentation @ 25% of equipment ...	16,125
4.	Building including land ...	50,000
5.	Working capital ...	50,000
	TOTAL ...	2,12,875
Direct Cost		
Raw Materials		
	Spent nickel catalyst, (20% Nickel), ½ ton @ Rs. 2,240/ ton ...	1,120·00
	Sulphuric acid, 1·5 ton @ Rs. 200/ton	40·00
	Solvent, 40 gal. @ Rs. 2/gal. ...	80·00
	TOTAL ...	1,240·00
Services		
	Steam, 10,000 lb. @ Rs. 3/1000 lb. ...	30·00
	Cooling water, 100,000 gal. @ Re. 0·25/ 1000 gal. ...	25·00
	Electricity, 250 kWh. @ Re. 0·06/ kWh. ...	15.00
	TOTAL ...	70·00
	Supervision and labour @ Rs. 100/day, For 1 day ...	100·00
	TOTAL DIRECT COST ...	1,410.00
Indirect Cost		Rs.
	Depreciation on equipment and building @ 10% ...	51·00
	Maintenance and Repair @ 5% ...	25·50
	Interest on working capital @ 6% ...	10·00
	Insurance on fixed investment @ ½% ...	3·00
	TOTAL INDIRECT COST	89·50
	TOTAL DIRECT AND INDIRECT COSTS	1,499·50
Credits		
	Oil, 0·24 ton @ Rs. 1000/ton ...	250·00
	Filter-aids, 0·142 ton @ Rs. 200/cwt.	340·80
	Nickel sulphate, 1,019 lb. @ Rs. 1.25/lb.	1,274·00
	TOTAL ...	1,864·80

The residue obtained after the extraction of nickel salts consists mainly of filter aids, which after proper washing and drying can be re-used for vanaspati manufacture.

Data on the economics of the process are given in Table 4.

Acknowledgement

We are grateful to the management of the D. C. M. Chemical Works, Delhi for their keen interest during the course of the investigations and for supplying samples of spent catalyst.

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Sorel Cement: Raw Materials and Manufacture of Flooring Tiles

MOHAN RAI & H. S. VIJAYANATH

Central Salt Research Institute, Bhavnagar

Magnesium oxychloride, commonly known as Sorel Cement, forms an excellent material for the manufacture of flooring tiles. The article describes a simple process for the manufacture of these tiles. Details regarding availability of raw materials, equipment, costs, etc. have also been given. Sorel cement tiles possess good mechanical properties ; they are hard, resilient, light and pleasing in appearance. The project can be taken up on a cottage industry scale.

MACLEOD (1825)[1] appears to have been the first to employ calcined magnesite for the preparation of a cement while engaged on the renovation of Fort St. George, Madras. In 1867, Sorel[2] studied the reaction between magnesium oxide and magnesium chloride and observed that the product of the reaction had cement-like properties and that one part of magnesia can bond more than 20 parts of sand, limestone or some other inert material to form hard blocks, while lime and ordinary cements can only bond two or three times their weight of other substances. Sorel prepared both magnesium oxide and magnesium chloride from salt bitterns.

The Sorel cement industry first took root in Austria and by the end of the last century, the industry had spread to the United Kingdom and U.S.A. Flooring was the only use to which the cement was extensively put. During the first World War, it was employed in Germany for foundations of heavy long-range guns. The cement has since found numerous uses – adhesive compositions, artificial stones, roofing and insulating compositions, binder for fuel briquettes, bone substitutes, decorative handles for tools, refractory bricks, etc. The cement is employed in India chiefly for flooring in railway carriages, kitchens and baths.

Raw Materials

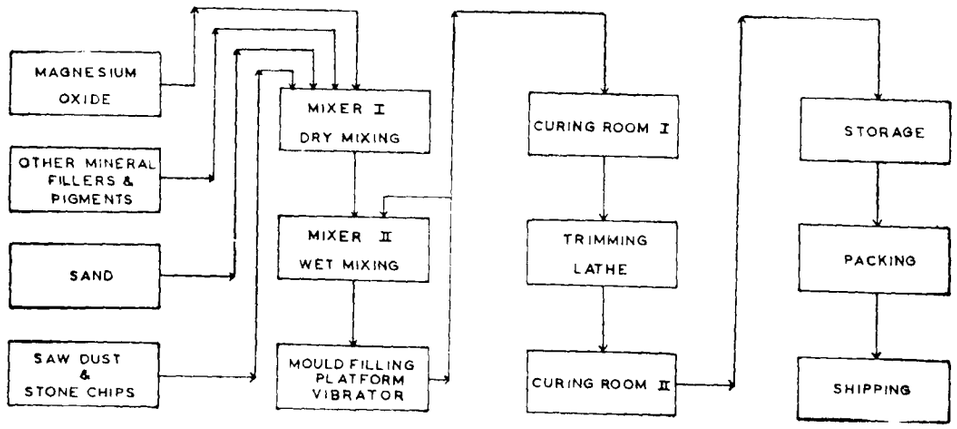
Magnesite – Large deposits of magnesite occur in Madras and Mysore States (Salem, Coimbatore and Trichinopoly in Madras State, and Coorg and Mysore in Mysore State) in the South and in U.P. (Almora Dt.) in the North. The combined output of Salem and Mysore magnesite is 35–40 thousand tons per year, valued at Rs. 30–32 lakh. At present about 75 per cent of the output is utilised in the manufacture of refractory briels and the rest is exported. A fair amount of magnesite exported from India is calcined and used in U.K. for the production of this cement.

Magnesium oxide can be produced from salt works in sufficient quantities to meet the demands of the magnesium oxychloride cement industry.

Magnesium chloride is produced in India in the following factories : *Pioneer Magnesia Works*, Kharagoda ; *Saurashtra Magnesia Works Ltd.*, Dhrangadhra ; *Mayurdhwaj Magnesia Works Ltd.*, Dhrangadhra ; *Tata Chemical Works*, Mithapur. The total installed production capacity is about 40,000 tons per year ; about 8,500 tons of magnesium chloride (purity, 98%) were produced in 1955–56.

On the basis of marine salt production in India, a much larger quantity of magnesium chloride, about 0·3 million tons, can be produced in the country.

Sawdust and Wood Flour Sawdust or wood flour is probably the most important filler used in the production of tiles from magnesium oxychloride (i.e. Sorel cement). It corrects many of the faults of calcined magnesite and also makes the tiles resilient and warm ; sawdust-filled tiles are amenable to cutting and machining. Sawdust from teak, *shisham* and *khair* woods has been found suitable. They should be cleaned and sieved to pass through 52 B.S. mesh ; the resin and moisture contents should be below 13 and 12 per cent respectively.



SOREL CEMENT FLOORING TILES: FLOWSHEET

Sand — Of the three varieties of sand commonly available, namely, quartzite, basaltic and limestone sands, quartzite (abs. wt., 165 lb. cu. ft.) is preferred for making tiles. The grains are hard, clean and well graded. If basaltic sand, found in trappean areas, has to be used, it should be washed free from soluble impurities. Limestone sand is also reported to be useful for tile making. White sand, such as that obtaining in Ennore (Madras coast), free from mud, clay and other soluble impurities, can be directly used after sieving and grading (fineness, — 52 + 100 B.S. mesh).

Granite, Trap and Marble Chips — Apart from imparting an ornamental finish to the tiles, the use of chips in tile compositions improves the strength, wearing property and water imperviousness of the product. Granite and trap stones in various colours (pink, red, blue, green and dark brown) are widespread in central and southern India. White and coloured marble stones are available in Jodhpur, Ajmer, Jaipur and Alwar. The stones have to be chipped to — $\frac{1}{2}$ in. + $\frac{1}{4}$ in. size for incorporation in the mix.

Soapstone, Talc and Asbestos — These silicates are incorporated in tile compositions up to 5 per cent. Soapstone obtained from Udaipur has been used in our trials with satisfactory results. Asbestos of suitable quality is found in Cuddapah (Andhra), Hasan (Mysore), Rajputana and Singhbhum (Bihar). These minerals are used in finely divided form (— 60 B.S. mesh) to facilitate trowelling. Soapstone and talc impart gloss while asbestos imparts wearing resistance and transverse strength.

Other Mineral Powders — Chalk, china clay, marble flour, barium carbonate, etc. are often employed in flooring tile compositions. They have little significance so far as the main properties of the product are concerned.

Pigments — Iron oxide, chromium oxide, ultramarine blue, prussian blue and yellow ochre are the pigments used in magnesium oxychloride mixes. Their use, however, is not necessary unless specially demanded. Tiles with pleasing shades may be obtained by using light and dark coloured sawdust filler in varying percentages. It is also possible to give a pigmented surface coat to tiles while casting. Pigments for tiles should conform to the B.S. 1014-1942 specification.

Specifications — B.S. Specification No. 776—1938 and Indian Standard Specification No. 657-658—1956 relate to raw materials for magnesium oxychloride flooring compositions. The following practical limits should strictly be adhered to: *Calcined magnesite:* Calcination temp., 800-1,000 C.; fineness, 170 B.S.-mesh; bulk density, 0·55-0·75 kg. l.; loss on ignition, 8% max.; total lime, 4% max.; magnesium oxide, 88% min.: magnesite should be freshly calcined and stored in air-tight drums.

Magnesium chloride — Alkali salts, 2% max.; calcium chloride, 1% max.; purity, 98% min.; no impurity other than magnesium sulphate should be present.

Composition & Processing

Dry Mix — Mixes containing the following ingredients have been tried and found to give satisfactory results:

	Weight %
Calcined magnesite ...	20-60
Sawdust woodflour ...	5-20
Sand ...	20-80
Soapstone, talc, asbestos powder	0-5
Pigments ...	0-5
Stone chips	Twice the total wt. of the above

Gauging Solution — A solution of commercial magnesium chloride (7 lb. 2 oz./gallon) is prepared and allowed to settle overnight. The clear liquid (22-24 Be) is siphoned off, mixed with one-tenth its volume of bitumen emulsion, and stirred to give a homogeneous mixture.

Sufficient gauging solution is added to the dry mix to give the proper working consistency. If the mixture is too wet, the heavier particles tend to concentrate at the bottom; if the gauging solution is insufficient, compaction is rendered difficult. The amount of solution should be determined empirically to suit the requirements of each batch.

The setting time is determined for each consignment of calcined magnesite by Vicat's apparatus[3]. The initial and final setting times for a charge of one part of calcined magnesite mixed with twice the quantity of sand, should be 30-45 min. and 120-180 min. respectively.

The ingredients of the dry mix are weighed separately and poured into a dry mixer in the following order: calcined magnesite, mineral fillers, pigments, sand, sawdust or woodflour, and stone chips. The dry mix is transferred to a rotary mixer and mixed with the required amount of gauging solution. The wet mixing should not take more than 12-15 minutes.

The wet mix is then filled into moulds and gently agitated to consolidate the material. Platform vibrators are employed for large scale operation. The moulds are made of detachable wooden sides and a highly glazed bottom plate, preferably glass. The moulds must be clean and grease-free.

TABLE I — TILE MANUFACTURE: PROJECT COSTS

(Basis: 6,00,000 tiles per annum)

Capital	*Rs.*
Land and sheds	60,000
Working capital	30,000
Equipment	
Firebrick calciner	1,000
Crusher	3,000
Disintegrator	2,000
Mixers (two)	6,000
Vibrating platform	2,000
Trimmer	2,000
Sieving equipment	1,000
Vibrating screen	5,000
Moulds and other equipment ...	5,000
Fittings	3,000
Miscellaneous tools, motors, etc. ...	20,000
TOTAL ...	1,40,000

Materials

(For producing 2,200 tiles (8 in. — 8 in. — $\frac{3}{4}$ in.) per day or 6,60,000 tiles per year of 300 working days)

	Rs.
Calcined magnesite, 108 tons ...	25,920
Sand, 324 tons	6,480
Sawdust, 81 tons	3,280
Soapstone, 27 tons	1,350
Magnesium chloride, 90 tons ...	13,500
Bitumen emulsion, 5,900 gal. ...	15,600
Water	3,000
TOTAL ...	69,130

Total Cost	*Rs.*
Raw materials	70,000
Labour 20 men @ Rs. 60 p.m. ...	15,000
Chemist	4,000
Asst. Chemist	2,500
Mechanic	1,800
Electricity & power	3,000
Laboratory and other charges ...	3,000
Packing & forwarding	4,000
Depreciation	4,000
Taxes, insurance, etc.	3,000
Office staff	3,000
Sales & distribution	4,000
Interest & bank charges	1,500
Miscellaneous ...	2,000
TOTAL ...	1,10,000
Total No. of tiles made	6,60,000
Allowing for breakages	6,00,000
Cost per 1,000 tiles	183·33
Market price 1,000 cement tiles ...	280·00

The moulds are kept on racks, away from any external source of heat or moisture and allowed to set for 3–4 hr. Cast tiles are taken off the mould and kept for curing with the glazed side up. Curing takes about 15 days, by which period the tiles would have attained constant weight.

General Characteristics of Tiles – Sorel cement tiles made in this way absorb lesser water than portland cement tiles. The surfaces have a pleasing appearance. In mechanical strength and resistance to abrasive wear, they are superior to portland cement tiles. They are also more resilient and are far lighter.

The manufacture of Sorel cement tiles can be taken up almost anywhere provided an assured market for the product exists. Details of equipment and costs for producing about 600,000 tiles per year are given in Table 1.

Acknowledgement

The authors are grateful to Dr. A. N. Kappanna, Assistant Director-in-Charge and Dr. D. J. Mehta, Senior Scientific Officer, C.S.R.I. for their keen interest, encouragement and suggestions. The authors acknowledge with thanks the facilities offered by the Director, Central Road Research Institute, New Delhi for carrying out the physical tests.

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Cyclised Rubber—Preparation and Properties

D. RAGHUNATH, R. G. GOKHALE & S. L. KAPUR

National Chemical Laboratory, Poona

Cyclised rubbers are finding increasing application in industry as rubber-to-metal adhesives and as reinforcing agents for natural rubber. In this article, a process for the preparation of cyclised rubber from natural rubber latex and its incorporation into natural rubber is described.

The process consists in stabilizing natural rubber latex with a non-ionic stabilizer (*Vulcastab L.W.*) and heating it with concentrated sulphuric acid at 80 C. for 3–4 hr. Cyclised rubber is precipitated from the mixture by diluting it with water, dried and powdered. For incorporating cyclised rubber into rubber latex, the dry powder is dispersed in water and mixed with fresh rubber latex in equal proportions. Cast sheets obtained from such mixtures can be compounded easily on conventional rubber equipment.

Cyclised rubber produced by this method is three times harder than natural rubber.

CYCLISED rubber is obtained by chemical or heat treatment of natural rubber, or subjecting it to silent electric discharge. During these treatments some structural changes take place in the rubber molecule. The adjacent units in the straight-chain structure of the rubber molecule undergo isomerization to yield a product with a cyclic or ring structure. Cyclized rubbers are more resistant to abrasion than natural rubbers, and vary from soft, tough guttapercha-like products to hard shellac-like products. The tough types are excellent rubber-to-metal adhesives, and the harder types are good reinforcing agents for rubber.

Cyclised rubbers are finding increasing application in industry and a number of them have been produced commercially. 'Thermoprenes', the first cyclised rubbers on the market, are obtained by treating natural rubber with sulphuric acid, sulphonic acid or chlorosulphonic acid. A variety of products is obtained depending on the cyclizing agent employed and the reaction conditions. The outstanding application of these rubbers is as adhesives for bonding rubber (both hard and soft) to metals, wood and masonary. Another application is in the formulation of chemical resistant paints. Two other commercial varieties, Plioform and Pliolite, also produced from natural rubber, are used in chemical resistant paints. Plioform has excellent dielectric properties and is used in the production of thin-walled insulation. Pliolite is used for coating paper. Marbon B, another commercial variety, which exhibits exceptional electrical properties and low moisture absorption, is used in the production of thin-walled submarine rubber insulation and in wire and cable insulation. 'Peperen', a German product produced during the war, is prepared by treating crepe rubber with a mixture of phosphorus oxychloride and phosphorus trichloride. This product was employed as an adhesive for bonding rubber to metals.

Cyclized rubber is also produced by the action of many chemicals other than those mentioned above. Stannic chloride, mixtures of phenols and hydrochloric acid, zinc dust etc. are some of the chemicals commonly employed for the purpose. The recent trend in the preparation of cyclised rubber is to react stabilized natural rubber latex[1] with concentrated sulphuric acid (98 per cent). In the method developed by the British Rubber Producers' Research Association[2,3], latex of cyclised rubber and stabilized natural rubber latex are coprecipitated to obtain a master-batch. A pilot plant for its manufacture has been recently set up at the Rubber Research Institute, Malaya.

Cyclization of Rubber Latex

A study of the kinetics of cyclization of natural rubber latex carried out at the National Chemical Laboratory resulted in the preparation of a mixture of cyclised rubber and natural rubber on a laboratory scale. The procedure employed for the production of cyclised rubber mixture is as follows :

Plantation latex (50–60 per cent D.R.C.) was stabilized with a non-ionic stabilizer (Vulcastab L.W. supplied by Imperial Chemical Industries Ltd.) and cooled to about 15 C. To the stabilized latex, concentrated sulphuric acid (98 per cent ; three times by weight on the D.R.C. of latex) was added slowly with continuous stirring. The temperature of the reaction was not allowed to exceed 50 C. during the addition of acid. The temperature was then slowly raised and maintained at 80 C. for 3–4 hr., when the reaction was complete. The progress of the reaction was followed by testing the mixture for unsaturation using the phenyl iodo-dichloride test[4].

The cyclised rubber was precipitated by pouring the mixture into three times its volume of water at 50–60 C. The product was washed free of acid and dried at 30–40 C. The dry powder was dispersed in water and mixed with fresh rubber latex in equal proportions. The master-batch was prepared from this mixture by casting it into sheets and drying it at about 40 C.

Compounding

Cast sheets obtained by the above method could be easily compounded on conventional rubber equipment and no difficulties were encountered. The compounding characteristics of such a mix were investigated using a 50/50 master-batch. Smoked sheet (R.M.A. Grade I) was masticated in a 12 in. mixing mill. After complete breakdown of rubber, calculated quantity of the cyclised rubber master-batch was added to the base mix (smoked sheet, 100 parts ; zinc oxide, 5 parts; Vulca-for T.M.T., 0·5 part ; sulphur, 2 parts ; stearic acid, 1 part ; and Agerite alba, 1 part), followed by the addition of the rest of the compounding ingredients. Tetramethyl thiuram monosulphide was used as the accelerator. The total time for mastication was 25–30 min. The milled mix, after aging for 18–24 hr., was vulcanized in standard test moulds in an electrically heated press at 275 F. for 10 min. The vulcanized products were cooled in water for 10 min. and tested, after aging for 18–24 hr., for their abrasion resistance, hardness and tensile properties according to the usual test procedures.

Characteristics of Compounded Mix – The physical characteristics of compounded mixes containing different proportions of

TABLE 1 — CHARACTERISTICS OF CYCLISED RUBBER MIXES

Cyclised rubber added %	Abrasion resistance loss in vol. h.p. hr.	Hardness (Shore)	Modulus at 300 % Elongation lb. sq.in.	Tensile strength lb./sq.in.
0	960	30	—	2950
30	562	40	396	3006
40	452	45	726	3061
50	365	55	1290	3033
60	390	55	1374	2893
70	338	65	1686	2450
80	115	70	1783	1782
90	105	75	—	—
100	—	95	—	—

cyclised rubber are given in Table 1. The results show that with increasing proportions of cyclised rubber the abrasion resistance of the mix increases rapidly up to 50 per cent loading, and is fairly steady between 50 and 70 per cent loading. The abrasion resistance falls rapidly between 70 and 80 per cent loading, after which it again tends to be steady. The incorporation of cyclised rubber into natural rubber imparts to it a greater degree of hardness under the same curing conditions ; the degree of hardness of the mixes increases with increasing proportions of cyclised rubber in the mix. The results obtained by us show that under similar conditions of compounding, cyclised rubber is three times harder than natural rubber. Modulus at 300 per cent elongation, determined with dumbell shaped samples shows a steady rise with increasing proportion of cyclised rubber in the mix whereas the tensile strength of the product decreases.

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Chemicals from the Wood Industry

The wood industry supplies a host of raw materials to the makers of chemicals, and it is a promising source for numerous other chemical materials. The article reviews recent developments in the field and underlines the need for further research on wood products to make the best use of this important source of raw materials.

WOOD, a renewable natural resource, has a bright future as a raw material for the chemical industry. Large quantities of wood residues are now available to the chemical industry each year. To avoid continued wastage of these residues, integration of the forest products industries is essential. This integration is rapidly becoming a reality in U.S.A. Sawmills have built pulp mills, which recover by-products from pulp residues. Pulp mills have put up chemical plants to recover extractives from bark and some species of wood. Conversely, pulp mills have built sawmills and veneer plants. Wood processing companies have built structural fibreboard and particle board plants. However, the full use of forest products by the chemical industry is far from being realized.

Silvichemicals (chemicals from wood) now on the market include vanillin, fatty acids, rosin, turpentine, dimethyl sulphide, ethanol, bioflavenoids, antioxidants, rubber reinforcers, plastic extenders, oil-well mud dispersants, emulsion stabilizers, ceramic binders, sugars, yeast, and lignin. Yet these are only suggestive of the rich prizes that await the chemical industry. — *Battelle Tech. Rev.*, **6** (1957), No. 9, 3.

Lignin

Lignin, one of the potentially important materials in wood, is a source for hundreds of products and can rival coal and petroleum as a source of synthetic chemicals. Yet kraft and soda pulp mills use millions of tons of lignin as fuel. In addition, large quantities of spent sulphite liquor lignin from pulping mills are wasted. Steps are now being taken to utilize this material. Several mills in U.S.A. are isolating and marketing both softwood and hardwood alkali lignin in commercial quantities. Some also produce vanillin from spent sulphite liquor. However, the requirements for flavouring vanillin are so limited that they absorb less than one per cent of the available spent liquor. The Institute of Paper Chemistry in U.S.A. is carrying on a fundamental research programme through which vanillin has been converted into hundreds of related compounds. In addition to vanillin and vanillic acid, other organic chemicals which can be prepared from spent sulphite liquor lignin are guaiacol, acetovanillon, syringaldehyde, syringic acid, 5-carboxyvanillin, and many other guaiacyl and syringyl compounds.

Lignin is a potential source of aromatic chemicals. Two new methods of processing the material to provide aromatics have been reported. One is controlled pyrolysis which gives aromatics in the tars with an activated char as the residual product. The second, catalytic hydrogenolysis, gives phenols, cyclohexanols, and substituted cyclohexanols. The most promising market for lignin, if the proper modification can be found, is in rubber, plastics, and other moulding compounds.

Hemicellulose

In the kraft process, the easily hydrolysable hemicellulose has been converted to saccharinic acids which are suitable as intermediates for the production of deoxyribose and nucleic acids — so valuable in diet supplements. The sulphite pulping process converts the hemicellulose material to free sugars, about 400 lb. per ton of pulp produced. These sugars are converted to *Torula* yeasts, which are being used in animal feedstuffs and as food supplements.

The major chemical derived by acid conversion of the pentose fraction is furfural, which in turn is converted to nylon intermediates. The hexose sugars can be hydrogenated to polyols, sorbitol, propylene and ethylene glycols, erythritol, and glycerine. The pentose and hexose sugars undergo many types of fermentation including alcohol, lactic acid, acetic acid, butanol, and acetone.

Wood chips, sawdust, and wastes may be hydrolyzed to produce levulinic acid. Many commercially important derivatives have been formed from levulinic acid, including vinyl levulinate, a water soluble cellulose levulinate acetate, dimethyl pyrrolidone, and basic aluminium levulinate.

Tall Oil

In the kraft pulping of resinous woods, the resins in the wood are both saponified and dissolved in the alkaline cooking medium. These soluble resins stay in the alkaline medium, and remain in the black liquor as sodium soaps. On concentration and cooling these soaps separate as skimmings which are removed and acidified to give 'tall' oil — a mixture of about 35–50 per cent resin acids, 40–60 per cent fatty acid, and 5–7 per cent neutral compounds. Today tall oil has reached the status of an important chemical raw material, especially for coatings, detergents, and resins.

Most tall oil is now refined by distillation. Modern distillation processes yield rosin products similar to gum and wood rosin and very fine fatty acid fractions containing mostly oleic and linoleic acids with only very small amounts of rosin acids and unsaponifiable matters. These new rosin and fatty acids are finding increasing use as major chemical raw materials in contrast to the use of tall oil as a cheap substitute a few years ago. Tall oil now ranks third in order of oils consumed by the paint and varnish industry in U.S.A.

The neutral or unsaponifiable portion of tall oil contains various sterols, generally classified as phytosterols; β-phytosterol, which may be recovered from tall oil pitch, is now being used for treatment of aetherosclerosis.

Condensation of the digester relief gases from the draft pulping of pine woods yields sulphate turpentine up to 22 lb. per ton of pulp. Today, sulphate turpentine makes up a high percentage of total turpentine production.

Major uses for whole and refined tall oil include asphalt additives, compounders, core oils, degreasing compounds, driers, flotation agents, linoleum, oil cloth, hardfloor coverings, lubricants and greases, rubber, soaps and detergents, sulphonating agents, surface coatings, and printing inks.

Bark Extractives

Extractives in wood and bark include water-soluble products, such as carbohydrates, organic acids, tannins, and dyes, as well as fats, oils, waxes, resins, terpenes, and essential oils. Dihydroquercetin and quercetin, useful as antioxidants, are nearing commercial production by an extraction process of Douglas fir bark. A promising bioflavenoid, myricetin, is being recovered from lodgepolepine bark and may find a market in the treatment of cold.

Commercial chemicals are being manufactured from redwood bark in a plant at Scotia, California. The dust and fine debris of the redwood bark are processed in a continuous digester to make industrial chemicals based on the phenolic constituents of the bark. Cooking with sodium hydroxide or sodium sulphite produces (yield 60–80 per cent) sodium salts of the phenolic materials which are present in the redwood bark. Commercial uses of these chemicals include dispersing agents, phenol and tanning replacements, ceramic binders, ore flotation agents, battery expanders, boiler-water treatment materials and oil-well drilling-mud conditioners.

Other By-Products

A commercial process is now in operation in U.S.A. to produce dimethyl sulphide from kraft waste liquor. Spruce turpentine, the condensate from the relief gases given off during the sulphate digestion of coniferous woods, is essentially ρ-cymene with small amount of dipentene, borneol, and sesquiterpenes. ρ-cymene has been converted on a commercial scale to such aromatic compounds as cumic acid, dimethyltotylcarbinol, methylacetophenone, phenol and methylstyrene.

Another by-product of the sulphite pulping industry is conidendrin, recovered mostly from the western hemlock waste liquors. Demethylation of conidendrin yields a very potent antioxidant for fats oils, and other materials.

Automobile Leaf Spring Industry in the Northern Region: A Survey

LEAF springs are important components of suspension systems of automobiles. An automobile leaf spring consists of a long strip of steel, known as the 'main leaf', master plate or mother plate and a number of shorter strips which are auxiliary leaves of gradually diminishing length. The thickness, width and length of the main leaf, the number of the auxiliary leaves attached to the main leaf and the weight of the assembled sets vary with the design details of the vehicle. Generally the range of variation is ¼ - ¾ in. for thickness, 1½ - 3½ in. for width and 30 to 60 in. for length of the main leaf; the number of auxiliary leaves vary from 7 to 21 and the weight of the assembled sets from 50 to 240 lb.

The industry took root in India during World War II. Though the indigenous manufacture is of inferior quality, due to the limited availability of imported material, the industry has since grown considerably. The post-independence policy of categorising the spring leaves under restricted importable items gave further impetus to this industry. The Small Industries Service Institute, New Delhi recently conducted a survey of the industry in the northern region. Some of the findings and recommendations made are reported here.

The automobile leaf spring industry can be divided into two sectors; (1) the large sector which is well mechanised, has the necessary testing facilities and is located in Bombay, and Bangalore, and (2) the small sector which is manufacturing the springs mostly manually, and is fairly spread out all over the country. The small sector may further be subdivided into units which employ satisfactory heat treatment and those which do not employ heat treatment.

Production — In the northern region, which has no large scale production units, there were in 1955, 10 firms producing annually 940 tons of springs without heat treatment and 2 firms manufacturing 1,230 tons of heat-treated leaf springs. The total production of 2,170 tons of spring leaves in the northern region compares well with the total production of the large sector amounting to 2,950 tons. A part of the production of the large sector consists of leaf springs for the railways. The growth of this industry in the northern region is largely aided by a number of re-rolling mills at Gobindgarh (Punjab) which provide steel leaves of standard sizes to the industry. The prosperity of the industry in this region is also due to the proximity of Delhi which is the biggest distribution centre for automobile parts in Northern India.

Demand — The total annual demand for spring leaves in the country is over 4 lakh units or 13,645 tons (30 springs weigh one ton on an average). The projected domestic demand by 1961 is estimated at nearly 6.5 lakh pieces or about 21,600 tons, an increase of 10 per cent per annum. The requirements in the northern region by 1961 are placed at about 2,920 tons against the present output of 2,170 tons. Possibilities of developing an export market also exist.

Raw Materials — The raw materials for the spring leaves are mainly silica manganese steel, chrome vanadium steel and chrome silicon steel. While the large firms depend on imports of these varieties of steel, the small firms largely depend on indigenous steels and on re-rolled shafts, grenade and tank plates. The use of re-rolled material, though cheaper than indigenous spring steel, is the cause of the poor quality of the leaves manufactured. The poor heat treatment given to the springs in smaller units also accounts for the inferior variety manufactured.

The equipment required in this industry includes hardening and tempering furnaces, power hammers, drills, hack saws, grinders, quenching tanks and testing equipment. The quality of the spring leaves depends mainly on the proper hardening and tempering of the leaves.

Future Prospects With suitable arrangements for the procurement of quality spring steels by the small scale manufacturers, the quality of the leaves produced can be considerably improved. In the northern region there exists a demand for 2,200 tons of spring steel and this is expected to increase by 10 per cent every year. Facilities for testing the finished products are also necessary to ensure quality. Provision of suitable furnaces for hardening and tempering of the leaves will improve the performance of spring leaves. Facilities for training small scale manufacturers in the latest manufacturing techniques could be provided to modernise the industry. Formulation of standards for automobile leaf springs and their adoption by the small manufacturers would also help the industry in producing springs conforming to specific requirements.

National Industrial Development Corporation: A Review of Progress

THE National Industrial Development Corporation was set up by the Government of India in 1954 for the promotion and development of industries in the country. The Corporation was registered as a private limited company, with an authorised capital of Rs. 1,00,00,000 of which Rs. 10,00,000 have been issued and subscribed wholly by Government.

The Corporation is conceived mainly as an instrument of Government for securing a balanced and integrated development of industries in both the private and public sectors. Its object would primarily be the development of industries, particularly those which are necessary to fill up gaps in the industrial structure. The Corporation will plan and formulate projects for setting up new industries or developing new lines of production. It will take up the study and investigation of industrial schemes and, while implementing them, will try to ensure the maximum possible use of industrial equipment, experience and skill available in the country.

Industrial Projects

The Corporation has had under consideration a number of industrial projects with a view to develop new lines of production in fields where the country is exclusively or mainly dependent upon imports. Out of these a selection has now to be made of the projects to be taken up for execution. These are : (1) Manufacture of industrial machinery in the field of heavy engineering ; (2) Production of the primary intermediates required by the organic chemical industries like drugs, dyestuffs and plastics ; and (3) Some crucial raw materials like aluminium and synthetic rubber. The present stage of development in the more important projects is briefly indicated here.

Heavy Machinery For developing capacity in the manufacture of heavy industrial plant and machinery, the N.I.D.C. has had in view since 1954 a number of heavy engineering projects. These included a heavy foundry for grey iron and steel castings, a heavy forge shop and heavy structural works. At the invitation of the Government of India a team of experts from the U.S.S.R. and another team from the United Kingdom under the joint auspices of the Colombo Plan and the Federation of British Industries have recently submitted reports recommending projects to be undertaken in this field.

Both these reports emphasize the importance of setting up capacity for heavy castings and heavy forgings. The Foundry/Forge project, which the N.I.D.C. has planned for this

purpose has made substantial progress. Detailed project reports have been received from firms in Czechoslovakia, U.K. and West Germany. These reports are under examination by Government for taking a decision on the implementation of the scheme in the context of the overall programme for the manufacture of heavy machinery to be developed by Government.

Primary Intermediates Most of the organic chemical industries in India today drugs, dyestuffs, plastics, etc. are based on imported intermediates. With the expansion of the steel industry, it would become possible to manufacture in the country most of these intermediates by utilising the coke oven by-products and the coal tar available from them. As the indigenous dyestuffs industry itself is in its nascent stage, the N.I.D.C. has arranged for a technical team of experts from Italy to come to India and prepare a report on the scope and pattern of developing the manufacture of intermediates taking into account the future development of the dyestuff industry. Reports on the subject were also submitted to Government by a consortium from West Germany and a firm in the United Kingdom, besides a study voluntarily undertaken by a group of Indian technicians. A team of experts from the U.S.S.R. have also appraised the intermediates requirements of the drugs and pharmaceuticals industry. Based on these reports, a project for the manufacture of the more important intermediates including, but not confined to, the primary intermediates, has been drawn up, and the terms of its execution are under negotiation with overseas firms, which have offered their collaboration in this field. It is expected that a final agreement with one or two of them will be reached soon.

Alloy and Tool Steels With the industrial development of the country particularly with the emphasis on the manufacture of industrial plant and machinery, there will be a growing demand for special alloy and stainless steels. Preliminary reports for a project to produce these steels in the country have been received from firms in Czechoslovakia, France, Italy and the United Kingdom. The first two have given their proposals for a plant with a capacity of 20,000-25,000 tons per annum for rolled and forged steel sections and 7,500 tons of tool steel sheets and stainless steel sheets, with provision for expansion at a later stage. The other two proposals are for a plant of 100,000 tons initial capacity. Discussions are in progress regarding the size of the project and the method of its implementation.

Aluminium The consumption of aluminium in the country has been steadily increasing and the gap between production and demand by 1960-61 has been estimated to be about 15,000-20,000 tons a year. The country has adequate supplies of bauxite and with the development of new hydro-electric projects from which cheap power is expected to be available, the expansion of the aluminium industry in India has been engaging the attention of the Government. An expert Committee set up by Government has recommended the setting up of units of 10,000 tons annual output with provision to expand to 20,000 tons and more as soon as feasible. Government have decided that the N.I.D.C. should process one such project and accordingly the Corporation arranged for the services of experts from the U.S.A. to study the economic and technical aspects of such a project. Based on this report negotiations are now in progress with a number of important manufacturing groups. The question of a second plant of similar capacity will be taken up when financial provision is available.

Synthetic Rubber The present demand for rubber (both natural and synthetic) in the country is about 28,000 tons and it is likely to increase to 45,000 tons in 1960-61. The production of natural rubber within the country is about 21,000 tons and both natural and synthetic rubber are being imported to fill the gap. Even though efforts are being made to expand the production of natural rubber and off-take for the entire production will be ensured, there will remain a gap to be filled by indigenous production of synthetic rubber whose inherent physical and chemical properties give it a superiority over natural rubber in many applications. Besides, the production of synthetic rubber will offer an economic outlet for the alcohol from sugar factories which by 1960-61 is expected to amount to 40 million gallons.

The Corporation invited a team of experts drawn from a consortium of four well-known U.S. companies to study and work out a preliminary project for producing 20,000 tons of synthetic rubber yearly. This study was followed by an independent assessment by

another large manufacturer-consumer of synthetic rubber and both the reports indicate that the scheme is technically feasible. Negotiations are in progress with firms interested in collaborating in this field for setting up plants for manufacture of not only synthetic rubber but also the chemical components. The styrene project will be located at Rourkela and the synthetic rubber plant will be established at Bareilly.

Cinema and X-Ray Films — The demand from the Indian film industry for cinematographic film is likely to increase from 300 million feet to 400 million feet by 1960-61. There is also a considerable volume of demand for X-ray films and photographic paper. At the invitation of the Government, a team of experts from East Germany visited the country in 1956 and submitted a preliminary report on the technical and economic aspects of the scheme. Negotiations for implementing the project are in progress. The plant will be located most probably at Ootacamund.

Newsprint — A team of experts from a firm in West Germany, who were invited to explore the scope for making newsprint from bagasse as well as to survey the prospects of making rayon grade wood-pulp from some indigenous raw materials, particularly bagasse, have indicated that it would be possible to make newsprint from sugarcane bagasse and that a plant of 30,000 tons initial capacity could be set up near Shakarnagar in Andhra State. This would help to cover a large part of the present gap between the current demand of about 80,000 tons and the capacity output of 30,000 tons from the only newsprint mill in the country. The Corporation has been conducting further negotiations with a view to its implementation.

Basic Refractories — With the expansion of India's steel industry the demand for basic refractories is growing very rapidly. After preliminary discussions with a number of firms, two proposals — one from an American firm and another from a French group — have been referred for technical examination to the Consultants to the Government of India.

Sulphur from Pyrites — As there are no indigenous sources of sulphur and there is imperative need for ensuring supplies of this commodity from local sources for at least the most essential industries, a proposal has been made for converting indigenous pyrites into sulphur by a suitable process such as the "Orkla" process. The most fruitful source of pyrites in the country is reported to be at Amjhor in Bihar and work on prospecting and proving these deposits is being expedited. It is proposed to establish a National Pyrites Mining Corporation at an early date.

Modernisation of Industry — Government have decided to use the Corporation as an agency for the grant of special loans for the modernisation and rehabilitation of the jute industry and the cotton textile industry. The Corporation may perform a similar function in relation to any other industry which the Government may desire to assist.

Applications from jute mills should be addressed to Member-Secretary, Jute Loans Advisory Committee, 4, Esplanade East, Calcutta. Applications from cotton mills should be sent to Member-Secretary, Cotton Textile Loans Advisory Committee, Office of the Textile Commissioner, Wittet Road, Ballard Estate, Fort, Bombay.

Technical Digest

Detoxication of Castor Cake

INDIA produces annually more than 125,000 tons of castor seed. Large quantities of the seed and oil are exported. The demand for the oil in the country for various industrial uses is also increasing. However, one of the serious economic hindrances to the large scale utilisation of castor seeds is the toxicity of residual meal (cake) obtained after extraction of the oil which renders it unfit for use as a cattle feed. The cake is, therefore, used mainly as a manure.

The toxicity is due to the presence in the cake of a protein (ricin) to the extent of about 1·5 per cent. A number of methods have been employed to detoxicate castor cake to render it safe for use as a protein supplement to livestock. The toxicity can be removed either by denaturing the ricin or by removing it from the cake by washing. Some of the methods developed and the results obtained are summarised here.

Methods of Detoxication

Treatment with Salt Solutions — Powdered castor cake was steeped separately in 1 per cent solutions of sodium chloride, ammonium sulphate, sodium sulphate, and disodium hydrogen phosphate for 2 hr. It was filtered off and washed with water 2–3 times. Finally the cake was filtered, pressed, dried and ground to a powder.

The cake treated with disodium hydrogen phosphate was detoxicated almost completely ; other salts were less effective.

Treatment with Hydrochloric Acid — Powdered cake was steeped in a solution of hydrochloric acid (0·2 N) for 24 hr., filtered and washed with hot water : about 5 washings were required for removal of the acid. After washing, the cake was filtered, pressed and dried.

Treatment with Organic Solvents — Powdered castor cake and ethyl alcohol (rectified) were mixed (1 : 4) and refluxed on water bath for 30 min. The alcohol extract was poured off and the residue extracted with fresh alcohol for the 1 hr. and filtered. The last traces of solvent were removed from the cake under vacuum.

Autoclaving — Steam under pressure (2 atm. at 134 C.) was allowed to come in contact with moist cake for 15 min. The cake thus produced could be directly added to the feed as it was almost dry.

Steaming — Powdered cake moistened with water and spread in a perforated dish was subjected to the action of steam in a closed vessel provided with a steam outlet. The period required for detoxication was 20-30 min. The dish was removed and the cake dried.

Cooking — Powdered castor cake was mixed with water to form a thick paste and cooked for 40 minutes. The contents became soft and increased in bulk. The cooked product could be directly fed to the animals. It should, however, be dried if intended for storage.

Boiling with Water — Powdered castor cake was boiled with excess of water (1 : 6) for a short time and the water poured off. Fresh water was added, the mixture reboiled, filtered and washed. Two to three washings sufficed for detoxication of the cake. The water was removed by pressing the cake in a thick cotton cloth and drying.

Tests for Toxicity — The detoxicated cake is tested by agglutination, colour and feeding of albino rats, rabbits and guinea pigs. Ricin, like other toxalbumins agglutinates the red blood corpuscles of mammalian blood ; this property is lost when the protein solution is heated to coagulation. Also, after coagulation, ricin becomes insoluble in water and hence the water extract of the

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TABLE I — AGGLUTINATION AND COLOUR TESTS FOR DETOXICATED CASTOR CAKES

Cake used	Ninhydrin Colour Index			Agglutination Test
	Yellow	Blue	Red	
Solvent extracted cake (with benzene or *n*-hexane)	0	10·0	14·0	0·5 ml. of 1·500 dilution
* Cake A	0	3·2	7·1	0·5 ml. of 1·200 do.
† Cake B	0	2·9	6·4	1·5 ml. of 1·200 do.
‡ Cake C	0	1·9	3·1	0·5 ml. of 1·100 do.
Cake boiled with water	3	5·0	4·9	nil
Steamed cake	3	1·5	10·2	do.
Alcohol-treated cake	2	1·5	2·6	do.
Cooked cake	3	1·3	2·4	do.
Cake treated with Na_2HPO_4	3	1·3	2·6	do.
Aqueous extracted cake	4	0·9	1·6	do.

* *Bhavnagar Oil and Chemical Industries Ltd.*, Bhavnagar
† *Chetty & Co.*, Madras State
‡ *Swastik Oil Mills Ltd.*, Wadala, Bombay

detoxicated castor cake gives a very faint blue colour with ninhydrin solution as compared to toxic castor cake. This also affords a useful method in ascertaining detoxication. Coloured slides may be prepared to match the blue colouration of the detoxicated cake ; such slides may be used to compare the colour of the water extract of detoxicated cake after treating it with ninhydrin solution.

Results

Colour and agglutination tests for different samples of cakes detoxicated by the above methods are given in Table I.

It is seen that Sample C has the least agglutinating power and hence is the least toxic. It can also be distinguished from other cakes by the faint blue colouration obtained with ninhydrin. The low toxicity of the cake is due to the extraction process followed in this particular case. After cold pressing of the seed, the meal is steam cooked retaining a certain amount of moisture in the cake and pressed again. This treatment denatures ricin, rendering the cake non-toxic. If the steaming is thoroughly done, the cake can be completely detoxified and rendered safe for use directly as a cattle feed.

Hydrocarbon solvents such as benzene and *n*-hexane extract castor oil without denaturing ricin in the cake.

Treatment of the cake with solvents such as ethyl alcohol and chloroform brings about detoxication but the method is not practicable on a small scale on account of the cost involved and difficulties of finding skilled labour, recovery of solvent, fire hazards, toxicity of solvent, etc. Boiling with water, cooking, steaming and autoclaving are the more practicable methods. Of these the cooking process is the simplest and can be worked out on a small scale even by unskilled labour. Detoxication with disodium hydrogen phosphate is equally simple ; however, water soluble inorganic salts are retained during cooking.

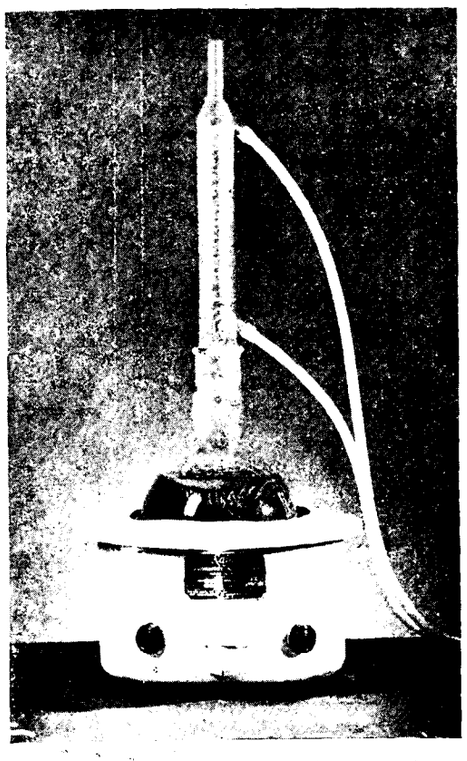
Samples of castor cakes detoxicated by cooking and treatment with disodium hydrogen phosphate were fed to a large number of albino rats and rabbits without causing any mortality. V. R. Ambekar and K. K. Dole, *Indian J. Dairy Sci.*, **10** (1957), 107.

Patents & Processes

Electrical Heating Mantles

Patent Appln. No. 62366
Shri Ram Institute for Industrial Research, Delhi-8

Difficulties are generally experienced in the laboratory in heating round bottom flasks and other similar apparatus requiring controlled and flame-proof heating. Common electrical appliances like heaters and hot plates are not satisfactory on account of the small and limited contact space available for heat transfer ; gas heating is equally unsuitable. Besides, such appliances cause bumping of the contents in the flask. Water, oil, sand and metal baths in use at present are cumbersome and are not easily controlled ; oil baths are sometimes unsafe to use because of the risk of fire.



Electrical heating mantle (one litre)

In foreign countries, an electrical appliance, known as heating mantle is generally used for heating round bottom glass apparatus. In India the manufacture of such devices has not so far been undertaken because of the non-availability of technical skill and know-how. The requirements, though limited, are being met from imports.

A device similar to the imported heating mantles has been developed at this Institute. It consists of a coiled heating element, insulated by a knitted layer of glass fabric, housed in a metal container. The coils are arranged to form a basket-like hemispherical surface which imparts uniform, controllable heat round the bottom of the flask. Temperatures up to 400 C. can be easily attained. A metal barrier protects the element from incidental overflows.

The device can be manufactured to suit 50 ml. to 20 litre flasks. Damaged parts can be easily replaced. Prototype heating mantles made at the Institute have been in use for a long time and have given satisfactory service.

The manufacture of these mantles can be taken up by firms engaged in the production of electrical goods. Small scale production is also possible with ordinary workshop facilities.

Details may be obtained from the Secretary, National Research Development Corporation of India, Mandi House, New Delhi.

Mango Cereal Flakes

Central Food Technological Research Institute, Mysore

Large quantities of mango pulp obtained as a by-product of mango canning industry are available in India. Besides, there is a large surplus of the fruit during the glut season which does not find

any profitable use at present. To utilize the surplus fruit, the Institute has developed a product, mango cereal flakes, for use as a breakfast food, porridge or snacks. The flakes contain : mango solids, 49% ; wheat flour, 23% ; and added sugar, 28%. They can also be used in ice cream as a thickener and as a flavouring material. One oz. of the product supplies about 3,500 I.U. of vitamin A besides other fruit nutrients.

The method of preparation consists in cooking the wheat or corn flour to gelatinize the starch and destroy the enzymes. Mango pulp, partially neutralised and heated separately, is added to the cooked flour. Cooking is continued till a desired consistency is obtained. Sugar and other additives are then added, the mixture is made homogeneous and dried into flakes on a suitable drum drier.

Production can be taken up independently, or preferably, in conjunction with other lines of fruit processing. With some additional equipment, existing fruit and vegetable preservation factories can take up commercial production without much difficulty.

Parties interested in commercial development of the process are invited to write to the Secretary, National Research Development Corporation of India, Mandi House, New Delhi.

Patents in India

THE report of the working of the Patent Office in India during 1956, which has just been released, records appreciable progress in the inventive activity in the country. This is reflected in the increase in the number of applications for patents and designs : applications for patents increased to 3,067 in 1956 from 2,736 in 1955 while those for registration of designs increased from 3,835 in 1955 to 4,376 in 1956. About 99 per cent of the applications for designs originated in India.

Applications for patents originating in India also showed an increase from 446 in 1955 to 540 in 1956. The States of Bombay and West Bengal together contributed 56 per cent of these applications.

The chemical industry retained its predominance in the field of inventions which concerned the preparation of steriods, hormones polymers and plastic compositions. In the inorganic field great interest was shown in the preparation of fuel elements and moderator material for use in nuclear or thermal reactors.

In the field of food and medicine, Indian inventions mainly pertained to the development of the sugar industry and improved processes for clarifying juices and saccharine liquids. Inventions from abroad related to antibiotics and compositions containing antibiotics.

Applications for patents relating to insecticides and fungicides were mostly for compositions containing phosphorous compounds and for the development of D.D.T. water dispersible concentrates.

The iron and steel industry continued to attract a large number of inventions from abroad. Many of these were for the refining of cast iron, electrical smelting of iron ore and special refining techniques for making steels.

In the field of coking and gas producers, inventions originating in India related to pretreatment of non-coking coal to make it suitable for coking and carbonizing vegetable matters.

Inventive activity was also noticeable in other fields such as India rubber compositions, paper manufacture, photography phonographs, and calculating and counting apparatuses.

Indian Patents

A few of the Patent Applications notified as accepted in the *Gazette of India*, Part III, Section 2, 14 December 1957 to 4 January 1958, are listed below :

Plant and Equipment

56723 Method and apparatus for condensing and separating liquids from a mixture of vapours containing the same: *Consisting of a jacketed cylindrical tank, inlet pipes for feeding a condensing medium and mixture of vapours and means to create vacuum inside the tank* — GOKHALE

57170 Improvements in apparatus for use in the making of paper or board : *One further slice is arranged serially along the parallel section of the lower run* — ANNE'S BOARD MILL CO. LTD.

60176 Method of and apparatus for condensing a sublimate from a hot carrier gas : *The carrier gas containing the sublimate having a temperature above vaporisation temperature of water is contacted with a mist of water at about its b.p., whereby the carrier gas is cooled and the sublimate is condensed* — CIBA LTD.

60177 Improved catalytic reaction vessel : *The vessel comprises a reaction chamber with an inlet and an outlet, at least two gas permeable layers of catalyst extending transversely to the direction of gas flow and means for charging and discharging catalyst from each layer independent of the other layer* — CIBA LTD.

57166 Improvements in digestors : *Firebox fitted to the base of a jacket surrounding the vessel* — V. A. P. CORPORATION (P) LTD.

57572 Improvements relating to cyclone furnaces and a method of producing hot gases therefrom : *Furnace chamber of circular cross section with means for primary and secondary combustion air and a liquid atomizing burner* — BABCOCK & WILCOX LTD.

57711 Improvements in ionisation chambers : *Coated inside with an electrically conductive material of high atomic number such as lead* — COLE LTD.

59424 Improved water filter : *Consisting of an inner member and an outer member closed and formed integral with the inner member at upper end, and the lower open end is adapted to receive one or more sieves of filters* — GUPTA

57683 Improvements in apparatus for moulding plastic materials : *Comprising a heated cylinder having a worm therein, valve means adapted to be opened by engagement with a mould and a rotary plate carrying two or more moulds* — WUCHER

Chemicals

59908 Improved process for the manufacture of absolute alcohol by distillation of fermented liquids : *Wherein the stripping and rectifying columns are worked at higher pressure and alcohol vapours from the rectifying column are used as source of heat for dehydration and benzene recovery columns* — VENKITESWARAN

58314 Improvements in dry battery carbon black and process for its production : *Burning non gaseous aromatic hydrocarbons having H/C ratio of 0·75-1·25 and mean molecular weight of 125-550* — CABOT, INC.

Fine Chemicals, Pharmaceuticals and Perfumes

57494 Process and apparatus for the production of dialkyl aluminium hydrides and aluminium trialkyls : *Wherein aluminium is heated with an aluminium trialkyl and hydrogen at a pressure higher than 20 atmospheres* — ZIEGLER

57531 Eugenol glycolic acid and *iso*eugenol glycolic acid amides : *Reacting eugenol or isoeugenol glycolic acid with a primary or secondary amine* — GEIGY A.-G.

57969 Therapeutic composition : *Comprising a novobiocin antibiotic and a tetracyclic type antibiotic, the content of former being 10-90 per cent* — CHAS. PFIZER & CO., INC.

58379 Improvements in a method of producing vitamin A : *β ionone is condensed with cyanoacetic acid, the product is decarboxylated and the acetonitrile is converted into an aldimine complex which is hydrolysed to β ionylidene acetaldehyde, the aldehyde being condensed with acetone and resulting C_{18} ketone being subjected to the same steps as before to obtain vitamin A aldehyde which is reduced to obtain vitamin A.* — N. V. PHILIPS' GLOEILAMPENFABRIEKEN

60175 Process for the oxidation of anthracene to anthraquinone : *Anthracene vapour is mixed with a stream of hot gas containing oxygen so that the composition of the mixture does not exceed the critical explosion limit* — CIBA LTD.

56914 Vaccine products and method of producing the same : *Subjecting aqueous medium containing living poliomyelitis virus to treatment with a combination of ultraviolet irradiation and heat and/or heat and formaldehyde* — PARKE, DAVIS & CO.

58824 Improvements in cosmetic preparations and methods of making the same : *Comprising a solution of a saturated polymer of a lower alkane*

in an ester of a fatty acid with an alcohol, incorporated with known ingredients for cosmetics — ATTERBY

61080 Process for the purification of lactic acid : *Lactic acid in the presence of at least 0·01 per cent of a non-volatile organic or inorganic acid is subjected to steam distillation* — AKTIESELSKABET DE DANSKE SUKKERFABRIKKER

61899 Vaccine products and method of producing the same : *Subjecting to ultraviolet light a thin film of aqueous medium containing living polio myelitis virus under an intensity of 12,500 to 32,000 microwatts per sq. cm. for less than 10 seconds and incubating the irradiated medium at elevated temperature for 2 days* — PARKE, DAVIS & CO.

57670 Process for the preparation of new pharmacologically active compound : *Treating the extract with acids or salts, adsorbing the said extract on an absorbing agent and then subjecting it to electrodialysis or ionophoresis followed by crystallisation of ranjemidine* — CIBA LTD.

Oils, Fats, Waxes and Detergents

59913 Mixed detergent composition : *The composition comprises a water soluble propylene tetramer (pentamer) benzene sulphonate detergent and a water-soluble inorganic polyphosphate salt forming water soluble complexes with hard water salts* — COLGATE PALMOLIVE CO.

60166 Production of a corrosion resistant stoving varnish direct from cashewnut shell liquid : *Heating and stirring cashew nut shell liquid and adding litharge manganese resinate and lead linoleate* — DIRECTOR OF RESEARCH & DEVELOPMENT, ARMAMENT DIRECTORATE

Foods

59455 Process for the preparation of a protein hydrolysate for oral use : *Subjecting proteins from mustard and sesame cakes to the action of papain* — COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH

Fertilizers

60500 Improvements in phosphatic manures : *A mixture of apatite, common salt, sand, carbonaceous material and water glass is calcined* — MINISTERUL INDUSTRIEI PETROLULUI SI CHIMIEI

59741 A method and apparatus for manufacturing phosphonitrogenous fertilizers : *Reacting gaseous ammonia with aqueous slurry which consists of phosphatic raw stuff and sulphuric acid* — RUMIANCA S.P.

Pesticides and Crop-control Agents

57890 Novel insecticidal compositions : *DDT and compound of formula* $Cl\,C_6H_4\,SO_2\,N(R)_2$ *where R is n alkyl radical with 3–7 C atoms* — HAMADAH AND NEEMAN

Glass and Ceramics

57514 Process for the production of alkali resistant instrument glasses, and instrument glass manufactured by this process : *Introducing zirconium oxide in the glass melt* — JENAER GLASSWERK SCHOTT & GEN

Building Materials

57839 Composite cement products and method of manufacturing same : *Pouring a cementitious mix in a mould, pressing an intake insertion thereon, pouring another layer of mix and subjecting the mould to vibrations* — SINGH AND SINGH

Fuels, Coal Products and Lubricants

60829 Automatic feed adjusting apparatus in coal washing machine : *Comprising inter alia number of electrical contact pieces arranged vertically in a row switched on to electric power by means of live roller attached to a float set in dressing chamber of coal washing machine* — KABUSHIKI KAISHA NAGATA SEISAKUSHO

61320 Improvements in the preparation of active carbon : Introducing steam or mixture of steam and air during carbonization in fluidized bed and subjecting resulting coke to air activation in fluidized bed — COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH

57013 Method for pre-treatment of non-coking, weakly coking and semi-coking coals for conversion to coking coals : *Dielectric heating with high frequency electric waves* — COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH

Fibres, Textiles and Dyestuffs

57542 Machine for winding filaments or yarns : *Relative movement of the spindle carrying yarn package and the frame in which the device determining the spot where the yarn is wound on the yarn package moves to and fro* — NAAMLOZE VENNOOTSCHAP HOLLANDSE SIGNAALAPPARATEN

58453 Improvements in loom pickers : *The bushes of synthetic material are fitted within the bores in the head of the picker through which the shaft passes* — TRADING CO. LTD. HEGT & CO. LTD.

58492 Process and apparatus for continuous manufacturing of artificial threads according to the wet-spinning method : *The threads are led through each strengthening bath with the aid of a positively driven roller partly immersed in the liquid and having a diameter of at least 40 cm.* — ALGEMENE KUNSTZIJDE UNIE N. V.

57030 Improvements in the preparation of textile fibres for use in the manufacture of textiles : *Feeding to a constant rate take-off mechanism at a rate of input in excess and means for continuously removing accumulated surplus input not accepted by the said mechanism* — BRITISH COTTON INDUSTRY RESEARCH ASSOCIATION

60358 New bromination process for the manufacture of anthraquinone dyestuffs : *Interacting 1 : 5 - diamino - 4 : 8 - dihydroxyanthraquinone with bromine* — I.C.I. LTD.

60534 Bleaching process by means of chlorites : *Chlorite solution having a pH of 3·5–5 is caused to act upon the goods at a temperature below boiling point of the solution* — FARBWERKE HOECHST AKTIENGESELLSCHAFT VORMALS MEISTER LUCIUS & BRUNING

Rubbers, Resins and Plastics

56797 Foamed resin products and the production thereof : *A foaming agent is introduced into a plastisol containing polyvinyl chloride* — NATIONAL CYLINDER GAS, CO.

56798 Process of forming foamed vinyl resin and the resin so formed : *Introducing a foaming agent having a boiling point between 40 to 175 F. into a plastisol containing polyvinyl chloride* — NATIONAL CYLINDER GAS CO.

58843 Improvements in the stabilisation of unvulcanised rubber : *Composition consists of unvulcanised rubber, a resin and a stabiliser* — SMITH & NEPHEW LTD.

57661 Improvements in methods of compounding rubber : *Preparing a mixture of hardenable resin and an aqueous dispersion of vulcanizable rubber* — DUNLOP RUBBER CO. LTD.

Cellulose, Lignin, Paper and Other Wood Products

56883 Process for the manufacture of panels, plates and shaped pieces from natural rice husk, and particularly from chemically and biologically treated rice husk : *Wherein a paste made from rice chaff or husk and self-hardening binders based on urea and/or formaldehyde and/or phenol and/or cement and substances containing magnesia, is cast into moulds* — CAFFI

61282 Continuous process for the esterification of cellulose : *Defibering cellulose in water, removing water, suspending the defibred cellulose in aqueous carboxylic acid, removing the said acid and esterifying the cellulose so impregnated with the carboxylic acid* — SOCIETE RHODIACETA

61415 Continuous process for the esterification of cellulose in homogeneous phase : *By treating the cellulose with esterifying agents, causing the resulting mass to undergo overall displacement while being subjected to a rotary and a reciprocating movement* — SOCIETE RHODIACETA

Metals and Metal Products

57508 Forging process : *Heating a steel blank to a temperature in excess of 200 F., subjecting the slug in a forging die to successive punching pressures so that metal is moved radially and axially to direction of application of the punching pressure* — HOLO-KROME SCREW CORP.

59175 Process of heat treatment of material preferably pellets of ores : *Mixing solid fuel with materials to be heat-treated and burning the same to provide a part of the heat required for the process* — METALLGESELLSCHAFT A.G.

59178 Method of driving and roasting or roasting and sintering : *Material is charged on the grate in two layers, the lower layer consists of raw material to be treated without admixture of fuel and the uppermost layer at least partially from return material* — METALLGESELLSCHAFT A.G.

61551 Improvements in the production of metallic coatings on the surfaces of metals : *The impacting material consists of glass spheres or spheres of hard non-metallic materials* — TAINTON CO.

57831–33 Process for the production of ferromanganese from high grade manganese-bearing materials : *Passing the ore in the form of a hot calcined charge into electric furnace and on to the composition charge and onto the surface of a molten slag bath, subjecting the charge to the action of a controlled amount of solid carbonaceous reducing agent* — STRATEGIC-UDY METALLURGICAL & CHEMICAL PROCESSES, LTD.

59250 Electro-winning of lead from lead sulphate : *Conducting electrolysis between 85 and 90 C. using leach liquor obtained by leaching pure lead sulphate and 20 per cent caustic soda, containing up to 45 g/litre of Pb as electrolyte* — COUNCIL OF SCIENTIFIC AND INDUSTRIAL RESEARCH

Engineering

57291 Improvements in filaments for electric lamps : *Plurality of filaments are connected in parallel between the leading-in wires*—GOVINDA MENON

59685 Improvements in method for separating carbon dioxide and hydrogen sulphide from gas mixtures: *Effecting cooling by reducing pressure over scrubbing solution leaving regeneration column, to evolve steam therefrom compressing the same and re-used in absorber column* — BENSON AND FIELD

57111 Continuous process for the improvement of catalytic vapour phase esterification : *Providing a packed fractionating column in addition to the catalytic reactor* — VENKATESWARLU, SATYANARAYANA AND RAO

61657 Evaporation of liquefied gases : *Comprises compressing the liquified gas to a pressure in excess of the required gas delivery pressure, evaporating the compressed liquified gas and warming the gas so produced by heat exchange with a heat source* — INDIAN OXYGEN & ACETYLENE CO. (P) LTD.

Miscellaneous

57516 Lantern top for hurricane lantern : *Outer chimney open at top and drawn to height of or above the height of inner chimney and closed at lower end with brim having a flat surface with rounded off corners raised to reach the side of inner chimney, the brim being fixed vertically to the axis of the lantern and having apertures* — VEB STURMGLATERNENWERK BEIERFELD

The Indian Standards Institution (Manak Bhawan, 9 Mathura Road, New Delhi-1) announces the publication of the following standards :

Ammonium Chloride, Pure — IS : 1113-1957 and *Ammonium Chloride, Technical* IS : 1114-1957 prescribe the requirements and methods of test for the two grades of the product. Price Rs. 1·50.

The technical grade is mainly used as a fertilizer while the pure salt finds application in the manufacture of dry cells and in the galvanizing, soldering and tinning operations. It is also used in some electroplating solutions, in dyeing textiles and in the manufacture of explosives. The country's annual requirements of about 4,100 tons are being met from indigenous production.

Methods of Chemical Analysis of Antimony — IS : 1047-1956 prescribes the methods for the determination of lead, silver, copper, iron, nickel sulphur, arsenic, tin and bismuth in antimony. Price Rs. 1·50.

Synthetic Resin Adhesives for Plywood (Phenolic and Aminoplastic) — IS : 848-1957 covers phenolic and aminoplastic synthetic resin adhesives used in the plywood industry for gluing veneers. It defines types of adhesives and the requirements for each type and also specifies the keeping qualities required of these adhesives. Price Rs. 1·50.

Natural Sour (Lactic) Casein for Glue Manufacture — IS : 850-1957 specifies the material, colour, odour and fineness of casein. Requirements and tests for moisture content, fat control, ash content, acidity, chloride and sulphate content are also given. Price Rs. 1·50.

Code of Practice for use of Metal Arc Welding for General Construction in Mild Steel — IS : 816-1956 is complementary to the Indian Standard Code of Practice for the Use of Structural Steel in General Building Construction, (IS : 800-1956) and covers the use of manual metal arc welding in the design and fabrication of general building construction in mild steel. The provisions of this code generally apply to the repair of existing building construction in mild steel and wrought iron but do not necessarily cover all the provisions applicable to the strengthening of existing structures.

The code also applies to normal buildings subject to wind load, and to crane gantries and runways embodied in the building structure and fixed to a member of the building. The standard attempts to lay down a code of good practice for the use of metal arc welding in general construction in mild steel with an eye on safety as well as economy without restricting the ingenuity of the design and construction engineers. The use of welded construction and the adoption of modern methods of design analysis will, in many cases, reduce the quantity of steel required for a structure. Price Rs. 2.

Code of Safety Requirements for Mains Operated Radio Receivers — IS : 616-1957 lays down detailed requirements for safety from electric shocks and fire risks as well as for robustness of construction of mains operated radio receivers intended for domestic or similar use. Limits of permissible leakage current on exposed live parts and tests for checking it are laid down. The code also covers general requirements, conditions of tests (both normal operating conditions and fault conditions), tests for prevention of shock and protection against accidental contact, protection against fire, resistance to heat, moisture resistance and mechanical strength tests as also details of safety marking. Price Rs. 2.

Ferro Alloys — IS : 1110 and 1111-1957 prescribe requirements in respect of size, chemical composition, chemical analysis, etc. for ferro silicon (IS : 1110-1957) and spiegleisen (IS : 1111-1957). The former covers five grades of the material, namely FeSi 75, 72, 65, 55 and 20 while the latter covers the standard and commercial grades of spiegleisen. Price Re. 1.

Scissors — IS : 989-1956 classifies scissors into certain broad categories based on the purpose for which they are used and also the process used in their manufacture. Besides specifying dimensional details for the different classes of scissors, the specification includes details of the materials to be used for the different parts of scissors, the heat treatment to be given to the blades and the quality of plating. Certain simple tests for judging the performance of the scissors and also the adhesion of plating have also been included in the standard. Price Rs. 2.

Spoons, Brass, Nickel and Silver — IS : 990 and 991-1957 specify requirements relating to materials to be used in manufacture, and dimensions and other features of these items. Price Rs. 1·50.

Handloom Cotton Fabrics — IS : 1093 to 1102-1957 cover Madras handkerchiefs ; gada cloth, grey ; dress material, bleached, dyed, printed, striped or checked ; Holland cloth, unscoured ; mosquito netting, bleached or dyed ; Cambrice, bleached ; lining cloth, dyed ; crepe, bleached or dyed ; cellular shirting, bleached or dyed ; and buckram cloth.

57890 — *Novel thiocolchicine compound of formula* $ClC_6H_4SO_2N(R)$, *where R is n-alkyl radical with 3-7 C atoms* — HAMADAH AND NEEMAN.

Glass and Ceramics

57514 Process for the production of alkali resistant instrument glasses, and instrument glass manufactured by this process : *Introducing zirconium diamino-4 : 8 dihydroxyanthraquinone bromine* — I.C.I. LTD.

60534 Bleaching process by means of chlorites : *Chlorite solution having a pH of 3·5-5 is caused to act upon the goods at a temperature below boiling point of the solution* — FARBWERKE HOECHST AKTIENGESELLSCHAFT VORMALS MEISTER LUCIUS & BRUNING.

Notes & News

Diosgenin from Dioscorea Tubers

In a previous communication (Chopra *et. al., Res. & Ind.*, **1** (1956), 130) it was reported that *Dioscorea deltoides* containing 4 per cent of diosgenin grows wild and in abundance in Jammu & Kashmir. A process for the preparation of pure diosgenin from the local dioscorea was also worked out. In view of the rapidly increasing demand for diosgenin as a starting material for the synthesis of cortisone and sex hormones investigations have been in progress to improve upon the earlier process.

Extraction of diosgenin from the local dioscorea tubers has been carried out following the method employed for the extraction of diosgenin from *Dioscorea berbasco* (*Industr. Engng Chem.*, **49** (1957), 186). Coarsely powdered air-dried tubers were hydrolysed with hydrochloric acid (5 per cent) and the hydrolysate heated for 4 hr. After cooling, the hydrolysate was filtered and the dark brown residue washed free from acid with water. The residue was then dried at room temperature and extracted in a soxhlet with petroleum ether (b.p. 40-60 C.). Diosgenin separated in the flask as a crystalline product which was filtered. The mother liquor, after washing with sodium hydroxide (2 per cent) and removal of solvent, yielded a further quantity of diosgenin. The total yield was nearly 95 per cent of theoretical. The product obtained was fairly pure, m.p. 200-201 C.

In another experiment, the dry hydrolysate (dark brown solid residue) was extracted with benzene instead of petroleum ether. The extraction in this case was complete in a comparatively shorter time but no solid separated out in the flask. The extract obtained was dark in colour, and on treatment with 2 per cent sodium hydroxide yielded rather impure diosgenin. — VISHWAPAL, K. L. HANDA and I. C. CHOPRA, Regional Research Laboratory, Jammu.

Cashewnut Shell Liquid Resin

Cation-exchange resins, which find use in water softening, are at present imported. A method for preparing resins from commercial cashewnut shell liquid, which is indigenously available in large quantities, has been worked out in the National Chemical Laboratory, Poona. The method consists in condensing the shell liquid with formalin and sulphonating the resulting polymer.

A project for the preparation of the resin on pilot plant scale has been recently sanctioned.

Jewellery Enamels

Enamels for use in jewellery are mostly imported. Compositions have been developed at the Central Glass & Ceramic Research Institute, Calcutta for producing white, transparent, opaque blue and transparent green enamels on gold and silver articles. Laboratory tests have shown that in fusibility, reflectance, gloss and other properties, these compositions compare favourably with imported enamels.

Bromine from Sea Water

A new method for the preparation of bromine from sea water has been used in Israel by the *Dead Sea Bromine Co.* The process is simple dispenses with the use of costly reagents, and produces bromine in a high state of purity — with a chlorine content of 0·01-0·02 per cent as compared with the generally accepted commercial standard of 0·2 per cent.

Concentrated brine is subjected to chlorination, and the bromine liberated from magnesium bromide (present in the brine) is removed from the solution by aeration and separated from the air by absorption in a sodium bromide solution at 0 F. Sodium bromide solution reacts with the bromine in the absorption towers to form polybromides. The absorption towers consist of columns packed with glass chips. The gas stream entering at the bottom of the columns, passes counter currently through an aqueous solution of sodium bromide (35° C.) at about 0 F. Saturated absorbent, containing about 35 per cent of bromine by weight, leaves the last tower at about 50 F.

Bromine is finally recovered by thermal dissociation of the polybromides in a steam-jacketed still, under slight vacuum at 230 F. Steam and bromine vapour from the still are condensed, and the water separated from the bromine in a decanter. Sodium bromide is recycled for another absorption step. — *Chem. Engng.* **64** (1957), No. 9, 164.

Pyridine from Coke-oven Gas

A process recently developed for recovering pyridine and ammonia from coke-oven gas (*E.P. 768, 745*) consists in passing the gas in succession through two scrubbers. In the first scrubber the gas comes in contact with a spray of acidulated ammonium sulphate liquor having a small sulphuric acid content (less than 6 per cent), whereby all the ammonia is converted into sulphate. The second scrubber is supplied with a spray of acidulated ammonium sulphate liquor having a higher sulphuric acid content (over 8 per cent) whereby the pyridine is converted to sulphate. Acidulated ammonium sulphate liquor and crystals are withdrawn from the first scrubbing space and acidulated ammonium sulphate/pyridine sulphate liquor is withdrawn from the second scrubber. — *Chem. Tr. J.*, **141** (1957), 959.

Fibrous Carbon

Carbon in the fibrous form has been obtained on a pilot plant scale by the pyrolysis of dilute hydrocarbon gases, particularly methane, at a temperature of 1150-1450 C. The fibrous carbon will eliminate two of the drawbacks of granular carbon, used in filtration, air conditioning and other plants, namely, the high pressure drop in granular beds and the difficulty of the removal of fine carbon particles.

Pyrolysis of dilute hydrocarbon gases is carried out in the presence of surfaces like alundum balls ; the carbon produced forms a mass of tufts or 'whiskers' on the balls. The form and the size of the fibres

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depend upon the temperature, the contour of the gas stream, the velocity of the gas over the collecting surfaces and other variables.

A second method of making strong and flexible fibrous carbon is by carbonising rayon into pure carbon. — *Chem. Tr. J.*, **141** (1957), 984.

Pelletizing as an aid to Sintering

A machine for pelletizing ore fines before subjecting them to the sintering operation has been developed by the British Iron and Steel Research Association. The use of sinter feed in the form of small pellets increases the permeability of the bed and greater output can be obtained from existing strands. The machine consists of a disc 3 ft. in diam., with a 7 in. surrounding wall. It can be rotated at speeds between 14 and 18 r.p.m. There are scrapers on both disc and wall which can be adjusted independently. The disc is inclined to the horizontal between 30 and 65 and a water spray is provided to moisten the material sufficiently for pellets to form.

With pre-determined positions of the scrapers, water spray and input, the size of the product depends on the speed of rotation and angle of inclination. In a typical test with Sydvaranger fines, a satisfactory proportion of pellets was obtained between $\frac{1}{8}$ and $\frac{1}{4}$ in. diam. at the rate of $\frac{1}{2}$ ton per hr. ; this rate could be appreciably increased.

The results have so far shown that the disc type pelletizer readily produces, from suitable material, pellets of a size range convenient for sintering, and this technique may contribute towards the increased sinter outputs.—*BISRA Survey*, (1956), 5.

Roller Tinning

When tinplate is made by the conventional hot dip method the strip remains in the tinning bath for some time and a brittle layer of tin and iron alloy is formed. In the roller tinning process this disadvantage is eliminated to a considerable extent by using two baths with a tinning roll dipping into each. The strip passes between the rolls without going into either bath and the tin is conveyed to the strip by the rolls. The operation is carried out in a reducing gas which cleans the strip and keeps the tinning unit clean.

Another advantage of this method, developed by the British Iron and Steel Research Association, is that the thickness of the coating can be easily controlled by adjusting the speed of the rolls relative to the speed of the strip. By having different speeds for the two rolls, coatings of different thickness can be applied to the two sides of the strip. Good coatings as thin as on electrolytic tinplate have been obtained on laboratory plant. A half scale plant to tin strip up to 12 in. wide is being built. It will be used to carry out the development work.—*BISRA Survey*, (1956), 11.

Plating by Ultrasonics

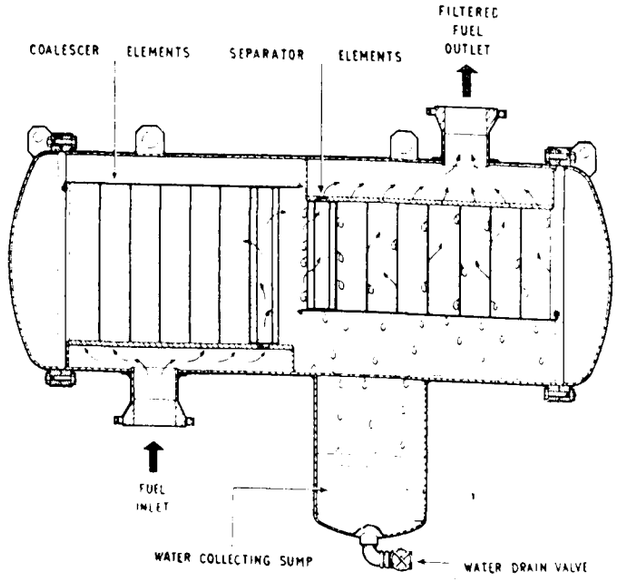
A number of advantages are claimed to have been obtained by carrying out electroplating under sonic and ultrasonic vibrations. The use of ultrasonic vibrations in electro-chemical baths increases adhesion, particularly on poorly cleaned surfaces and intricate shapes, decreases porosity, increases hardness and brightness and decreases polarization.

Plating is done directly on flat steel panels. No nickel or copper undercoat is necessary with ultrasonics. Steel cathodes used are partially masked with standard chromium masking lacquer. Anodes are of lead, as in commercial operations, and are positioned just outside the direct acoustic beam to reduce disintegration. Most of the measurements are made with the higher frequency waves (at intensity of 3·5 watts/sq. cm.) produced by a quartz transducer aimed vertically upward through the bath. — *Chem. Engng News*, **35** (No. 44) (1957), 50.

Fuel Filter-Separator

A new compact bulk fuel filter separator designed by the *Automotive Products Co. Ltd.*, Leamington (U.S.A.) extracts simultaneously water as well as solid particles, thereby eliminating the necessity of an additional filter.

The efficiency of water removal depends to some extent on the operating conditions, but the filter separators designed are stated to be 99·98 per cent efficient. All solids greater than five microns are removed by the filter together with a large proportion of smaller particles. Models suitable for flow rates from 250 to 750 gal. min. have been fabricated.—*Chem. Age*, **78** (1957), 366.

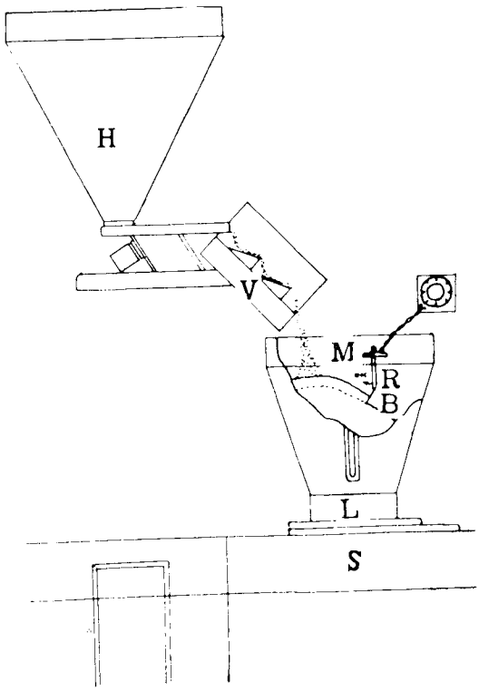


Fuel Filter-Separator

Maintaining Powder Level in a Feed Hopper

A simple automatic system for balancing the inflow of powder into a hopper against outflow from the bottom has been reported. The process maintains a constant "head" in the hopper and ensures constant flow of a powdered plastic into a screw conveyor feeding extrusion dies.

The hopper *L* feeding the conveyor screw *S*, is replenished from a hopper *H*, at higher level. The outflow from this is governed by passing over a vibrator unit *V*, which is stopped and started by the action of a mercury switch *M* in its power circuit. The switch is mounted across the top of a vertical, swivelling arm *R*, which carries at its bottom end a brass plate *B*. When powder in *L* rises above a given working level it deflects the plate, causing *M* to tilt and break the power circuit of *M*. This stops the vibrator until the powder level has fallen enough to allow the plate *M* to swing back into its former position.



Automatic System for Maintaining Powder Level

High Temperature Ceramic Filters

Ceramic filters made from aluminium oxide aluminium silicate have been designed to remove submicron particles at temperatures as high as 1500 2300 F. The property to function at high temperatures makes the filters an important tool in nuclear energy installation where they can prevent the escape of radioactive particles into the atmosphere, particularly in the event of an accident. Two filter designs have been worked out so far.

The deep bed filter for filtration down to particle size of one micron handles gases at temperatures up to 1500 F. The unit is a cylindrical filter cell, allowing minimum edge to filter area ratio and eliminating longitudinal joints in the filter medium. Larger units can be formed by end to-end joining of cylinders. Filter cartridges are made by rolling layers of the spun ceramic fibre (in blanket form) on to a spool fabricated from stainless steel wire mesh. It can play an important function in gas cooled nuclear power reactors where temperatures from 1300 to 1400 F. and pressures up to 225 lb./sq. in. are met. An efficiency of 99 per cent has been achieved for particles down to 2μ.

Pleated filters have been designed to handle particles below one micron in size and temperatures around 2300 F. The filters are made by pleating an aluminium silicate ceramic paper between corrugated ceramic spacer elements. The filter paper edges are then embedded in a ceramic casting mixture which forms the filter frame when hardened. These filters can stand extreme heat shock. — *Chem. Engng News*, **35** (1957), 74.

Indian Pharmaceutical Congress, Bombay

The tenth Indian Pharmaceutical Congress was held at St. Xavier's College Hall, Bombay during 28 31 December 1957.

In his welcome address to the Congress, Dr. K. A. Hameid referred to the non-existence of facilities for effective clinical trials of the various drugs produced and tested in the laboratory. It was largely for this reason that the Indian pharmaceutical manufacturers had not undertaken the production of drugs based on their own researches. Dr. Hameid suggested that effective steps should be taken to remove this lacuna.

Inaugurating the Congress, Shri Manubhai Shah, Union Minister for Industry traced the phenomenal progress of the Indian pharmaceutical industry from a capital investment of Rs. 20 crores before Independence to the present inlay of Rs. 45 crore, most of which had come from within the country. Shri Shah enunciated a National Drug policy and a National Drug Programme for the future development of the industry to achieve self sufficiency in drugs and pharmaceuticals. This should include (i) production in the country of primary basic intermediates of the drug industry, and (ii) production of all basic and synthetic drugs from primary chemicals and intermediates to the finished stages. There should be complete integration and co-ordination of production programmes in the public and private sectors so that all the diverse and numerous ranges

of vitamins, synthetic drugs, antibiotics, hormones, alkaloids, sulpha drugs, penultimates, formulations and complexes are manufactured in the country in the shortest possible time. Shri Shah announced that three major pharmaceutical projects will be launched in 1958 by the Government of India for the manufacture of (1) organic and inorganic chemicals and intermediates, (2) synthetic fine chemicals, and (3) antibiotics, vitamins and alkaloids.

Shri P. M. Nabar, the president-elect referred to the growth of the industry and the various steps taken by the Government to promote its development. He laid special emphasis on providing properly qualified personnel to make greater headway in the development of the pharmaceutical industry.

At the science session of the Congress, 18 technical papers were read and discussed. These included papers relating to phytochemistry of some herbs, antiseptic properties of soaps from Indian inedible oils, effect of garlic on intestinal microflora, and factors affecting the stability of vitamin B_{12} in liver extracts. A symposium on tranquillisers was also held in which eminent medical researchers and practitioners participated.

In the open session held on 30 December 1957, the Congress passed eight resolutions dealing with the growth of the pharmaceutical industry, participation of the public sector in the industry, education and training of personnel, restriction on the use of tranquillisers (ataraxic drugs), etc.

Production and Export of Vanaspati

The production of vanaspati in India has gone up by about 40 per cent in the last three years. In 1957 about 3·2 lakh tons were produced compared with 2·56 lakh tons in 1956, 2·61 lakh tons in 1955 and 2·31 lakh tons in 1954.

There are 46 vanaspati factories in the country. Of these 16 are in the western region, 12 in the southern region and nine each in the eastern and northern regions. Since December 1953, all vanaspati factories are statutorily required to fortify their product with synthetic vitamin A.

A number of measures have been taken by the Government of India to stimulate export of vanaspati. Rebate of excise duty on the vegetable oil content of vanaspati is being given on its export in addition to the refund of excise duty on vanaspati itself. No export duty is levied on vanaspati.

There has been a rising trend in the export of this commodity. In 1956-57, exports amounted to 11,150 tons valued at about Rs. 2·06 crores as against 900 tons in 1953-54 valued at Rs. 21 lakhs. The exports were of the value of Rs. 1·75 crores in 1955-56 and about Rs. 1·48 crores in 1954-55. The domestic consumption of vanaspati was estimated at Rs. 2·53 lakh tons in 1956-57.

Indian vanaspati is exported to countries in West Asia, Burma, Pakistan, the United Kingdom, Aden, Australia, Malaya, Singapore and the Fiji Islands.

Aid to Small Scale Industries

Addressing the 10th meeting of the Small Scale Industries Board held in New Delhi recently, Shri Manubhai Shah, Union Minister for industry explained the various measures introduced to assist small scale industries. A sum of Rs. 4·5 crores has been sanctioned by the Union Government to State Governments during the current financial year for the development of small industries. In addition, Rs. 5·5 crores have been sanctioned for supply of machinery to small industries on hire purchase, for industrial co-operatives and for other schemes.

From 1958 every State in India would have a separate Institute for small scale industries suited to its needs. At the same time there would be a Regional Institute for each of the five zones. The fifth Regional Institute is proposed to be set up at Kanpur during 1958. The technical officers in each region will work in a pool so that the available technical manpower could be put to the best possible use.

To meet the requirements of trained personnel in small industries, 114 training cum production centres have been established so far in different States. During the current year an equal number of centres is likely to be set up. Already 1,400 people have been trained and another 2,000 are undergoing training. The Small Industries Service Institutes also provide training facilities in special cases.

The Institutes have also prepared 75 pamphlets containing model schemes and technical details on different industries. It is proposed to translate these booklets into different Indian languages. Special surveys of important industries and selected areas are being made to supply industrialists information on the prospects of different industries in the respective areas.

ISI Certification Marks for Insulated Cables

The Indian Standards Institution has granted five more licences for use of its Certification Marks to the *National Insulated Cable Co. of India Ltd.*, Calcutta. The Certification Marks will be applied to (i) Hard drawn copper solid and stranded conductors, (ii) Bare annealed copper wire, (iii) Hard-drawn stranded aluminium and steel-cored aluminium conductors for overhead power transmission purposes, (iv) Rubber-insulated cables and flexible cords for electric power and lighting (for working voltages up to and including 11kV.), and (v) Cotton-covered high conductivity annealed round copper wire, manufactured by the firm.

PRINTED BY A. SENDALL AT THE ASSOCIATED PRINTERS (MADRAS) PRIVATE LTD., MADRAS AND BANGALORE

Regd. No.
M-6958

Research and Industry

March 1958

COUNCIL OF SCIENTIFIC & INDUSTRIAL RESEARCH

VOL. 3, NO. 3,
MARCH 1958

Research and Industry

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RESEARCH & INDUSTRY *is issued monthly.*

Communications regarding contributions for publication, books for review, subscriptions and advertisements should be addressed to the Editor, RESEARCH & INDUSTRY, COUNCIL OF SCIENTIFIC & INDUSTRIAL RESEARCH, *Old Mill Road, New Delhi-2.*

Editor : **B. N. Sastri** *Asst. Editor :* **R. D. Taneja**

Annual Subscription : Rs. 8 **Single Copy : Re. 1**

Utilization of Wastes from Vanaspati Factories: Part II—Recovery of Bleaching Earth and Oil from Filter-press-Mud

V. SETHURAMAN, SATISH CHANDER, R. K. BHATNAGAR & N. R. KULOOR

Shri Ram Institute for Industrial Research, Delhi

The bleaching efficiency of activated earths used for refining vegetable and animal oils depends upon the characteristics of the original earth (bentonite, fullers' earth, etc.) used for their manufacture. Only a few sources of raw materials, which can yield high grade bleaching earths comparable to imported products, are known to exist in India.

The paper describes a process which makes it possible to reclaim and reactivate repeatedly bleaching earth from the filterpress-mud of vanaspati and allied oil industries. The process consists in extracting the oil from the filterpress-mud using a benzene-ethanol azeotrope mixture followed by the activation of oil-free residue by calcination at 500 C. for 10 - 30 min. The bleaching efficiency of the reclaimed earth compares favourably even after repeated reclamations with that of the original earth.

COMPLEX alumino silicates, available in nature in various forms like bentonite, fullers' earth, etc. have inherent or develop after simple chemical treatment, preferential adsorption characteristics for vegetable colouring matters. Because of this they are called active earths or bleaching earths, and are used on a large scale for decolourizing vegetable and animal oils in the manufacture of vanaspati, margarine, salad and other varieties of cooking oils.

In India, vanaspati industry alone consumes 2,500 tons of activated earth, worth Rs. 13·75 lakh per annum. According to the Planning Commission, our annual consumption by 1960–61 may exceed 4,000 tons valued at Rs. 28 lakhs. The entire requirement of this material, till recently, was procured from abroad, and even now, the bulk of our demand is met from imports. The quality of the indigenous product is inferior to the best grades of the imported product. When an inferior product is used, a larger amount of it will be required for obtaining a standard bleach, which in turn will result in higher processing losses. It is therefore necessary that activated earth employed for bleaching purposes should be of high quality.

The main difficulty encountered by indigenous manufacturers of bleaching earth is the non-availability of a uniformly good quality raw material in sufficient quantity Bleaching earths of different qualities have, therefore, to be blended to manufacture a uniform quality product. To obviate this difficulty, systematic surveys will have to be carried out to locate suitable sources of earths which could be processed into quality activated earth.

The most widely used process for the manufacture of bleaching earth consists in acid digestion of natural earths to dissolve free iron and aluminium oxides followed by filtration and washing. The leached earth is dried and then activated by heating to a high temperature, and finally powdered.

Bleaching earth after use for decolourization purposes in the oil industry is rejected in the form of filter-press-mud. Some of the vanaspati factories, which do not employ activated carbon along with bleaching earth, use the filter-press-mud in the manufacture of inferior grade washing soap, but most factories throw it away. This filter-press-mud, besides containing used bleaching earth, may also contain 20–50 per cent oil. In order to re-utilize the filter-press-mud, some of the vanaspati factories burn the oil contained in

it and use the calcined mass for bleaching purposes. The bleaching characteristics of such calcined products are extremely poor. We have observed that if the adsorbed oil from the filter-press-mud is extracted by *solvents, the reclaimed earth can be reactivated to its original bleaching efficiency.* Though any organic solvent can be used for the extraction of oil, benzene-ethanol azeotrope mixture (benzene 67 per cent and ethanol 33 per cent) has been found to be the best from considerations of availability and efficiency for the selective removal of adsorbed colouring matter from the earth. Reactivation of the earth is carried out by calcining the reclaimed earth to 400–600 C. for 15–30 min. Though the bleaching efficiency of the reclaimed earth can be slightly improved by acid digestion, prior to calcination, the improvement achieved is not significant and this step in the treatment of the earth appears to be unnecessary.

Unlike in the manufacture of activated bleaching earth from raw bentonite, reclamation of active earth as described above does not call for huge acid digestion vessels, acid resistant pumps, filter-presses, washing and settling equipment, and drying and grinding machines. All that is required is a simple oil extraction plant for the recovery of oil and a rotating kiln for the activation of the earth.

Extraction of Oil from Filter-press-mud

A sample of filter-press-mud procured from a vanaspati factory was extracted with benzene-ethanol azeotrope mixture in a Soxhlet apparatus for 12 hr. About 21–23 per cent of a brown coloured oil was recovered.

Activation of Oil-free Filter-press-mud

The oil-free press-mud obtained as described above was dried and heated in an electric muffle furnace. The bleaching efficiencies of the activated earth samples obtained by heating the oil-free residue at different temperatures and for different intervals are recorded in Table 1.

The bleaching efficiencies of the samples were determined as follows : Bleaching earth (1 per cent on the weight of oil) was mixed with groundnut oil heated to 93 C. and the mixture stirred mechanically. The colour intensity of the oil, before and after treatment with activated earth, was determined with the help of a Lovibond Tintometer using 1 in. standard cell. The colour index of the oil and the bleaching efficiency of the clay are computed with the help of the following formulae :

Colour index $= Y - 5R$, where Y represents *the yellow units and R the red units on the Lovibond scale*

$$\text{Bleaching efficiency} = \frac{\text{Decrease in colour index of oil}}{\text{initial colour index of oil}} \times 100$$

The effect of steeping reclaimed earth in dilute sulphuric acid of varying strengths (0·5, 0·8, 1·0, 2·0 and 9 per cent), prior to their activation by heating at 500 C. for different intervals (15, 30 and 60 min.), was studied. The bleaching efficiency of the samples were compared with that of Standard Tonsil Optimum (a widely used imported activated earth) and also with an untreated sample of the reclaimed earth activated in the same way. The results indicate that the acid treatment does not enhance the bleaching efficiency of the earth significantly. On the other hand, a significant fall in bleaching efficiency is observed when high strength acid is used ; the bleaching efficiency of the earth treated with 9 per cent acid and heated for 15 min. was 33·3 per cent as compared to 65·0 per cent for untreated earth activated in the same way.

The effect of reclamation and reactivation on the bleaching efficiency of Tonsil Optimum was investigated. The reclaimed sample was activated by heating at 500 C. for 1 hr. The results are recorded in Table 2. In Fig. 1 are compared the bleaching efficiencies of Standard and reclaimed Tonsil Optimum with the efficiency of reclaimed and activated

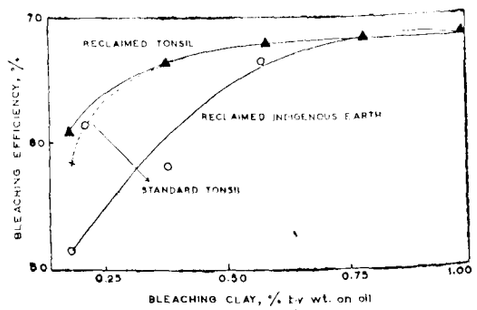

FIG. 1—VARIATION OF BLEACHING EFFICIENCY WITH CONCENTRATION OF BLEACHING EARTH

TABLE 1—BLEACHING EFFICIENCY OF RECLAIMED EARTH ACTIVATED BY HEATING AT DIFFERENT TEMPERATURES

Activation temp. C.	Period of activation min.	Colour intensity: Unbleached oil — Yellow units	Unbleached oil — Red units	Bleached oil — Yellow units	Bleached oil — Red units	Bleaching efficiency %
405	30	5·0	0·5	2·3	0·2	56
	60	5·0	0·5	2·3	0·2	56
	90	5·0	0·5	2·0	0·2	60
	120	4·4	0·4	2·1	0·2	51
430	30	4·4	0·4	2·2	0·2	50
	60	4·4	0·4	1·8	0·2	56·2
	90	4·4	0·4	1·6	0·2	59·2
	120	4·4	0·4	1·4	0·2	62·5
485	30	5·0	0·5	1·3	0·2	69·3
	60	5·0	0·5	1·2	0·2	70·7
	90	5·0	0·5	1·2	0·2	70·7
	120	5·0	0·5	1·2	0·2	70·7
500	15	4·4	0·4	2·2	0·2	65·0
	30	4·4	0·4	1·6	0·1	67·2
	60	4·4	0·4	1·3	0·1	71·9

TABLE 2—BLEACHING EFFICIENCY OF FRESH AND RECLAIMED TONSIL OPTIMUM

(Reclaimed earth heated at 500 C. for 1 hr. ; colour intensity (Lovibond scale) of fresh oil : yellow units, 5·2 ; red units, 0·4)

Wt. of bleaching earth used % on oil	Fresh Tonsil Optimum: Colour intensity of bleached oil — Yellow units	Fresh Tonsil Optimum: Colour intensity of bleached oil — Red units	Fresh Tonsil Optimum: Bleaching efficiency %	Reclaimed Tonsil Optimum: Colour intensity of bleached oil — Yellow units	Reclaimed Tonsil Optimum: Colour intensity of bleached oil — Red units	Reclaimed Tonsil Optimum: Bleaching efficiency %
0·2	2·0	0·2	58·33	1·8	0·2	61·12
0·4	1·4	0·2	66·66	1·4	0·2	66·66
0·6	1·3	0·2	68·06	1·3	0·2	68·06
0·8	1·3	0·2	68·06	1·3	0·2	68·06
1·0	1·3	0·2	68·06	1·3	0·2	68·06

TABLE 3—BLEACHING EFFICIENCY OF ACTIVATED EARTH AFTER REPEATED REACTIVATION

(Colour intensity (Lovibond scale) of fresh groundnut oil : yellow units, 7·1 ; red units, 1·5 ; reclaimed earth heated each time at 500° C. for 1 hr.)

Reactivation cycle	Wt. of bleaching earth used % on oil	Colour intensity of oil		Bleaching efficiency %
		Yellow units	Red* units	
Original clay	1·0	3·4	0·9	45·9
	0·8	3·9	0·9	42·5
	0·6	4·0	1·0	38·4
	0·4	4·1	1·0	37·7
	0·2	4·2	1·0	37·0
1st cycle	1·0	2·9	0·7	56·2
	0·8	3·0	0·7	55·5
	0·6	3·0	0·8	52·0
	0·4	3·6	0·8	48·0
	0·2	3·95	0·9	42·0
2nd cycle	1·0	3·5	0·9	45·2
	0·8	3·7	0·9	44·0
	0·6	3·8	0·9	43·1
	0·4	4·0	1·0	38·4
	0·2	4·2	1·0	37·0
3rd cycle	1·0	3·5	0·9	45·3
	0·8	3·7	0·9	44·0
	0·6	3·8	0·9	43·1
	0·4	4·0	0·9	41·8
	0·2	4·2	0·9	40·5
4th cycle	1·0	3·4	1·0	42·5
	0·8	3·6	1·0	41·0
	0·6	3·8	1·0	39·8
	0·4	4·0	1·0	38·4
	0·2	4·2	1·0	37·0
5th cycle	1·0	3·6	1·0	41·1
	0·8	3·7	1·0	40·4
	0·6	3·8	1·0	39·8
	0·4	4·0	1·1	35·0
	0·2	4·1	1·1	34·3

* The value obtained for red units should be multiplied by 5 for colour index value.

indigenous bleaching earth. The results show that the reclaimed earth exhibits almost the same bleaching efficiency as Standard Tonsil Optimum.

In order to determine the number of times the same bleaching earth can be activated and reused, a sample of earth supplied by a local manufacturer was processed five times and the bleaching efficiency of the sample after each reclamation and reactivation cycle was determined. The results recorded in Table 3 show that the bleaching efficiency of the earth does not show any appreciable fall. On the other hand, the earth after the first cycle of reclamation and reactivation shows higher bleaching efficiency ; at 1 per cent concentration the bleaching efficiencies of original and reactivated earth are 45·9 and 56·2 per cent respectively.

Economics of the process

The economics of the process for reclaiming and reactivating activated earth and for recovering oil from the filter-press-mud are given in Table 4. The flowsheet for the process is shown in Fig. 2.

TABLE 4 — PROJECT COSTS FOR PROCESSING FILTER-PRESS-MUD

(Basis : 5 tons of filter press-mud containing 20% oil and 80% earth processed per day ; 300 days per year)

	Rs.
Capital	
Equipment and machinery	35,150
Installation including cost of foundation, supports, erection etc., @ 50% of equipment	17,550
Piping and instrumentation @ 25% equipment	8,700
Building including land	50,000
Working capital	22,000
Total	133,400
Direct Cost	
Raw materials	
5-ton filter-press-mud @ Rs. 200/- ton	1,000
250 gals. of solvent (Basis 5% loss and ½ gal./lb. of earth) @ Rs. 2 gal.	500
Total	1,500
Services	
Steam 20,000 lb. @ Rs. 3/1000 lb.	60
Water 100,000 gal. @ Rs. 0·50/1000 gal.	50
Power 300 kWh. @ Rs. 0·06 per kWh.	18
Fuel 30 gal. @ Rs. 2 gal.	60
Total	188
Supervision and labour	150
Total Direct Cost	1,838
Indirect Cost	
Depreciation on equipment, machinery and building @ 10%	20·4
Maintenance & repair @ 5% on equipment, machinery and building	10·2
Interest @ 6% on working capital	4·4
Insurance @ ½ % on total investment	2·2
Total Indirect Cost	37·2
Total Direct and Indirect Costs	1,875·2
Credits	
Cost of 1 ton oil @ Rs. 1000	1,000
Cost of 3·8 ton active clay @ Rs. 400/ton	1,520
Total	2,520

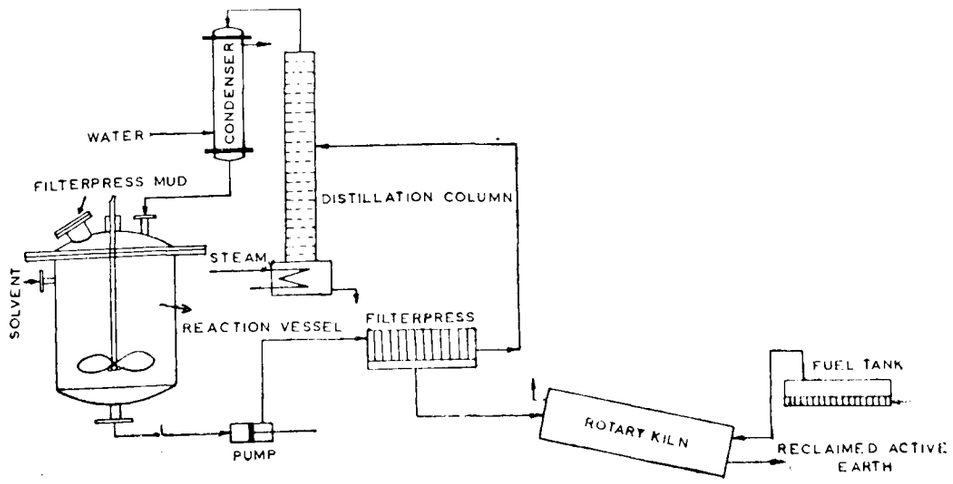

FIG. 2 — RECOVERY OF OIL AND BLEACHING EARTH FROM FILTER-PRESS MUD : FLOWSHEET

Conclusion

The process for reclaiming filter-press-mud from vanaspati and allied oil industries is not only an attractive and economical proposition but will also go a long way in effecting a saving in foreign exchange. Since the bleaching efficiency of the active earth does not suffer to any appreciable extent by repeated reclamation and reactivation, it is quite possible to meet the entire activated earth requirement of the country from indigenous sources of good quality bentonite and fullers' earth. Indigenous manufacturers of activated earth possess most of the equipment and machinery required for processing filter-press-mud. This will lower the capital investment needed resulting in a proportionate reduction in the cost of processing the material.

Reference

1. *Indian Patent* No. 61157, 20 July, 1957.

Fusel Oil Titanate and its Use in the Production of Insulating Varnishes

P. G. NERLEKAR & J. GUPTA

National Chemical Laboratory, Poona

Fusel oil, a by-product of the alcohol industry, has been made use of in the preparation of fusel oil titanate silicate by direct esterification with titanium/silicon tetrachloride. The product obtained forms a good substitute for butyl titanate which is now widely used to modify and improve the insulating and water-resistant properties of surface coating compositions. Varnishes prepared from fusel oil titanate silicate and cashewnut shell liquid-formaldehyde resin have been found to possess superior electrical strength to the conventional varnishes.

THE esters of titanic acid, generally obtained by the interaction of titanium tetrachloride and alcohols, are coming into prominence as surface coating materials. Among the aliphatic esters, butyl titanate[1] has been studied in detail. When used as a vehicle for aluminium paints, it gives coatings which are much superior to ordinary aluminium paint in respect of resistance to heat and corrosion. When stoved on steel, it leaves a firm coating of aluminium and titanium dioxide, which is resistant to corrosion even at high temperatures. The paint is, therefore, used for painting chimneys of factories. Higher aliphatic or phenolic mixed esters of titanic acid are useful as water repellents, surface coating compounds, resin cure accelerators, and sizing agents for glass and cellulose fibres. Butyl titanate is used for modifying alkyd resins, phenol-formaldehyde resins and amino-plast polymers. It is also used as accelerator to improve the drying properties of linseed oil and other drying oils, and as a water-proofing agent for textile, wood, paper and leather.

Fusel oil, a by-product of the alcohol industry, has been made use of in the preparation of a substitute for butyl titanate. Investigations in this Laboratory have shown that fusel oil titanate is easy to prepare and has properties very similar to those of butyl titanate.

Fusel oil is a mixture of *iso*amyl and other alcohols, and is recovered as a higher boiling fraction after the ethyl alcohol portion has distilled over. The quantity of fusel oil produced may vary from 1-5 gal. per thousand gal. of ethyl alcohol produced. It is estimated that about 900,000 tons of

TABLE 1 — INSULATING PROPERTIES OF CNSL-FORMALDEHYDE TITANATE VARNISH

VARNISH	ELECTRICAL STRENGTH AT 90 C. *Volts/mil.*	RESISTANCE TO MOISTURE (ELECTRICAL STRENGTH AT 25 C.) *Volts/mil.*
CNSL-formaldehyde (oil-modified)	1500 - 2000	700 - 1000
CNSL-formaldehyde titanate silicate (oil modified)	3000 - 4000	1000 - 1200

molasses will be available in India from the sugar industry for the manufacture of alcohol from 1959-60 onwards.

This will yield about 45 million gal. of ethyl alcohol[2] and over 100,000 gal. of fusel oil every year.

Preparation of Fusel Oil Titanate/silicate

Fusel oil titanate silicate is prepared by direct esterification from titanium-silicon tetrachloride and fusel oil. The commercial fusel oil is distilled, and the fraction collecting between 105 and 132 C. (recovery 70% by volume) is used for the esterification. The tetrachloride is treated with fusel oil in benzene at 0 C., and ammonia gas is passed into the reaction mixture to neutralise the hydrochloric acid liberated. Ammonium chloride formed is filtered, the solvent distilled off, and the crude ester purified by distillation under reduced pressure.

Preparation of CNSL-formaldehyde Titanate-silicate Varnish

We have used this ester for ester-interchange with cashewnut shell liquid-formaldehyde resin to obtain a varnish of superior electrical insulating properties[3]. It is of interest to note that the constitution of amyl esters of titanic acid suggests likelihood of their direct condensation with formaldehyde[4].

The reaction can be carried out (i) by reacting cashewnut shell liquid, fusel oil titanate/silicate and formaldehyde, all together, and distilling off the liberated fusel oil; (ii) by reacting cashewnut shell liquid-formaldehyde resin with fusel oil titanate silicate and distilling off the liberated fusel oil; and (iii) by reacting the cashewnut shell liquid titanate/silicate (prepared by ester-interchange between fusel oil titanate silicate and cashewnut shell liquid) with formaldehyde. The resin so obtained is used as such with gilsonite and/or bitumen dissolved in mineral turpentine or xylol, or cooked with drying oil to produce oil-modified products. The varnishes are cured by baking for 2-4 hours.

The varnishes prepared were tested according to BSS 514-1933 for their insulating properties[3]. The results are presented in Table 1.

It is seen that the new varnish has superior electrical strength to the conventional varnishes prepared from CNSL-formaldehyde resin.

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Studies on Iron Pyrites
Part III—Recovery of Sulphur

K. N. MOORTHY & D. S. DATAR

Regional Research Laboratory, Hyderabad

Extensive deposits of iron pyrites occur in Bihar, Himachal Pradesh and Mysore. The utilization of these deposits for producing elemental sulphur to relieve the acute shortage of this important raw material in the country is assuming increasing importance. Investigations in progress at the Regional Research Laboratory, Hyderabad for the recovery of sulphur from iron pyrites obtained from a proved deposit (estimated at 1·5 million tons) from Mysore State are presented here.

Steam is passed over the ore heated to 800 C. for 170 min. The entire pyritic sulphur is recovered as elemental sulphur (35 per cent) and hydrogen sulphide (65 per cent). A further quantity of elemental sulphur is obtained by reacting the hydrogen sulphide produced with sulphur dioxide obtained by passing air at a slow rate over pyrites heated to 400 C.

IN a process[1] that is being worked out in this laboratory for the recovery of sulphur from iron and coal pyrites, steam is passed over the pyrites in the presence of coal when a part of the pyritic sulphur is recovered as elemental sulphur and the remainder is converted to hydrogen sulphide. A further amount of elemental sulphur is obtained by reacting the hydrogen sulphide produced with sulphur dioxide also obtained from the pyrites. This process has now been extended to the recovery of sulphur from iron pyrites obtained from Inghladal, Mysore State. This paper reports the results of studies carried out to determine the optimum conditions for the production of sulphur dioxide from the pyrites and the reaction between pyrites and steam.

The pyrites used in these investigations was obtained from a proved deposit, estimated at 1·5 million tons, at Inghladal, 5 miles from Chitaldrug town, Mysore State. The pyrites analysed to : S, 35·3 per cent ; Fe, 43·9 per cent (of this 30·8 per cent was FeS_2) ; and silica, 13·5 per cent.

Experimental Procedure

Production of Sulphur Dioxide from Pyrites — About 10 g. of iron pyrites powder (passing 100 mesh B.S.S.) were taken in a silica tube and heated in an electric furnace. Air was introduced into the tube through an aspirator consisting of an upper vessel fitting into a lower vessel and displacing an equal volume of air. The rate of air passage was maintained constant by keeping the water level in the aspirator fixed.

The effect of varying the temperature at which the oxidation of the ore was carried out and the rate of air passage was investigated. In the first series of experiments, air was passed over the heated mass at the rate of 1 litre/min. and the temperature of the mass was varied from 350 to 400 C. In the second series, the ore was heated to 400 C. and air was passed over it at rates varying from 0·07 litre/min. to 1·66 litre/min. The oxidation reaction was carried to completion in both instances.

The products of combustion were analysed. Sulphur dioxide was estimated iodimetrically using starch as external indicator. Sulphur trioxide was determined by precipitating it as barium sulphate. The residual mass was analysed for ferrous and ferric sulphates. Ferrous sulphate was estimated by titration against standard potassium permanganate, while ferric sulphate was determined by estimating the total sulphate and subtracting the sulphate present as ferrous sulphate.

Reaction between Pyrites and Steam — Ten g. of iron pyrites (passing through 100 mesh B.S.S.) were taken in a silica tube and heated to 600 C. in an electric tube furnace with and without coke. In one series of experiments the temperature of pyrites was maintained at 800 C. In another series coke was replaced by coal. Steam was passed over heated iron

pyrites for 2 6 hr. The mixture of sulphur dioxide and hydrogen sulphide produced was first passed through gas traps, where a part of these gases combined to produce sulphur. The gas mixture was then passed through neutral cadmium chloride solution where hydrogen sulphide got precipitated as cadmium sulphide and later through iodine solution where free sulphur dioxide got oxidized to sulphuric acid. The amounts of hydrogen sulphide and sulphur dioxide produced were calculated from these data.

Results and Discussion

Oxidation of Pyrites — The results of experiments on the oxidation of pyrites at different temperatures given in Table 1 show that the oxidation reaction is accelerated with rise in temperature and that the pyrites is almost completely decomposed at 400 C. The results of experiments in which the rate of air passage was varied (Table 2), show that oxygen in the air passed is completely utilized when the rate of air passage is between 0·07 and 0·2 litre/min.

The mechanism of oxidation of iron pyrites appears to be as follows : one of the sulphur atoms in the pyrites molecule, which is generally termed "labile", gets oxidised to sulphur dioxide and the other atom is oxidised to give ferrous and ferric sulphates, which decompose liberating sulphur trioxide. A

TABLE 1 — PRODUCTS OF OXIDATION OF PYRITES AT DIFFERENT TEMPERATURES

Temp. C.	Rate of air passage *litres/min.*	Vol. of air supplied *litres*	Products (expressed as % pyritic sulphur) SO_2	SO_3	$FeSO_4$	Total
350	1·07	50	6·8	0·1	nil	6·9
360	1·15	90	25·2	4·9	1·7	31·8
370	1·15	55	47·9	5·2	2·8	55·9
380	1·20	78	67·2	0·4	3·0	70·6
400	1·25	70	47·5	5·6	29·0	82·1

TABLE 2 — OXIDATION OF PYRITES AT DIFFERENT RATES OF AIR PASSAGE

Rate of air passage *litres/min.*	Vol. of air passed *litres*	Products (expressed as % pyritic sulphur) SO_2	SO_3	$FeSO_4$	$Fe_2(SO_4)$	Total
1·66	117	72·7	2·6	nil	19·9	95·2
1·58	231	53·8	30·7	nil	13·7	98·2
1·25	70	47·5	5·6	nil	29·0	82·1
0·86	107	54·4	19·5	1·5	6·5	81·9
0·36	61	76·4	24·4	nil	1·0	101·8 (100·0)
0·29	49	66·6	27·5	nil	4·2	98·3
0·21	29	63·1	30·1	nil	4·7	97·9
0·12	28	86·0	nil	4·9	6·7	97·6
0·07	27	78·4	13·9	nil	6·8	99·1

TABLE 3 — PRODUCTS OF DECOMPOSITION OF PYRITES WITH STEAM

(*Wt. of Pyrites taken for each expt.*, 10 g.)

Wt. of coke g.	Rate of steam passage *g./min.*	Period for which steam passed *min.*	Temp. C.	Products (expressed as % pyritic sulphur) S	SO_2	H_2S	FeS	Unreacted pyrites (by difference).
nil	—	120	600	10·0	traces	21·4	31·2	37·4
nil	—	240	600	1·8	13·3	28·0	24·8	32·1
5·0	0·3	120	600	nil	nil	45·0	55·0	nil
14·0 (coal)	—	270	600	nil	nil	58·9	40·0	1·1
5·0	6·9	544	600	5·0	nil	70·0	23·0	2·0
5·0	1·2	170	800	35·0	nil	65·0	nil	nil

portion of the sulphur trioxide decomposes producing a further quantity of sulphur dioxide. With higher rates of air passage, the decomposition of sulphur trioxide is somewhat suppressed and as it is carried away by air before it gets decomposed, sulphur dioxide is produced only from the labile sulphur atom (50 per cent of pyritic sulphur). With slower rates of air passage, about 86 per cent of the pyritic sulphur in the ore is converted into sulphur dioxide. Thus a slow rate of air passage and a temperature of 400 C. seem to be the optimum conditions for producing sulphur dioxide from iron pyrites.

Reaction between Steam and Pyrites The results of experiments are recorded in Table 3. Experiments carried out by passing steam for 2 and 4 hr. respectively over pyrites heated to 600 C., show that the dissociation of pyrites is negligible at this temperature. The dissociation of pyrites is also not enhanced by carrying out the reaction at 600 C. in the presence of coke or coal, or by increasing the rate and amount of steam passed. However, the reaction proceeds rapidly when steam at the rate of 1·2 g. /min. is passed over the ore heated to 800 C. for 170 min. and the entire pyritic sulphur is recovered as elemental sulphur (35 per cent) and hydrogen sulphide (65 per cent).

Acknowledgement

The authors are deeply indebted to Dr. S. Husain Zaheer, Director, Regional Research Laboratory, Hyderabad for helpful suggestions.

Reference

1. MOORTHY, K. N. et al., *Indian Pat.* 47999 (1952).

Prospects for a Mica Grinding Plant in India

Large quantities of cheap mica scrap available in India are at present exported. The possibility of utilizing the scrap for the development of a mica grinding industry in the country has in recent times engaged the attention of the Government of India. The various aspects of the setting up of a mica grinding plant in India have been examined in a study recently conducted by the National Council of Applied Economic Research. It is considered that India should set up a mica wet grinding plant with a capacity of 1,000 tons per year, expandable to 2,000 tons. The plant would require an investment of Rs. 3 lakh. The return on the outlay should be 17 per cent or more.

THE powdered form of mica, known as ground mica, is used in the manufacture of roofing materials, welding rods, wall paper, rubber, paints and plastics, and in well drilling. The world consumption of ground mica has been steadily rising in recent years ; in 1956 it was 110,511 tons as against 74,631 tons in 1951.

India has long been the major supplier of mica to world markets. Her exports of mica account for more than 75 per cent of the total world supply. During the past 5 years they averaged 3,67,000 cwt. per year valued at Rs. 9,06,00,000. The exports comprise splittings, blocks and waste which are about 52, 47 and 1 per cent respectively in terms of value. However, India has not developed a mica grinding industry despite the growth of the industry in other countries, particularly in the United States. The economic advisability of developing a mica grinding industry to utilize mica scrap has been particularly stressed by the Government in the light of the importance accorded to the development of mineral industries in the Second Five-Year Plan.

TABLE 1 — WORLD CONSUMPTION OF GROUND MICA (1952-56)

(*Short tons*)

COUNTRIES	1952	1953	1954	1955	1956
North America	76,202	74,521	81,395	107,565	101,861
United States	74,806	73,072	80,072	106,185	99,981
All others	1,396	1,449	1,323	1,380	1,880
South America	561	393	422	407	928
Europe	5,250	3,615	3,945	7,755	6,836
U.K.	3,076	2,059	1,563	3,710	2,316
Norway	1,093	583	874	2,053	1,737
Sweden	48	174	128	134	189
Belgium	377	146	273	306	350
West Germany	380	237	365	734	1,066
France	196	200	432	484	480
Italy	52	197	218	298	265
All others	28	19	92	36	73
Asia	49	307	803	495	650
India*	24	25	30	4	27
Indonesia	1	6	—	—	19
Japan	19	265	735	467	313
Philippines	5	—	30	—	34
All others	—	11	8	24	266
Africa	49	113	95	43	227
Oceania	65	1	48	—	—
TOTAL	82,176	78,950	86,708	116,265	110,511

*Consumption in India is based on imports. There is some internal production which is consumed in the country but the quantity is small — a few hundred tons.

The Government of India recently received a proposal from a foreign firm to establish a mica grinding plant in India, in collaboration with Indian enterprise. The Commerce and Industry Ministry examined the proposal and after making some preliminary investigations asked the *National Council of Applied Economic Research* to submit a detailed report with regard to the advisability of setting up a mica grinding plant in India and also to furnish the Government with reports on foreign firms which may be considered for collaboration with Indian capital in setting up the plant. The report of the Council has been recently released.

The report is based on analysis of published data on production, exports, imports, etc. ; survey in industry and trade circles, foreign and domestic ; and personal interviews with officials and representatives of trade and industry.

Nature of Demand

The United States accounts for more than 90 per cent of world consumption of ground mica. In 1956 all the countries in Europe together consumed about 6 per cent while the Asian countries consumed about ½ per cent. During 1952-56 the annual consumption in U.S.A. averaged about 87,000 tons, in European countries about 5,500 tons and in Asia 470 tons. (Table 1). Roofing material and paints accounted for about 30 per cent each of the total consumption. The quantity consumed by miscellaneous industries has also been rising. This suggests that new uses for ground mica are being developed or expanded.

Of the two types of ground mica, dry and wet, the consumption of dry ground mica has been rising faster. The U.S. consumed in 1955 six times more dry ground mica than the wet ground material ; the former was used for roofing materials, welding rods and well drilling ; only wet ground was used for wall paper while rubber, paint and plastics used both.

An analysis of the trend in demand for ground mica shows that demand in U.S.A. is likely to increase by 20 per cent in 1961. The annual consumption has been rising at the rate of about 3,000 tons of dry ground and 1,000 tons of wet ground mica. Increase in demand in European countries is also likely to be the same as that in the United States.

Sources of Supply

The main source of the world supply of ground mica is the United States. Most of the European countries import mica scrap and waste from India and grind them for domestic use in addition to importing ground mica from U.S.A. It is possible that some of these countries may be exporting limited quantities of ground mica to neighbouring countries.

The two important varieties of mica which are used in grinding are muscovite and phlogopite. Muscovite is used more commonly for wet grinding. The most important sources of mica scrap are India, United States, Canada and South Africa. These countries are in a position to produce ground mica without depending on external resources for the supply of raw material. Both India and the United States have large supplies of muscovite scrap and waste. The U.S. has been importing limited quantities of mica scrap and waste from India. But compared to the U.S. consumption of more than 100,000 tons of scrap in 1956, imports of about 8,500 tons from India are not significant.

Economics and Know-how

The decision to set up a mica grinding plant in India will depend on the ability of the country to sell the finished product at competitive prices in international markets. This should be considered mainly on the basis of the cost of production which would depend upon the availability of raw material at competitive prices, knowledge of technical processes and adequate margin to meet production and marketing costs.

As stated above, India has abundant sources of scrap ; she produces more than 50,000 tons of scrap mica per year which is available at Rs. 50 per ton. In quality, Indian scrap is as good as U.S. scrap, but the cost of muscovite scrap in U.S.A. varies from about Rs. 125 per ton for mine scrap and flakes to about Rs. 330 per ton for fabricators' scrap. Thus the raw material costs in India are apparently much lower than those in the U.S.A.

Technical Know-how — Technical knowledge and ability to produce at competitive prices also affect the capacity of the country to supply ground mica to the world market. There are two methods available for grinding mica — the dry and the wet. The wet grinding process is more difficult of the two and requires expert technical knowledge. The Central Glass & Ceramic Research Institute, Calcutta has developed a method for wet grinding which is more economical than the U.S. method. Most of the equipment required for the method can be fabricated in India.

Some firms in India have undertaken mica grinding by the dry process. In 1956, 250 tons of mica were ground by one firm. Another Indian firm has plans to produce about 1,500 tons per year of ground mica : the firm is expected to go into production shortly.

Costs — Estimates of the margin between the value of Indian scrap and waste mica plus marketing costs and the current prices of dry and wet ground mica in the U.S. indicate that India would be able to compete in the U.S. market on a price basis if the cost of wet grinding is not more than Rs. 175 per ton. The cost according to the process developed by the Central Glass & Ceramic Research Institute is estimated at Rs. 125 per ton. This would leave a margin of Rs. 50 per ton on wet ground mica sold in U.S.A.

Size of Plant — The proposal made by the foreign firm to the Government of India envisages the establishment of a wet grinding plant of 1,000 tons per day capacity with a capital of Rs. 1·25 crores. The firm estimates annual requirements of scrap for grinding purposes at 250,000 tons per year. This would mean an annual output of approximately 225,000 tons of wet ground mica, assuming the loss in the grinding operation at 10 per cent. In 1955, U.S.A. produced 91,695 tons of dry and 14,490 tons of wet ground mica. In other words, the proposed plant would have an installed capacity to produce more than double the entire U.S. production of ground mica. World consumption of ground mica will not reach this level even in the next 20 years. The proposal, therefore, cannot be considered to be a sound one.

The Council considers that a plant capable of producing 1,000 - 2,000 tons of wet ground mica would be suitable for India having regard to market demand which can be met by the country. Capital investment on such a plant is estimated at Rs. 3,00,000 and the plant would earn a profit of Rs. 50,000 or more per annum ; this works out to a return of 17 per cent on capital which appears to be adequate.

The U.S. Mica company, which is willing to supply technical know-how and act as a selling agent, has suggested setting up a plant of 100 tons capacity per month. This may be a good size to start production. In view of the growing market, provision should be made for expansion up to 2,000 tons a year.

National Research Development Corporation: Progress during 1956-57

DURING the year 1956-57, 134 inventions were reported for development to the Corporation by 21 research institutions and private individuals. The total number of inventions reported up to the end of March 1957 was 388.

The National Chemical Laboratory, Poona contributed 60 inventions, the largest number, followed by Central Leather Research Institute, Madras (31) ; Council of Scientific & Industrial Research Schemes (30) ; Indian Institute of Science, Bangalore (28) ; Central Electro-chemical Research Institute, Karaikudi (23) ; Central Food Technological Research Institute, Mysore (22) ; Regional Research Laboratory, Hyderabad-Dn. (22) ; and the Central Glass & Ceramic Research Institute, Calcutta (19). Nine new applications for patents were filed for Indian Institute of Science, Bangalore ; Central Water and Power Commission, New Delhi ; Indian Agricultural Research Institute, New Delhi ; Indian School of Mines and Applied Geology, Dhanbad ; Indian Institute of Sugarcane Research, Lucknow ; and Technical Development Establishment (ME), Kirkee.

Licences Negotiated — Licences have been negotiated for the following processes during the year ending 31st March, 1957 : (1) Lisasorb ; (2) Improving the storage life of cashew kernels ; (3) Bamboo boards ; (4) Thermo couple ammeters ; (5) Desiccants and dehumidifiers from Indian coals and (6) Ethyl ether.

A developmental licence agreement has been negotiated with *Atul Products Ltd.*, Atul, according to which the firm will undertake detailed investigations for the design and fabrication of a large scale plant for production of benzidine.

Processes in respect of which negotiations are in progress with interested parties are : (1) Ceramic capacitors ; (2) Electrolytic cuprous oxide ; (3) Manganese sulphate ; (4) Demineralisation of graphite ; (5) Fruit juice-powder and (6) Sealing devices.

Developmental Projects — Four new projects relating to copper chlorophyll, infant foods, thermoelectric generators and phthalic anhydride were sponsored during the year.

Pilot plant studies on copper chlorophyll and phthalic anhydride have been sponsored at the Shri Ram Institute for Industrial Research, Delhi at an estimated cost of Rs. 10,000 and Rs. 2,00,000 respectively. The pilot plant for the production of 500 lb. of phthalic anhydride per day is based on the fluidised bed oxidation of coal tar oil, a process developed at Central Fuel Research Institute, Jealgora.

The project for the experimental production of infant foods on a 2-ton scale has been set up at *Kaira District Milk Producers' Union Ltd.*, Anand at an estimated cost of Rs. 10,000. According to this process (developed at Central Food Technological Research Institute, Mysore), buffalo milk can be processed and dried in the same way as cow's milk.

A sum of Rs. 2,000 has been sanctioned for the fabrication of 12 prototype thermo-electric generators at the National Physical Laboratory, New Delhi, according to the invention of All India Radio.

Projects already instituted by the Corporation have shown satisfactory progress. Project studies on deionization of cane juice at the National Sugar Institute have led to the fabrication and erection of bench scale units with 4 in. Perspex column for deionization of cane juice. It is now proposed to set up a pilot plant with a capacity to process 200 gal. of juice per batch. A design for the pilot plant has been prepared. Pine oil has been produced on a pilot plant scale satisfactorily. Further studies on bamboo mechanical pulp have been carried out to determine the role of parenchyma cells in pulping, rate of delignification, bleaching of pulp, etc.

Models in Plant Design

THE value of models in cutting down costs and time in the development of processes from the small to the industrial scale is now being increasingly recognized by chemical engineers. One of the most recent instances of the successful adoption of this technique is provided by the *Imperial Chemical Industries*. The firm is currently making use of two types of model—a process design model which is essentially a three-dimensional sketch made of the simplest materials, and a detailed design model which in the case of chemical plant may be termed the pipework model. The process design model is produced from the flowsheet and may be made of wood or cardboard, roughly to scale and indicative of the actual plant shape. A design team of chemists, engineers and method study experts sitting round such a model can easily assess and modify the arrangement thus saving many draughtsman-hours. For the next stage the detailed design of the items of equipment and of the buildings and structures—the drawing board is still necessary, but the plant assembly drawings are avoided by the pipework model which in this case is one accurately constructed to scale. Once this model is finalized, it can be used to run and position pipelines, instruments, valves, electric cables, etc. with ease, certainty and speed which would not be possible with a mass of drawings.

Apart from its use in design, a model is obviously a great help in giving construction people a real picture of the complete job. Also the production staff will find models to be a great help in deciding on the manning of the plant and in the training of supervisors and workers before the start-up. *I.C.I. Magazine*, **35** (1957), 110.

Technical Digest

Medicinal Charcoal from Jute Sticks

JUTE sticks have been found to be a suitable raw material for production of active carbon for use as medicinal charcoal as a result of investigations carried out at the Pharmacy Training Centre, Jalpaiguri (West Bengal). The charcoal is prepared by low temperature carbonization of jute sticks activated with zinc chloride.

Jute sticks (obtained from Tossa jute plant) were washed with water to remove extraneous matter and water-soluble substances dried in air, divided into longitudinal quarters, cut into small pieces (0·1–0·2 cm.) and stored in glass containers. The cuttings were dried at 105° for 1 hr. and boiled with an aqueous solution of zinc chloride (6·66 per cent) till no liquid was left at the bottom. Jute sticks, thus impregnated with activators, were dried at room temperature and carbonised in a closed steel tube (30 cm. × 2·5 cm.) by heating with a limited supply of air in a furnace at 350 ± 10° for 4 hr. The carbonised mass was cooled in absence of air and triturated in a porcelain mortar with dilute hydrochloric acid. The mixture was transferred into a beaker, boiled for 10 min. and filtered hot. The residue was boiled with water and filtered, and the operation repeated. About 90 per cent zinc chloride was recovered in the three filtrates. The material was then repeatedly washed with boiling water to remove the last traces of activator, dried at 105°, weighed and immediately ground to a powder passing through a No. 200 British Standard sieve.

The optimum proportion of zinc chloride has been found to be 100 per cent on the weight of oven dry jute sticks. The resultant carbon shows the maximum activity.

Jute stick charcoal has high adsorptive power for gases and liquids. The adsorptive power of the material is, however, low for acids and bases. This can be improved by treating the carbon with aqueous solutions (0·05 N) of oxidising agents such as potassium bichromate.

Jute stick charcoal satisfies both B.P.C. and I.P. specifications. The specimens prepared were found to contain less than 5, 25, 10, 50 and 50 parts per million of arsenic, copper, lead, zinc and heavy metals respectively; water soluble matter, loss on drying and residue on ignition were 0·5, 0·29 and 4·29% respectively. Chloride and sulphate were less than 0·21 and 0·2% respectively; an aqueous extract (1 in 20) gave a *p*H of 6·8. Sulphide, uncarbonised constituents and cyanogen compounds were absent. The adsorption capacities for strychnine sulphate, caramel, iodine, methylene blue, phenazone and chloroform (gas) were 100, 2 500, 901, 476, 315 and 614 mg. g. respectively.—A. B. DUTTA, *J. & Proc. Inst. Chem.*, **27** (1955), 274; **29** (1957), 263.

Potassium Chloride from Sea Bitterns

MORE than three million tons of common salt are produced every year in India by solar evaporation of sea water. The waste bitterns contain significant quantities of potassium chloride and it is estimated that as much as 85,000 tons of potassium chloride could be recovered from them. Indigenous production of potassium chloride is almost negligible at present and the requirements (47,500 tons per annum by 1961) are met mainly by imports.

Investigations carried out at the Central Salt Research Institute, Bhavnagar, have led to the development of a method for the recovery of potassium chloride from waste bitterns of

the marine salt industry. The method consists in desulphation of the bittern by calcium chloride followed by concentration of the sulphate-free bittern. The double salt carnallite ($KCl.MgCl_2.6H_2O$) which crystallizes out is either leached with cold water or a supersaturated solution of the salt is cooled to recover potassium chloride. The product thus obtained has a purity of 97–99 per cent.

Ten litres of 35·0 Be′ bittern were taken in a three gallon stainless steel vessel. The liquid was kept agitated by means of a stainless steel propeller-type stirrer attached to a 1·6 h.p. motor. Concentrated solution of commercial calcium chloride was added slowly, stirring being continued for 1 hr. and the precipitate filtered under vacuum into a 3 gal. porcelain mug filter. The precipitate was washed thoroughly to remove the adhering potassium chloride. The filtrate was taken in a stainless steel vessel and concentrated, using glass coiled electric heater under constant agitation. When the temperature of the boiling liquid reached 123 C., heating was stopped and the liquor cooled slowly to room temperature. The double salt ($KCl.MgCl_2.6H_2O$) obtained was filtered in a mug filter. The cake was freed as far as possible from the mother liquor, and dried at 110 C. The filtrate, consisting mainly of magnesium chloride, yielded white, needle shaped crystals of hydrated magnesium chloride on solar evaporation.

The double salt was taken in a 5-litre beaker, dissolved in minimum quantity of water, and the solution concentrated to a point when the temperature of the boiling liquid was 115 C. The first crystals formed, mainly sodium chloride and calcium sulphate, were removed by filtering the solution while hot and the filtrate allowed to cool slowly to 20 C. The crystals thus obtained were filtered in a Buchner funnel, washed twice on the filter paper with a spray of saturated solution of potassium chloride, and dried at 110 C.

The overall yield of potassium chloride (purity, 96·8 per cent) was 75·12 per cent, the main impurities being magnesium chloride (0·8 per cent) and sodium chloride (2·2 per cent). The yield of by-product magnesium chloride was 34·1 per cent. — G. T. Gadre, A. V. Rao and H. M. Bhavnagary, Central Salt Research Institute, Bhavnagar.

Solvent Extraction of Cottonseed Oil

STUDIES on the extraction rate of cottonseed using different solvents have been carried out at the Oil Technological Institute, Anantapur. Of the four solvents studied, viz. commercial *n*-hexane, *Pegasol* 1222, (Standard Vacuum Oil Co.), S.B.P. Spirit (Burmah-Shell) and absolute alcohol, Pegasol 1222 has been found to give the highest extraction rate at ordinary temperature (27·8 C.). Pegasol-extracted cottonseed oil has a comparatively lower specific gravity, saponification value, iodine value and gossypol content than the oil extracted with the other solvents. The alcohol extracted oil has the highest gossypol content.

Extraction studies were carried out using a moving current of solvent through a stationary column of cottonseed flakes. The physical characteristics of the solvents used are given in Table 1.

The extraction apparatus employed consisted of a jacketted pipe in which a column of the flakes could be maintained over a sieve plate at the bottom. The solvent was run from a reservoir through a constant head tank into the column of the flakes from bottom to top. Provision was made for inserting a thermometer to note the temperature of the solvent miscella.

Cottonseed flakes (175 g.) of thickness varying from 0·007 to 0·01 in. were taken in the extractor for each run and the solvent from the reservoir was passed into the extractor at 55 ml. per 5 minutes. Samples of the effluent miscella obtained at room temperature and constant solvent flow-rate were collected at 5-min. intervals over a period of one hour. The solvent in each sample was evaporated and the weight of oil extracted over each time increment determined. The total initial oil content of the cottonseed flakes was determined by Soxhlet extraction of the flakes with the respective solvents used for rate-extraction studies. The oil samples obtained by extraction of the flakes with each of the solvents were analysed for their physical and chemical characteristics and gossypol contents (Table 2).

The results of extraction rates show that absolute alcohol has the lowest extraction rate for cottonseed. Pegasol extracts at a slightly higher rate than *n*-hexane and S.B.P. Spirit. The poor extraction rate of alcohol is due to the low solubility of cottonseed oil in ethyl alcohol at ordinary temperature.

TABLE 1 — PHYSICAL PROPERTIES OF SOLVENTS USED FOR EXTRACTION

	Pegasol 1222	*n* Hexane	S.B.P. Spirit	Absolute alcohol
Sp. gr.	0·6920	0·6904	0·682	0·7938
Colour (Saybolt)	plus 26	—	plus 25	—
Boiling range, C.	60–90·2	67·1–70·4	62·2–74·9	77·7

TABLE 2 — PHYSICAL AND CHEMICAL CHARACTERISTICS OF COTTONSEED OIL EXTRACTED WITH DIFFERENT SOLVENTS

Solvent Used	Sp. gr. at 28 C.	Refractive index at 28 C.	Sap. value	Iodine Value (Wijs)	Gossypol in oil %	* Gossypol in meal after extraction %
Pegasol	0·9119	1·467	187·5	100·2	0·0724	0·794
Hexane	0·9156	1·465	193·1	104·1	0·0916	0·747
S.B.P. Spirit	0·9159	1·467	191·9	105·5	0·1093	0·804
Alcohol	—	1·470	190·2	105·8	0·3189	0·011

* Gossypol in flakes, 0·915%.

The oils extracted with Pegasol 1222, S.B.P. Spirit (62-82 C.) and commercial *n*-hexane were refined and the refining losses and factors evaluated. The refining factor of the oils extracted with the three petroleum solvents was practically the same. The crude oil colours of crude as well as the refined and bleached oils extracted with these solvents were also nearly the same.

Although Pegasol 1222 gave better rates of extraction and the oil had a somewhat lighter colour, and lower gossypol content compared to that obtained with S.B.P. Spirit and *n*-hexane, recovery losses with Pegasol (which contains mainly hexane and heptane, besides a small quantity of pentane) may be somewhat higher due to its wider boiling range, compared to *n*-hexane. G. V. Rao, K. Chandrasekharan and K. S. Murti, *Indian Oilseeds J.*, **2** (1958), 18.

Patents & Processes

Electroplating on Aluminium

National Metallurgical Laboratory, Jamshedpur

PLATED aluminium articles possess several advantages over plated brass or steel articles ; they are light, easily workable and corrosion-resistant. Usually, however, aluminium is plated to secure protection against corrosion and for decorative effects. Some possible applications of plated aluminium are for garment accessories, costume jewellery, novelties, and bicycle, automobile and aircraft accessories. Tabular furniture, bathroom fixtures and household utensils are other uses of plated aluminium. In India, on account of large resources of aluminium and limited resources of copper, plated aluminium can be used for many purposes for which copper, brass or steel is employed at present.

Anodic oxidation is usually employed to impart bright finishes to aluminium articles but it is not applicable to surfaces requiring good electrical conductivity because of the comparatively higher resistance of the oxide layer. The process is sensitive to small variations in alloy compositions and is not applicable to die and sand cast alloys. Copper and magnesium bearing alloys are also difficult to plate by this process.

PLATED ALUMINIUM ARTICLES

Direct electroplating of other metals on aluminium normally results in films having poor adherence. Because of this and other technical difficulties, electroplating of aluminium has not been practised in India on an appreciable scale.

A new process for electroplating aluminium with nickel, chromium, gold, silver, etc. has been developed in which a primary iron film is imparted as a preliminary to normal electroplating of other metals. The aluminium article is thoroughly cleaned by dipping in an alkali solution for a short time followed by washing with water, immersing in a dilute solution of hydrofluoric acid for a few minutes followed by a short dip in nitric acid solution. The article is then immediately immersed in an acidic solution of ferric chloride to impart a thin deposit of iron on it. This is followed by a thin electrodeposit of copper or brass from a cyanide bath. The article so prepared can now be electroplated with other metals, such as nickel, chromium, silver, gold and tin. Heating the article at 100 110 C. for a few hours prior to final electroplating further improves the adhesion of the deposit.

The deposits obtained by this process have good adhesion as shown by bend test, furnace test and hammering test. The corrosion resistance properties of the plated metals are also good. Blistering is not normally encountered and rejections are lower than with the zinc process.

Normal electroplating equipment with the addition of a few vats for various acids and chemicals, can be used for the process.

Free-Flowing Table Salt

Patent No. 60556

Central Salt Research Institute, Bhavnagar

THE purity of refined salt produced in India is not high enough and the salt has a tendency to absorb moisture from the atmosphere, resulting in wetting and caking of the crystals. The crystals being cubical in shape are difficult to coat with a hydrophobic agent. These defects can be removed by processing refined salt to produce table salt of high purity.

Although in foreign countries, manufacture of table salt is well established, it has not so far been developed in India on any appreciable scale because of want of technical know-how. The country's requirements of table salt are at present entirely met from imports.

A process for producing high grade table salt has been developed at this Institute. Sambhar or marine salt is refined to a purity of 99 per cent or above by one of the conventional methods fractional crystallization, chemical treatment or centrifugal washing. The purified brine is crystallized under controlled conditions in a specially designed evaporator. The crystals after centrifuging are dried in a rotary drier at 110 C. and given a thin coating of paraffin wax followed by a fine coating of basic magnesium carbonate. The mass is then sieved and oversizes and fines are re-processed. The proper sized material is packed in polythene lined bags for storage.

The novelty of the process consists in producing round shaped crystals which minimizes the caking tendency and enables the crystals to be uniformly coated. Absorption of moisture is negligible and the product compares well with the imported material in all respects.

The equipment required consists of a boiler, filterpress, centrifuge, rotary drier, stainless steel tanks, double jacketted vessels and a sieving set.

The process is simple and is equally applicable to lake and marine salts.

Parties interested in undertaking the commercial development of the process are invited to correspond with the Secretary, National Research Development Corporation of India, Mandi House, New Delhi.

Building Boards from Sawdust and other Wood Wastes

Patent No. 47411

Forest Research Institute, Dehra Dun

WOOD wastes, consisting of forest waste and manufacturing wastes like sawdust, veneer and plywood waste, are mostly utilized as fuel. A process has been developed to convert these wastes into hard boards.

According to this process, sawdust or other similar material, is mixed with activators like tamarind fruit pulp, a phenolic substance, and water in a mixer and then dried to the desired moisture content. The mixture is then pressed into boards at a high temperature and suitable pressure. Boards thus obtained compare favourably with commercial hard boards. They are strong, uniform in colour and can be painted, varnished or polished as desired. They can be used in panelling, partitions, ceilings, cupboards, shelves, furniture and as a core for plywood. By using suitable moulds, articles like ink stand, ash tray, tank packing, knobs, etc. can also be made from the same composition.

The process is applicable both to soft and hard woods, and their wastes. The equipment required consists of a disintegrator (if material other than sawdust is used), sieving machine, mixer, drier, and a hot press. Manufacture can be undertaken on a small or large scale. Saw mills and plywood factories, with their own supply of wood waste can adopt the process with advantage.

Parties interested in the commercial development of the process may write to the Secretary, National Research Development Corporation of India, Mandi House, New Delhi.

Indian Patents

A few of the Patent Applications notified as accepted in the *Gazette of India*, Part III, Section 2, 11 January to 8 February 1958 are listed below :

Plant and Equipment

59091 A storage vessel for low temperature storage of fluids : *Storage cell having a metal shell covered on the inside with a layer of insulating material compatible with fluid to be stored* — INDIAN OXYGEN & ACETYLENE CO. (P) LTD.

59092 Apparatus for the storage of liquefied gases : *Storage vessel constituted for liquefied gases by non-metallic closed pore cellular material* — INDIAN OXYGEN & ACETYLENE CO. (P) LTD.

57616 Disc for a device for extruding flour in paste form : *Outer rim provided with three movable arms, raised mid portion with holes on it, and the mid portion pressed down to form a conicular, tube like orifice* — KULKARNI

59101 Fluid conveying apparatus : *A device carried by hose carrying boom independent of connection for manœuvering other end of the hose to a position adjacent other containers* — FOOD MACHINERY & CHEMICAL CORP.

58248 Process and apparatus for mixing or homogenising powdered material : *Introducing compressed air at different pressures through separate annular zones at the bottom of the column of material to be homogenised* — KLINGER K. G.

58121 Closing device for bottles, containers and the like : *Closure obtained by surface contact between opening of bottle and the lining of cork, rubber or like resilient material provided on non-resilient cylindrical projection provided internally on the screw cap* — ALEMBIC CHEMICAL WORKS CO., LTD.

61034 Improvements in portable hand loom : *A pair of supports, a warp beam, a take up roll, a plurality of harnesses positioned between the warp beam and take-up roll, a selector mechanism for controlling the harnesses and a reed frame* — HAND-SKILL LOOMS INC.

Chemicals, Paints, Varnishes and Inks

59121 Process for the manufacture of cadmium sulphide : *Metallic cadmium is converted into cadmium oxide by using atmospheric oxygen. The cadmium oxide is dissolved in an acid and a sulphide added* — SHRI DHAR

59535 Improved pigmented printing compositions and process for the manufacture of pigmented prints : *Treating with composition comprising thermo-hardenable initial condensation product of thermo-setting resin, aqueous polymer dispersion from butadiene, amide and ester or nitrile of acrylic or methacrylic acid* — I.C.I. LTD.

Fine Chemicals, Pharmaceuticals and Perfumes

60957 Process for the manufacture of adreno-corticotropic hormone preparations : *ACTH is adsorbed on unmodified carboxymethyl cellulose in an aqueous system at a pH below 8 and then eluted at different pH ; use being made of carboxymethyl cellulose which is insoluble at the pH values during adsorption and elution* — ORGANON LABORATORIES LTD.

59418 Isolation of keto steroids from *Lantana camara* Linn : *The plant Lantana camara linn is extracted with a solvent, and the keto-steroid Lancamarone is isolated* — COUNCIL OF SCIENTIFIC & INDUSTRIAL RESEARCH

60156 Process for the simultaneous production of refined shark liver oil and vitamin A concentrates along with the recovery of other therapeutically active by-products : *Stearin is separated from the crude oil, which is then refined, the stearin fraction being saponified and the unsaponifiable matter being extracted with ether* — MAHDIHASSAN, MOINUDDIN, ALI & HAQ.

61780 Therapeutic composition containing calcium dioxytetracycline and preparation thereof : *The composition comprises calcium dioxytetracycline in an aqueous vehicle containing a non toxic alkaline earth metal alginate and a pharmaceutically acceptable suspending or wetting agent* — CHAS. PFIZER & CO. INC.

57982 Improvements in antibiotics : *Antibiotic E. 129 is produced by culturing streptomyces E. 129 NCIB No. 8792, NRRI No. 2558 or a mutant thereof in a nutrient medium* — GLAXO LABORATORIES LTD.

59048 Production of potassium persulphate : *Establishing a body of aqueous sulphuric acid solution, introducing ammonium persulphate into the top of the body and potassium sulphate into the bottom of the body and withdrawing solid potassium persulphate from the bottom* — FOOD MACHINERY & CHEMICAL CORP.

58001 Composition for treating diabetes : *Comprising n-butyl sultanilyl urea and a pharmaceutical carrier* — BOEHRINGER & SOEHNE G.M.B.H.

58154 New optical bleaching agents and process for the preparation thereof : *Condensing a molecule of 4 : 4-diaminostilbene with two molecules of cyanuric chloride or bromide* — COMPAGNIE FRANCAISE DES MATIERES COLORANTES.

59204 Process of preparing gibberellic acid : *Introducing carbon dioxide in aerated nutrient solution for cultivation of strain Gibberella fujikuroi* — I.C.I. LTD.

Oils, Fats, Waxes and Detergents

58010 Liquid detergent compositions : *Comprising organic synthetic detergent and water soluble inorganic alkaline builder salt in aqueous alcoholic medium* — COLGATE-PALMOLIVE CO.

Foods

57955 Process of obtaining non-bitter stablized soya, bean flour having perfectly assimilable proteins apparatus therefor and the flour obtained by this process : *Dry heating soya material spraying it with water* — DUCHANGE

Pesticides and Crop-control Agents

59457 New process for preparation of fine dusts or wettable *powders* of insecticides such as DDT : *A molten mass of the insecticide is spray-atomised* — COUNCIL OF SCIENTIFIC & INDUSTRIAL RESEARCH

Building Materials

58490 Improvements in concrete sleepers : *Concrete bodies joined to one another by a metal tube extending in a longitudinal direction of the concrete bodies* — INDHAR A.B.

Fuels, Coal Products and Lubricants

58007 Process for the manufacture of active carbon from coals and lignites : *The material to be carbonised is directly heated by the hot gases obtained by combustion of the gas evolved during carbonisation and by recirculating the hot gases* — COUNCIL OF SCIENTIFIC & INDUSTRIAL RESEARCH

58102 Method for conveying coal in the form of a water slurry through a pipeline : *Conveying coal by use of a water slurry comprising coal comminuted to top size in the range of 28 mesh to 6 mesh, with less than 25 per cent by weight of the coal comprising 14 mesh particles, the water slurry comprising 35 to 55 per cent by weight of coal* — PITTSBURGH CONSOLIDATION COAL CO.

59036 Process for incorporating water-soluble solids in lubricating greases : *By emulsifying aqueous solution of the solid in a lubricating oil to form an emulsion, dehydrating it and mixing it with a lubricating grease* — N. V. DE BATASCHE PETROLEUM MAATSCHAPPIJ

Fibres, Textiles and Dyestuffs

61605 New Colouring process : *By treating the textile materials with the monoazo or polyazo dyestuff containing at least one ionic solubilising group and at least one sulphon fuloride group and with an acid binding agent* — I.C.I. LTD.

61666 Improved desizing process : *Treating the sized material for a period not exceeding 30 minutes with trichlorethylene or perchloroethylene, optionally providing an opportunity for solvent to drain and then treating the material with hot water* — I.C.I. LTD. AND STANDFAST DYERS & PRINTERS LTD.

58624 Process for the preparation of oxidation dyestuffs on textile fibres : *Oxidising on the fibres, a substituted derivative of phenylglycine* — COMPAGNIE FRANCAISE DES MATIERES COLORANTES

58895 Textile processing plant : *Providing means for entertaining in air stream, the heat given off by the motor and for conveying the motor heated air stream into a duct extending longitudinally of the machine* — BAHNSON JR.

61223 Process for the dyeing of fibres of polyacrylonitrile : *The dyeing is conducted in the presence of a quaternary ammonium salt containing at least two quaternary nitrogen atoms and at least one aliphatic hydrocarbon radical containing at least 8 carbon atoms* — CIBA LTD.

59474 Improvements in the carding process : *Textile fibres subjected to drafting process between the point of their collection and condensation into silver form and its delivery into silver can* — DELHI CLOTH & GENERAL MILLS CO. LTD.

Rubbers, Resins and Plastics

57797 Improvements in method for removing volatile ingredients from thermoplastic polymer compositions : *Heating a mixture of non volatile polymers of vinylidene compounds and vaporizable organic ingredients* — DOW CHEMICAL CO.

57835 Improvements in the manufacture of alkyd resins and water-base paints made therefrom : *Heating polyethylene glycol polybasic carboxylic acid polyhydric alcohol and drying oil or fatty acid thereof to complete esterification* — LEWIS BERGER & SONS LTD.

59252 Antioridation of rubber : *Adding to the rubber 2 : 6-dialkoxy-4-alkyl phenol* — UNIVERSAL OIL PRODUCTS CO.

57790 Catalysts for the polymerization of olefins and process for preparing them : *Reacting halogenated organic compound with titanium alloy* — MONTECATINI SOCIETA GENERALE PER L' INDUSTRIA MINERARIA E CHIMICA AND ZIEGLER

57859 Process for the production of plastics : *Heating polyhydric alcohol with thioether glycol* —FARBENFABRIKEN BAYER AKTIENGESELLSCHAFT

57121 Process for producing graft polymers : *Subjecting polymer to ionizing radiation in presence of oxygen and contacting irradiated polymer with grafting material capable of being polymerized by free radicals* — CENTRE NATIONAL DE LA RECHERCHE SCIENTIFIQUE

Cellulose, Lignin, Paper and Other Wood Products

58889 Apparatus and method for treating paper : *Passing the web of paper successively through two press roll arrangements* — COMBINED LOCKS PAPER CO.

57992 Improvements in the drying of fabrics, papers, cardboards, and other lengthy materials : *Drying the material by simultaneous action of gaseous circulating fluid and radiating element* — DUNGLER

Metals and Metal Products

61803 Improvements in the manufacture of steel balls : *Rolling partly shaped steel balls in red hot condition at a pressure between two identical rollers rotating at high speed* — KRISHNAMURTHY

59317 Improvements in heat treatment of copper wire : *Comprising winding wire on ferrous spool having a barrel, with discontinuous flange at each end, the heat treatment being carried out on the spool* — BRITISH INSULATED CALLENDERS' CABLES LTD.

59710 Improvements in methods of making metal caps, for incandescent lamps : *Making metal caps for incandescent lamps wherein one or more parts of a cylindrical member which extend at right angles to the longitudinal direction of this member and are integral with the member are severed from this member by a pressing operation* — N. V. PHILIPS' GLOEILAMPENFABRIEKEN

57248 Process and apparatus for improving the qualities of sheet metal for use particularly in electrical equipment : *The sheet after it is rolled, is subjected to magnetisation all along its length in the course of its process of manufacture* — WALZWERK NEVIGES, WILLY H. SCHLEICKER & CO.

57941 Method of processing steel bars, especially reinforced steel : *Cold twisting and cold stretching a steel bar during the processing zone between two gripping devices* — THE TENTOR STEEL CO. LTD.

57174–77, 57179–80, 57182–83 Improvements in chemical nickel plating : *Comprising an aqueous solution of nickel ions and hypophosphite ions, the ratio between nickel ions and phypophosphite ions in the bath expressed in molar concentrations being within the range* 0·25 to 0·60

Comprising providing an aqueous solution containing nickel ions and hypophosphite ions, wherein the ratio between nickel ions and hypophosphite ions in the solution is within a first predetermined range and the absolute concentration of the hypophosphite ions in the solution is within a second predetermined range

Comprising an aqueous chemical nickel plating solution of the nickel cation hypophosphite anion type having a pre determined composition characterised by stability and a low plating rate at a temperature within a first given range disposed well below the boiling point thereof

Exposing a fresh roughened surface of the body having secured thereto dispersed growth nuclei consisting of minute particles comprising a catalytic material, immersing the body in a bath of aqueous solution of nickel salt and a hypophosphite

Bath consisting essentially of an aqueous solution of a nickel salt and a hypophosphite and a complexing agent and a separate and different exalting adttive

Bath comprising an aqueous solution of nickel ions hypophosphite ions, lactic ions wherein the concentration of hypophosphite ions in the bath expressed in mole litre is within the range 0·15 to 1·20

Comprising an aqueous solution of a nickel salt and a hypophosphite which is circulated from the exterior into a plating chamber and then back to the exterior, maintaining the solution in the plating chamber at a temperature in the range 90° to 100° C.

Chemical nickel plating bath comprising nickel ions, hypophosphite ions, acetate ions, ammonium ions and ortho-boric acid, the concentration of nickel ions being at the range of 0·07 to 0·10 mole-litre

Engineering

57620 Automatic [illegible] governing spinning wheel, i.e. *Charkha : Comprising a spinning wheel and a twister wharve both driven positively and working in coordination with each other so as to draw, twist and wind yarn continuously* — SATHE

57928 Speed indicator for airplanes : *Comprises correction elements connected by a connection link, means for deriving performing movements from one place of link and means for correcting deviations of transmitting mechanism* — VYZKUMMY A ZKUSEBNI, LETECKY USTAV

60120 Improvements in shaft and bearing mechanisms : *Shaft or axle provided with collared bush within bearing* — COUNCIL OF SCIENTIFIC & INDUSTRIAL RESEARCH

Indian Standards

The Indian Standards Institution (Manak Bhawan, 9, Mathura Road, New Delhi-1) announces the publication of the following standards :

Common Burnt Clay Building Bricks — IS : 1077 1957 provides a guide for manufacturing a uniform quality in bricks, both in regard to strength and dimensions. The standard specifies the quality of bricks, dimensions, and tolerances and compressive strength and takes note of the principles of modular co-ordination as specified brick dimension conforming to a module of 10 cm. Price Rs. 1·50.

Pyrethrum Extracts — IS : 1051 1957. Pyrethrum extracts containing varying percentages of pyrethrins, are largely used in the control of insect pests of medical, agricultural and veterinary importance. The standard stipulates the variations that are permitted in the nominal percentage. The solvents used in extracting pyrethrum being of an inflammable nature, the lowest permissible flash point has been specified in this standard so as to reduce the risk of fire during handling and transport of the material. Since pyrethrum extracts are also used as aerosols, a maximum limit for matter insoluble in dichlorodifluoromethane has been prescribed in addition for the material suitable for use as an aerosol. The standard also specifies the mode of packing and marking, and methods of tests for various requirements. Methods of sampling, based on statistical considerations have also been given. Price Rs. 2·50.

Marine Plywood — IS : 710 1957 lays down requirements for marine plywood specifying the timber species to be used in the manufacture of plywood and also requirements for the manufacture of marine plywood. The dimensions of boards, tests and marking have also been specified in the standard. The adhesives used in the manufacture of plywood have specifically been stated. Price Rs. 2·00.

Arrowroot Starch — IS : 1006 1957 specifies the microscopic appearance of the starch to ensure freedom from adulteration ; requirements for particle size, moisture content, total ash, acid insoluble ash and *p*H of aqueous extract are specified to safeguard the wholesomeness of the material. The standard also specifies the mode of packing and marking, and methods of sampling, based on statistical considerations. Price Rs. 1·50.

Single Pole 5-Ampere Tumbler Switches for AC/DC — IS : 1087–1957. Electrical wiring accessories are being manufactured in India on an increasing scale and the tumbler switch is one of the most common accessories to be found in every installation. The standard lays down specifications for materials and tests for electrical performance including insulation resistance, high voltage test and electrical endurance test. The standard also includes a type test for the plastic insulating material used in such switches. Price Rs. 1·50.

Rolled Steel Sections, Tee Bars — IS : 1173–1957 lays down the nominal dimensions, weight and basic geometrical properties of rolled steel tee bars. Normal tee bars are not efficient for use in certain types of construction, particularly where welding is used. Wide Flange Tee Bars and Long Legged Tee Bars covered by the standard, are particularly meant to meet the needs of welded fabrications.

Dieldrin, Technical — IS : 1052 1957 specifies requirements for moisture, concentration of the active ingredient, total organic chlorine content, etc. and also the method of packing and marking. Methods of test have been specified to verify conformity with the requirements. In order to ensure that the sample taken for test is truly representative of the consignment, a method of sampling, based on statistical considerations has also been specified. Price Rs. 2·00.

Preferred Numbers — IS : 1076 1957. Preferred numbers are theoretical numbers suitably rounded off for practical convenience. These numbers help to secure some measure of uniformity in the choice of sizes while planning the production of any commodity. Preferred numbers may also be applied with advantage to the selection of articles by length, area, volume, weight, power, rating, etc., or to the individual dimensions of component parts in engineering. They provide the designer with a guide, which, while not restricting the liberty of choice for the purpose of his design, would serve to minimize the unnecessary multiplicity of sizes. This Standard explains the theory and gives a series of preferred numbers recommended for use in India : a guide to the use of Preferred Numbers is also given. Price Rs. 2·00.

Code for Practice for Resistance Spot Welding for Light Assemblies in Mild Steel — IS : 819 1957 lays down the procedure for resistance welding of the single impulse spot and stitch type used in the fabrication of assemblies from the mild steel sheet, strip and plate. It also covers the procedure for the design of spot welds and prescribes suitable tests for ascertaining the quality of the weld.

This code of practice is meant to serve as a guide to the industries using the resistance welding process in the fabrication of light mild steel assemblies. Equivalent values in the metric units have also been included. The standard is also related to the trade and technological practices being followed in this field in India and abroad. Price Rs. 2·00.

Notes & News

Thackeron Stainless Steels

Nickel free austenitic stainless steels, designated 'Thackeron Steels' have been developed at the National Metallurgical Laboratory, Jamshedpur. In these steels, the nickel in the standard 18 : 8 chromium steels, has been entirely replaced by manganese and nitrogen. The development becomes significant in view of the fact that India has no indigenous sources of nickel and imports about 7,000 tons of nickel-bearing austenitic stainless steels valued at over Rs. 6 crores annually.

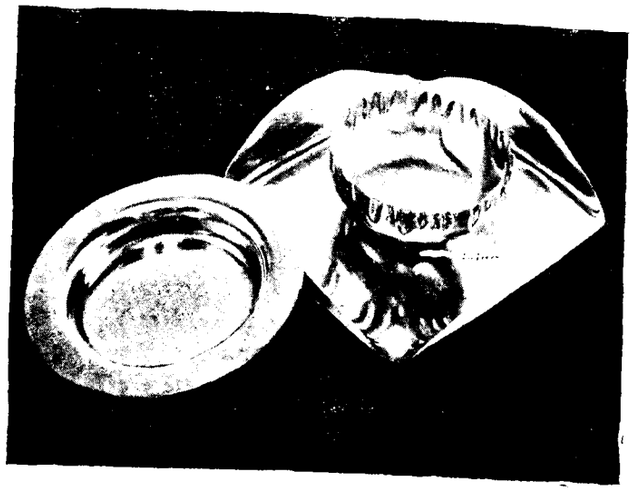
Composition — The new stainless steels are based on chromium manganese and nitrogen ; copper may also be added if enhanced corrosion resistance is desired. A feature of these steels is their high nitrogen content by virtue of which it has been possible to produce steels of very high chromium contents, completely austenitic and non-magnetic, and entirely dispensing with the use of nickel.

Properties and Uses — The new steels possess excellent deep drawing properties, corrosion resistance to boiling nitric acid, organic acids (e.g. citric acid, acetic acid, etc.), marine and industrial atmospheres including sulphurous atmosphere.

The steels can be used for all kinds of domestic utensils, pressure cookers, cooking ranges, washbasins, sanitary fitting, etc. They may also be used for hospital ware, dairy equipment, decorative and architectural purposes, steel furniture, high strength structural members, etc. and for applications requiring metals with low magnetic permeability. The steels can also be work-hardened to high strength. In high temperature oxidation and scaling Thackeron steels are superior to 18 : 8 chromium-nickel stainless steels.

Production — The steels can be manufactured from indigenous raw materials available in India. Both electric arc as well as induction furnaces normally employed for the standard 18 : 8 chromium-nickel steels can also be used for these steels, but the melting technique has to be modified in certain respects, particularly for the retention of nitrogen. Forging and rolling operations are more or less similar to the 18 : 8 chromium-nickel steels excepting that Thackeron steels may require extra power for hot and cold working due to the presence of manganese and nitrogen in these steels. Final finishing operations such as pickling and polishing do not require any special technique or equipment.

A proposal to set up a plant for the production of stainless steel based on the process developed at the Laboratory is being considered by the Government.—B. R. NIJHAWAN, National Metallurgical Laboratory, Jamshedpur.



ARTICLES MADE OF NICKEL-FREE 'THACKERON' STAINLESS STEEL DEVELOPED AT NML, JAMSHEDPUR

Removal of Sulphur from Iron

Considerable progress has been made recently in the methods of removing sulphur from iron and steel. The operation can now be accomplished during sintering, smelting in the blast furnace and/or immediately before steelmaking. In the sintering operation, controlled ignition, preheated air, and double-layer sintering all promote desulphurization without reducing the yield of strong sinter. It has been found possible in this way to remove over 90 per cent of the sulphur compared with 70-80 per cent achieved in normal practice.

Low-sulphur, low-silicon pig iron can be produced by using highly basic slags. Optimum compositions are chosen to combine maximum desulphurization and a liquidus temperature not exceeding 1,500 C.

Sulphur-reduction in liquid iron is usually effected by the familiar soda-ash method. A new and cheaper process employing lime has now been developed by the French research organization, IRSID. Here a form of converter containing the hot metal is bottom-blown with a blast of air or nitrogen carrying powdered lime in suspension, reducing the sulphur content from, for example, 0·1 per cent to 0·003 per cent within 5 minutes. The process is to be used commercially on a 1,000 tons-per-day plant in France. — *BISRA Survey*, (1957), 3.

Autothermic Process for Dialkyl Phosphites

A simple, economical and continuous process for preparing dialkyl phosphites has been developed by *Monsanto Chemical Co.* The process requires no solvent (this permits greater capacity and easier recovery of by-product alkyl halide) and minimizes or eliminates cooling. Products of high purity are obtained in yields up to 98·5 per cent with relatively simple equipment.

The process consists in permitting the reagents (phosphorus trichloride and alcohol) to react in a spray nozzle, cooling the reaction product stream in the case of lower homologues, and removing low-boiling by-products from the liquid reaction product with a packed column stripper operated under reduced pressure. The process is autothermic — the reaction temperature is allowed to seek its own level and the heat of reaction is removed as latent and specific heat by the reaction products.

Under these reaction conditions, a short exposure to hydrogen chloride at elevated temperature does not significantly decompose the dialkyl phosphite product ; much heat of reaction and about two-thirds of the hydrogen chloride are removed automatically. Because the liquid reaction-product stream is at elevated temperatures and still contains significant amounts of hydrogen chloride, decomposition following reaction must be avoided. This can be done by minimizing the hold-up time between reaction and stripping, and for esters below butyl, by cooling the stream. Incorporating the reactor nozzle into the stripping column should be possible, but this would generally increase vapour load on the evacuating system. — *Industr. Engng Chem.*, **49** (1957), 1871.

Preparation of Nicotinamide

A process for the preparation of nicotinamide developed by the *Distillers Co. Ltd.* (*Pat. No.* E.P. 777,517) consists in hydrolysing 3 cyanopyridine at elevated temperatures in an aqueous medium containing as a catalyst a compound having a solubility in water not more than 0·1 per cent at 20 C, and whose saturated aqueous solution at the same temperature has a *p*H value between 8 and 11. The reaction is terminated when not more than 80 per cent of the 3-cyanopyridine is converted into nicotinamide. The hydrolysis is conducted at 100 -130 C. Specified catalysts are magnesium oxide, calcium carbonate and barium carbonate. The nicotinamide is recovered by distillation and extraction of the residue with acetone. The distillate containing the unreacted 3-cyanopyridine is passed through an ion-exchange resin to remove ammonia and the resulting solution recycled to the hydrolysis process. — *Chem. Tr. J.*, **141** (1957) 1274.

Water-white Liquid Epoxy Resin

Development of a new water-white liquid epoxy resin based on Bisphenol-A and epichlorophydrin has been announced by Dow Chemical International Limited, a subsidiary of The Dow Chemical Company. Called D.E.R. (Dow Epoxy Resin) 332, the product is the monomeric diglycidyl ether of Bisphenol A rather than a conventional mixture of polymers. The resin is water-clear, uniform, and has low viscosity. It is designed to be of special interest to the tooling, electrical, paint, adhesive, reinforced plastic and chemical industries.

Simultaneously with the announcement of D.E.R. 332, Dow put on the market two other liquid epoxies. D.E.R. 331 is a standard unmodified resin suitable for customary use in tooling, casting, adhesives, and electrical encapsulating. D.E.R. 334 is a modified low viscosity resin reported to be especially suitable for laminating.

Liquid epoxy resins are plastics which have the ability to change from liquids into extremely hard solids when catalysed under proper conditions. The solidified resins are recognized by the industry as being among the toughest and most durable known.

New Copper Oxychloride Plant

India has a great potential market for pest control products. Copper dusts (4 6 per cent Copper) and wettable copper formulations have been in use in tea gardens and rubber plantations in the country for the past several years. During 1957, imports of copper oxychloride are estimated to be about 650 tons valued at Rs. 21·50 lakhs. The consumption is expected to increase considerably as the beneficial effects of the products become better known.

Manufacture of copper oxychloride on a substantial scale has been recently undertaken in the country by *Tata Chemicals Ltd.* who have set up a plant with a capacity to meet the entire estimated requirements of the country for several years to come. The product is being marketed through Messrs *Tata Fison Private Ltd.*, who formulate the product with inert media for different end uses.

The entire plant has been designed by the Company's Development and Process Control Department and built with materials available in the country.

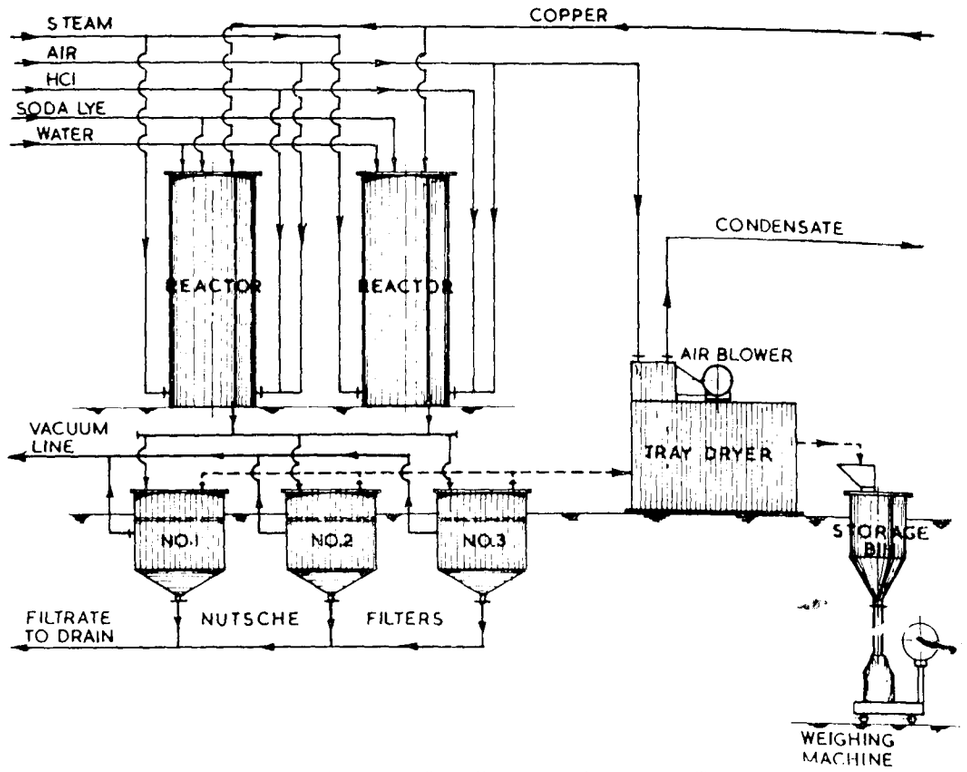


FIG. 1. LAYOUT OF COPPER OXYCHLORIDE PLANT DESIGNED AND FABRICATED BY TATA CHEMICAL CO.

The Process — Copper scrap is subjected to the action of dilute hydrochloric acid in specially constructed reactors in the presence of a vigorous blast of air. The slurry containing copper oxychloride is withdrawn from these reactors in batches after neutralizing the unreacted acid. The reaction time varies from 8 to 12 hours. The slurry is filtered in Nutsche vacuum filters. The thixotropic cake containing about 35 per cent water is dried in tray drier type ovens. The whole process in reactors, filters and driers is carried out in batches.

The concentration of hydrochloric acid is kept at 5 per cent and the temperature in the reactor in the initial stages is not allowed to exceed 40 C. A similar control is employed in the ovens where the temperature of hot air is not allowed to exceed 80 C. This is important since it affects the fungicidal properties of the final product. The flowsheet of the process is given in Fig. 1.

Sheller for Oilseeds

A machine for shelling oilseeds designed under the India-University of Tennessee Technical Assistance Programme enhances considerably the efficiency of shelling and lowers the cost of the operation. The machine is simple, inexpensive and is estimated to cost Rs. 40. It has one stationary disc and one rotating disc, each faced with $\frac{3}{8}$ in. sheet rubber. The stationary disc has a hole in the centre through which seeds from the hopper enter the space between the discs. Here they are rolled till the shell is broken, and the kernel and broken shells drop out. It is possible to attach a fan so that the kernels are separated from the broken shells.

The output of the machine depends upon the speed of rotation ; when turned by hand about 75 lb. per hour of castor or 50 lb. per hour of *neem* and *mahua* seeds can be shelled. The output can be increased if an electric motor is used. — *Indian Oilseeds J.*, **2** (1958). 47.

Development of Essential Oil Industry

The problems and prospects of the essential oil industry in India were discussed at the Second Annual Convention of the Essential Oil Association of India held at Bangalore during January 1958. The convention was inaugurated by Shri V. Baliga, Minister for Legal Affairs and Labour, Mysore State. Dr. M. Habibullah, Vice-President of the Association, presided in the absence of Dr. D. R. Dhingra.

Dr. Dhingra traced the history of the essential oil industry in the country and analysed the causes which led to its decline. It was stated that the inability of the Indian manufacturers to keep pace with scientific and technological developments in the field was mainly responsible for the present state of the industry. Another cause which adversely affected the Indian industry was the introduction of cheap aromatic chemicals and synthetic essential oils. Dr. Dhingra observed that the industry should take advantage of the restrictions imposed recently on the import of essential oils by undertaking the production of various aromatic chemicals and synthetic essential oils, which formed the backbone of the industry. New perfume bearing plants should be cultivated so that those natural oils for which the country is dependent on imports, could be produced in India. Improved techniques and equipment should be used to improve the yield and quality of the products and to reduce their cost.

TABLE I — EXPORTS AND IMPORTS OF ESSENTIAL OILS

	Imports, Rs.			Exports, Rs.		
	1954-55	1955-56	1956-57	1954-55	1955-56	1956-57
Natural essential oils	50,00,263	66,61,227	72,24,134	2,14,42,641	2,72,79,815	2,73,47,955
Synthetic essential oils	36,40,012	36,78,760	46,78,086	...	...	...
Essential oil bearing seeds and spices			...	11,70,81,044	10,96,83,642	9,35,99,308
Sandalwood				29,07,491	36,21,952	44,32,829
Camphor	47,02,425	44,42,621	46,02,289			

Recent Progress — A number of steps have recently been taken to promote cultivation of new perfume bearing plants, production of aromatic chemicals, improvements in distillation techniques and survey of aromatic raw materials resources in the country. The Essential Oils Research Committee of the Council of Scientific and Industrial Research has sanctioned several schemes and projects in this regard. Regional Research Centres for cultural and chemical studies of essential oil bearing plants have been established at Dehra Dun, Kanpur, Poona, Bangalore, Jammu-Kashmir and Ootacamund.

Among the technical papers presented and discussed at the Convention were those relating to manufacture of palma rosa oil from cultivated rosha grass evolution of a rational still for essential oil bearing materials and introduction of some exotic aromatic plants in Jammu and Kashmir.

Exports and Imports — India exports appreciable quantities of some essential oils, essential oil bearing seeds and spices, and sandalwood. Sizeable quantities of natural and synthetic essential oils and camphor besides aromatic chemicals are imported to meet the requirements of the soap and cosmetic industries. Figures for imports and exports during the last three years are given in Table 1.

Oilseeds in India

A 82-page review of *Oilseeds in India* has been issued by the Economic and Statistical Adviser, Government of India, New Delhi. The review gives an analysis of the oilseeds position during the quinquennium 1951-52–1955-56 and also statistical data for the period.

India is one of the main oilseeds producing countries of the world and in particular, is a major supplier of groundnut, castor and linseed oils ; in addition, India produces significant quantities of minor oilseeds, like cottonseed, nigerseed, safflowerseed, mohwa seed, and neem seed.

The total production of the five major oilseeds, viz. groundnuts, sesamum, rape and mustard, linseed and castorseed in 1950-51 was 50·78 lakh tons. Production data during the First Five Year Plan period (1951-56) are respectively 49·49, 46·59, 52·85, 62·42 and 55·96 lakh tons. The considerable fall of 6·5 lakh tons during the year 1955-56 was caused by adverse seasonal conditions ; even so the production was higher by 1 lakh tons than the targetted production under the First Five-Year Plan.

The review gives an account of measures taken in India to increase the yield per acre of oilseeds. The *Indian Central Oilseeds Committee* have sponsored several schemes in various States with a view to evolving improved strains of seeds and studying agro economic problems like economics of seed rate, optimum and economic dose of manure, efficient crop rotation etc. Some of the investigations have already yielded promising results. Spanish varieties of groundnut have been tried in Punjab, and a yield of 1,080 lb. per acre was obtained against the existing yield of 400 lb. per acre.

The problem of improving the efficiency of *ghanis* has also been taken up by the Committee. There is a scheme for organizing co-operative societies of oil crushers. The Committee has also undertaken schemes for popularizing the Wardha *ghani* and for drawing up standards for vegetable oils.

Metric Measures

The Standing Metric Committee of the Union Ministry of Commerce & Industry has started a new journal *Metric Measures*. The journal purports to be a medium for disseminating information on various aspects of metric system of weights and measures, with particular reference to the introduction of the system in India. The first number (January 1958) includes articles, such as Some aspects of metric reform, Shape of weights to come and Metric progress in industries.

The journal is published every two months from its editorial office at Udyog Bhavan, New Delhi. Annual subscription, Rs. 2.

Silk and Rayon Industries of India

A new monthly Journal, under the above title published by the *Silk and Art Silk Mills' Research Association*, Bombay has made its appearance. The journal is intended to give impetus to the growth and development of the rayon and synthetics industry in India by disseminating information on technological developments in the field and by focussing attention on various matters affecting the industry. A section of the journal will be devoted to featuring the activities of the Research Association month by month.

The growth of man made fibres in recent years has been almost phenomenal. The impact is being felt in India, particularly by the rayon weaving industry which has lately made some rapid strides; the number of looms has now risen to over 20,000 from about 11,000 in 1949. There is much scope for expansion in various fields. The new journal fulfils a long felt need and should go a long way in stimulating the development of the industry.

The inaugural number (January 1958) includes the following articles: Technical education and industry, National Research Development Corporation, Indian rayon weaving industry, and the new finishes.

Output of Penicillin in 1957

The *Hindustan Antibiotics (Private) Ltd.*, Pimpri produced nearly 23·6 million mega units of penicillin during 1957 as compared with 14·1 million mega units produced in the previous year. In terms of the finished product for clinical use, the production of penicillin was nearly 17·9 million mega units during 1957 as compared with 5·2 million mega units in the preceding year.

The capacity of the factory is to be increased by 60 per cent by the installation of additional plant and equipment to meet the increasing requirements of penicillin in the country. Equipment for the expansion programme has been arriving in Pimpri and some of the items are already in the process of erection.

A project to manufacture streptomycin in the Pimpri factory is being considered by Government. Negotiations are now being conducted with foreign firms for technical collaboration in this project. The scheme envisages the manufacture of 15,000–20,000 Kg. of streptomycin at an estimated cost of Rs. 1·12 crores.

Phosphoric Acid and Phosphates Industry

Data regarding the capacity licensed, actual production and annual requirements of phosphoric acid and the principal phosphates in India are given in Table 1. It is seen that the capacity licensed meets the entire requirements of Indian industries. The Development Council for Heavy Chemicals (Acids & Fertilizers) has, therefore, recommended that no further capacity for production of these chemicals should be permitted.

TABLE 1 — PHOSPHORIC ACID AND PHOSPHATES PRODUCTION

(tons/per annum)

	Capacity licensed	Actual production	Requirements
Phosphoric Acid:			
Star Chemicals	600	240	300
West India Chemicals	240	—	
Excel Industries	150	85	
Dharamsi Morarji Chemical Co.	1,500	—	
Phosphoric Acid (for Phosphate Salts)	275	—	
Disodium hydrogen phosphate	3,600	360	360
Sodium hexameta phosphate	180	100	125
Calcium phosphate	84	50	50
Polyphosphates	120	—	25
Triple superphosphate	3,000	100	variable

Consumption of Sodium Sulphate

India's annual requirements for sodium sulphate, now placed at 20,000 tons, are expected to raise to 40,000 tons by 1960–61. About 3,000 tons per annum are obtained as a by-product in the production of hydrochloric and nitric acids. The most promising source of supply, however, will be as a by-product of viscose rayon manufacture. While the *Gawalior Rayon Silk Manufacturing Co. Ltd.*, Gawalior are recovering Glauber's salt, *National Rayons* are converting substantial quantities of the salt recovered into anhydrous sodium sulphate. When the rayon factories now under construction go on stream, they will be in a position to meet the bulk of the country's requirements of sodium sulphate.

The Development Council for Heavy Chemicals (Acids & Fertilizers) at its meeting held at Madras during January 1958 recommended that licensing of new capacity for viscose rayon should be made conditional to the simultaneous setting up of capacity for recovery of sodium sulphate. The Council agreed that during the interim period the deficit in sodium sulphate should be met by imports.

Production of Mica in India

The production of crude mica in India during the quarter ending September, 1957 was 130,547 cwt. as against 125,445 cwt. in the corresponding period of the previous year, according to the Indian Bureau of Mines.

Bihar, which is the leading producer of mica, accounted for 69,990 cwt. while output from Rajasthan and Andhra, the other major producing States was 34,840 cwt. and 23,560 cwt. respectively.

The production of crude mica during the period January – September 1957 stood at 441,142 cwt. showing an increase of 16,807 cwt. compared with the production in the corresponding period of 1956.

As a result of dressing, 18,323 cwt. of sickle-dressed blocks and 2,098 cwt. of chillas were recovered by the mine owners in the quarter ending September 1957 compared with 24,486 cwt. of sickle-dressed blocks and 2,544 cwt. of chillas recovered during the same period last year.

The statement about ownership and other particulars about *Research & Industry* as required to be published under Rule 8 of the Registration of Newspapers (Central) Rules 1956.

FORM IV

1.	Place of Publication :	C.S.I.R., Old Mill Road, New Delhi-2
2.	Periodicity of its Publication :	Monthly
3.	Printer's Name :	Associated Printers (Madras) Private Ltd.
	Nationality :	—
	Address :	165, Mount Road, Madras-2.
4.	Publisher's Name :	Council of Scientific & Industrial Research
	Nationality	—
	Address	Old Mill Road, New Delhi-2
5.	Editor's Name :	Shri B. N. Sastri
	Nationality :	Indian
	Address :	Publications Directorate, CSIR, Old Mill Road, New Delhi-2
6.	Names and Addresses of Shareholders holding more than one per cent of the total capital :	—

I, B. N. Sastri, hereby declare that the particulars given above are true to the best of my knowledge and belief.

Date : 25th March 1958.

Signature of Publisher : (Sd.) B. N. Sastri
Chief Editor, Publications Directorate,
Council of Scientific & Industrial Research.

PRINTED BY A. SENDALL AT THE ASSOCIATED PRINTERS (MADRAS) PRIVATE LTD., MADRAS AND BANGALORE

Regd. No.
M-6958