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Technologists Annual Day Special Number

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A MESSAGE FROM A FORMER COLLEAGUE

(These excerpts are from a message received from Mr. T. V. Ramanathan, B. Sc., (Engg.) formerly Dy. Works Manager with the Mettur Chemical and Industrial Corporation, Ltd., and now Chief Engineer with the Mysore Vegetable Oil Products, Ltd., Madras. Thanks largely to his initiative and enterprise, the Society of Technologists, was founded.)

" This Society has had the privilege of welcoming in the past many an eminent man of science. Now, you have in your midst another distinguished scientist in the person of Dr. V. Subrahmanyan. His address *Recent Trends in Food Processing* should be of special interest in view of the present grave food shortage of the country, and the need for the careful preservation of all available food...

Now, to recall briefly the origins of the Society : the Society was formed to tackle the day-to-day technical problems of the Mettur Chemical and Industrial Corporation, in its initial years. The problem of frothing in the smelting of caustic lye was the first one to which a solution was found after discussion. The need for a forum for the exchange of ideas and information was then realised, and the Society was born. I am glad to note that it is " going strong ".

Today, the responsibility of technologists is even greater. Not only have they to turn out better products—and more and more of them—but they have ceaselessly to strive to bring down costs.

I wish you all success in your endeavours."

T. V. RAMANATHAN.

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JOURNAL DEVOTED TO THE HEAVY CHEMICAL INDUSTRY

SOCIETY, FRIENDSHIP AND KNOWLEDGE

LEARNED Societies have an important part to fill in the cultural and intellectual life of the community. What a former British Education Minister once observed about the Chemical Society applies, in broad terms, to all learned and scientific bodies. He said: "The Chemical Society pursues knowledge in a spirit of friendly rivalry, and with a deep sense of its responsibility to the peoples of the world. When the nations can work at the political level in the same unselfishness and zeal for a common purpose, as the Society and others like it show for the advancement of learning, then the world will at least be on the way to the kind of society which the United Nations are trying to build".

A body like our Society of Technologists—to whom this issue is dedicated—represents 'the advance guard of the human spirit continually probing the frontiers of new knowledge'. The quest for truth must go on and on. And, in the last analysis, this search is nothing obscure or recondite, but will be found to be something related to the more day-to-day-to-things of our daily lives.

Again, in no other body, perhaps, than in a scientific one, is such readiness displayed as to give credit to each other's view-point and to acclaim achievements, regardless of any extraneous considerations.

Invariably, discussions are full, free and frank to the benefit of all concerned, and assessments are, necessarily, objective.

It is a happy augury that industry is gradually beginning to recognize the importance of the role of pure science. Facilities for discussion, lectures, visits to other plants, attendance at meetings of learned societies and technical conventions are all part of the modern industrial pattern.

The alkali-chlorine industry in this country is still in its swaddling clothes. For it to grow and develop, it requires the fostering care of such technical societies as the Society of Technologists.

In all sincerity, therefore, we wish our Society continued success.

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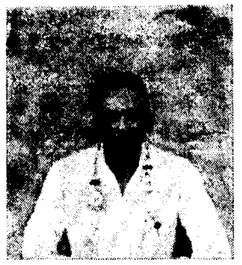


Mr. K. Ramanath

PRESIDENT'S ADDRESS

SOCIETY OF TECHNOLOGISTS ANNUAL DAY

GENTLEMEN:

AS President of the Society of Technologists, it is my privilege to extend a most hearty welcome to our distinguished guest, Dr. V. Subrahmanyan, Director of the Central Food Technological Research Institute, Mysore. A brilliant research scholar, he received, as early as 1926, the medal awarded by the Royal Agricultural Society, London. Besides being the author and editor of more than 300 papers bearing on Agricultural Chemistry, Nutrition and Food Processing and other allied subjects, Dr. Subrahmanyan has made outstanding contributions to such varied subjects as compost manufacture, the preparation of gland products, manufacture of vegetable milks, treatment of industrial wastes, etc. He is an executive member of several learned societies, scientific bodies, industrial panels and Government committees, and you will all be pleased to know, that he was, also, recently elected President of the Chemistry Section of the Indian Science Congress for 1953.

ORIGINS

The presence of such an eminent scientist as Dr. Subrahmanyan in our midst, this evening, augurs well for the future of our Society. This Society came into existence 11 years ago, about which time our factory, also, went into production. Even in the early years, its members were fully alive to its great possibilities and the scope that it offered for the exchange of information and ideas on the problems that our industry had to face. As one of our distinguished past Presidents once observed, the Society afforded not only opportunities for free discourse, but its deliberations "paid off," in concrete results, too. It gives me great pleasure to mention, in this connection, that although the function of the Society is, in the main, to serve as a forum for the exchange of ideas between members only, it has also been serving as a clearing-house of ideas from other sources. Several are the distinguished men of science and industry who have addressed our members, in the past, and it is our earnest hope that we will be able to get several more to address us, in the future, too.

GROWTH

The Society has always been looked upon with pride by our industry. Our company—pioneer Indian manufacturers of electrolytic alkali—went into production in July 1941, with capacities of 5 tons of caustic soda, 7·5 tons of bleaching powder and one ton of liquid chlorine per day. Gradually, we enlarged the sphere of our activities by installing a vanaspati plant,

a soap plant, a potassium chlorate plant, a hydrochloric acid plant and so on. Recent additions include Hooker 'S' Cells, Swenson caustic soda evaporators, a Worthington chlorine plant, a Vitreosil hydrochloric acid plant—and mercury are rectifiers to work the cells at higher capacity. These additions have enabled us to step up our production capacity to 13 tons of caustic soda per day. With the growth of our industry, the responsibilities of our Society have, also, simultaneously grown.

INDUSTRY'S PROGRESS

In recent years, the chemical industry in India has made considerable progress, although it must be admitted that there is still much leeway to make up. The yardstick of industrial progress is self-sufficiency in essential needs. And as we move towards self-sufficiency, we will gradually be consolidating our position. To mention two outstanding examples: the production of caustic soda in our country was stepped up from 10,500 tons in 1946 to 18,725 tons in 1950, and liquid chlorine production—from 2000 tons in 1946 to 9140 tons in 1950.

It must be pointed out, here, that such progress has been achieved, despite heavy odds. For nearly all capital equipment such as evaporators, electrolytic cells, special type of corrosion-proof pumps, heavy electrical and mechanical equipment and their spares, we have still to depend on foreign manufacturers. Our salvation would come only with the manufacture of capital equipment in our own country. Let us all hope that that day is not far off.

FIVE-YEAR PLAN

It is axiomatic that no progress is possible without proper planning, and it is not all surprising, therefore, that the decision of Government to set up the Planning Commission was enthusiastically received all over the country. The Commission was set up in March 1950, and in July of the same year, it was called upon to prepare a plan for the economic development of the country. Since September 1950, the Commission has been engaged—in active co-operation with the Central and State Governments—in examining, in detail, schemes under execution as well as those proposed under the Five-Year Plan. The Plan aims at the completion of the various projects now in progress, on time, and, also, provides for further development on a planned basis with such resources as are available in the country. The plan covers an outlay of 1793 crores of rupees out of which the part involving an expenditure of 1,493 crores represents the outlay on development manageable with resources in sight. The schemes proposed for development are agriculture and rural development, irrigation and power, transport and communication, industry, social services, rehabilitation and a host of sundry items. With the completion of the various multi-purpose projects, it is expected, that our dependence on foreign countries for our food supplies would greatly be reduced.

ROLE OF PRIVATE ENTERPRISE

In the industrial sector, the Plan lays emphasis on raising the output of existing

industries to their installed capacities. In the large-scale industries, the production of steel, cement, aluminium, paper and salt is expected to go up considerably. Increased production in basic commodities like steel, cement and aluminium together with the expansion of electric power to about one million kw—(all of which are expected to be achieved by 1955–56) would quicken the pace of the country's industrial development. The programme envisaged under transport and communication is also an ambitious one.

As a greater part of the outlay of the Plan is to be devoted to the development of agriculture, irrigation and power, it is obvious that the responsibilities for the expansion of industrial production during the period of the Plan should largely vest with the private sector, which, subject to the overall objectives of the Plan, should be free to pursue its normal activity. In the private sector, the annual production of heavy chemicals such as caustic soda is expected to go up to as high as 25,000 tons in 1955–56. The production of sulphuric acid, soda ash and other chemicals is, also, expected to touch new "highs," although it is hardly possible now to give reasonably correct forecasts.

TRAINING WITHIN INDUSTRY

It seems to me, however, that the question of provision of facilities for training in industry has not received the attention that it deserves in the *Draft Outline*, although there is the barest hint in it to show that some attention has been bestowed on this question. I, for one, feel that training facilities should be provided not only to higher technical personnel, but, also, to levels further below—say, at least to the foreman class of worker.

In this connection, I would like to draw your attention to the commendable work that is being turned out by the I. L. O. under its "Training within Industry" schemes. This great organization has evolved the most suitable schemes for imparting instruction to lower as well as higher technical personnel in industry. Their schemes were tried in our own factory, to its considerable advantage, under the guidance of one of our chemists, who underwent special training at Bangalore, the field headquarters of I. L. O. in India.

ROLE OF RESEARCHER

The research worker has also to keep abreast with the growing problems of industry. Fortunately for us, we have at the helm of affairs, a man whose lofty ideals are matched only by his grim determination to turn them into realities. The establishment of several National Laboratories in the years following the advent of freedom is an indication of the importance our Prime minister attaches to research.

Gentlemen, the country has a glorious future before it, and all of us have a part in it, however humble.

Once more, I welcome Dr. Subrahmanyan to our midst.

RECENT TRENDS IN FOOD PROCESSING*

by

Dr. V. SUBRAHMANYAN

PROCESSING of food is perhaps the oldest of human endeavours, but, at the same time, it is one which has moved at the slowest. This is, largely, due to the conservatism of man, rather that of woman.

In ancient literature, there exists ample evidence to show that, in the earliest times, man subsisted largely on certain types of edible leaves, wild fruit, honey and raw flesh. The process of cultivation and the introduction of starchy foods, such as we now consume, are latter-day developments. Cooking of food was taboo in days of yore, and as Charles Lamb has it in his delightful essay, '*A Dissertation upon Roast Pig*, (1) the pioneers had to burn down their huts together with the living pigs to get their first pork. As in our own country—in several others too—religion largely enters into the food habits of the people, and as Sir A. Ramaswami Mudaliar once remarked, "many of our menus go back to the days of Manu!"

SCIENCE AND NATURE

During the last century, especially during the last few decades, two trends have been distinctly noticeable. One is the welcome willingness displayed by the layman to try any food, provided it is backed by the nutritionist's assurance that it is wholesome. This is particularly true of countries like America where people are much less bound by tradition than we are in our country. The second and a more important one is the growing conciousness on the part of the scientist, himself, that he can reproduce even surpass Nature, in certain fields of creative effort. There is a host of substances of which either Nature is unaware or which she produces only in minute quantities, but which man can produce on a gigantic scale, and which can also be put to new kinds of uses. Scientists go on producing, day after day, hundreds of thousands of chemicals unknown in Nature. The substances that are now being produced on a manufacturing scale at Mettur occur only in traces in Nature. There is a whole range of drugs, dye-stuffs, vitamins, etc., which man produces on a colossal scale. If only human nature, particularly human character, could keep pace with advancing scientific knowledge, the world would, indeed, be a much happier place than what it is now.

New developments which we will deal with presently give us cause to hope that we can practically revolutionise our food practices, if only we will get together and bring to bear upon the subject, a critical and scientific mind.

* Annual Day address to the Society of Technologists.

(1) According to one critic, he who has not discovered *Roast Pig* could well have been spared the pains of learning to read!

DEEP FREEZING

Among recent developments, one that stands foremost, is the application of intense freezing for the preservation of various types of food material. Ordinary cold storage is steadily giving place to deep freezing, because many of the spoilage changes continue to proceed, though slowly at 0° to 10°C. At a temperature of—20° or even lower, the changes are almost completely arrested—so much so that a variety of perishable food material, including cooked food, can be preserved fresh and unchanged, quite indefinitely. Food can be cooked for a whole week, for even a month, and taken out in instalments. If different dishes are stored at the same time, a varied menu can be offered each day, and all that one will have to do will be to warm the food before use.

There is always scope for some change to occur between the time of purchase of a material and its cooking and storage. To a considerable extent, this can be arrested by the use of dry ice, the use of which—one is happy to note—is being increasingly appreciated.

It might objected that, in our own country, such methods are not practicable, because large sections of our population cannot afford the luxury of deep freezing. Nevertheless we should be able to devise a heat treatment that would enable us to keep our food from day to day. This will apply only to such types of food material as will stand repeated heating. A more promising approach is that of dry processing our grains in such a way that they will cook practically in no time. A product known as the "Minute Rice" has already been developed. This is a pre-treated product which, if preserved carefully, will help the users to cook the rice, in less than one-twentieth of the usual time. A similar treatment can, also, be given to *dal*. Such a treatment will help both in the saving of fuel and labour considerably. For all practical purposes, it will be as efficient as deep freezing with much less expense.

COLD STORAGE

Cold storage of various kinds of fruit and vegetables has now reached a stage that we can easily get them at reasonable prices in the off-seasons. Cold storage has particularly been successful in the case of the potato which we can now get all the year round in very fine condition. In this connection, I should like to recall the excellent suggestion stated to have been made by Mr. V. Seshasayee, that the huge quantities of potato grown in the Madras State—particularly in the Nilgiris District—should not be sent outside, but distributed through Government agencies as part of or supplement to the rations. Potato is an excellent article of starchy food, and can partly take the place of rice, wheat or millets. At one time, potato was on ration in England, and people seem to have done very well on it. If we can install cold storage units in different parts of south

India, we can store not only off-season food material, but also large quantities of potato, the production of which in the State will, also, be greatly stimulated. Our experience with cold storage shows that the cost of storage is very small, as compared with that of the material. The capital cost involved can be recovered in a few years.

We will now consider some related facts and figures. In the glut season, the Nilgiri potato can be had at a price not exceeding Rs. 4/- per maund. The *ex*-farm price is stated to be even less. The same potato may rise to Rs. 20/- or Rs. 25/- per maund in different parts of the province during the off-season. With adequate cold storage facilities, potato can be sold at a price not exceeding Rs. 10/- or Rs. 12/- per maund in the off-season, thus resulting in considerable saving to the consumer and, at the same time, yielding a fair margin of profit to the investor on storage. I am hoping that Messrs. Seshasayee Bros Limited, who have been pioneers in the electrical and chemical industries will take a lead, in closely allied lines which will be profitable to them, and, at the same time, beneficial to the people. Our Institute at Mysore will gladly help in such an effort.

There is not much meat in the country. What little is produced is consumed almost immediately. On the other hand, egg production varies with the season, and eggs can be stored in a fresh condition by the silicate treatment, combined with cold storage, for the best part of a year. Fish can be stored only for short periods by ordinary cold storage. It requires deep freezing which does not cost very much more. The fish once frozen to a hard, solid mass, can be stored at 0° to 5°c without much change. The fish industry in India has suffered considerably through our neglect to develop storage and technology to any appreciable extent.

Dehydration

During the last War, dehydration was extensively adopted throughout the world. India produced large quantities of the dehydrated potato and meat. The effort died out completely at the end of the War, because the products lacked the desired quality. The technique of dehydration requires to be drastically overhauled. We have to desiccate at a fairly low temperature, and combine it with evacuation in such a way that only the minimum amount of flavour will be lost. Work in this direction has already been started in different countries, and we should make a fresh start in India, too. If quality could satisfactorily be preserved, desiccated food material will be of very great value to us. Such food is clean, compact and is easily transported.

Freeze drying has successfully been applied to a variety of food material including such juicy fruit as the tomato and the strawberry. However, it is still a luxury even in a country like America. The most satisfactory working arrangement will be to combine freeze drying in the early stages with vacuum drying at higher temperatures in the later stages. This compromise arrangement is suggested

because the loss of flavour and of nutritious principles would appear to be higher in the early stages.

In recent years, the dehydration of juicy fruit has made considerable progress. Dried prunes, as now produced in the States, are no longer the hard and shrivelled things that they were in the past. By suitable sulphuring, the moisture content could be retained at 25–30 per cent, with a corresponding improvement in taste and flavour. Sulphur-dioxide is not the only substance which can be used for this purpose. There are quite a number of bactericides and fungicides, which are harmless, tasteless and odourless. Sodium propionate is now coming increasingly to the fore. In America, prejudices against the use of such harmless preservatives rule less than in Britain.

Fruit Canning

During the past decade, the basic principles of canning have not advanced to any considerable extent. The technique has, however, been considerably refined, and quite a number of attractive products are now produced. Some canned products actually taste better than even the raw fruit. Among South Indian fruit, the *Satgudi* orange offers considerable scope for canning in the form of segments. The segments are so elegant to taste that one should prefer them to the raw fruit. Some of the surplus fruit of the hill districts, like pears and peaches, should be the better for canning.

As regards squashes, again, the tendency is increasingly to go in for new blends. As with perfumes, so with squashes, it should be possible for an ingenious person to produce new and "exotic" types, combining various desirable qualities.

Another sadly neglected industry in our country is that of fruit juice concentrates. Various kinds of wild, and apparently unattractive fruit, yield delightful juice concentrates. The success of the technique depends on judicious flash pasteurization combined with treatments to eliminate terpenes, bitter principles of the skin and elimination or liquefaction of pectin. These juice concentrates, which represent many times the original volume, are both palatable and wholesome. In Britain, they started importing orange juice concentrates during the last War as a measure of saving shipping space. Now they are importing millions of pounds of concentrated juice primarily for reasons of economy. The fashion now is to go in for concentrates rather than for the fresh fruit.

Pickling and sweet preserves are other lines, in which India has long been a pioneer, but, in which, however, we have not made any new advance. There is a growing demand for new and exotic varieties of pickles, and it will be possible to make them. There is, also, a great deal of work awaiting to be done in regard to the standardisation of pickling methods as now adopted in our country. A very considerable part of the pickles made in India gets quickly spoilt, to the great loss of the producers.

Vanaspati

What a stiff, uphill task scientific workers in this country had in demonstrating the harmlessness of hydrogenated

oils is now common knowledge. The last round of the battle is not yet won, although opponents of Vanaspati now concede that it has its uses and does deserve to exist. The melting point of the product, as now prescribed, still continues to be a handicap, because, in large areas of the country, the Vanaspati of melting point 37°C becomes a fluid, during the hot weather, and suffers some spoilage, besides giving rise to leakage and other troubles. In America, the industry has already recognised the need for using a product of a higher melting point for the hot weather. With a suitable extender, even fats melting at higher temperatures up to 42 or 43°C can easily be assimilated. We should aim at producing a first-class product which will have the taste, flavour and the vitamins of ghee, indeed, at a much higher level.

Recent investigations conducted by us as well as other colleagues have shown that there is nothing sacrosanct about the butter fat. Experiments with generations of animals, as also with human subjects, have shown that, in the ordinary diet, butter fat can completely be replaced by a processed vegetable product, without any adverse effect, provided the necessary vitamins are only added. If only we will tend to be a little less sentimental about ghee and accept proven scientific facts, we will be making a more helpful, a more constructive approach to the problem of meeting our requirements for a properly fortified fat. Even the problem of adulteration of ghee, which is fairly widespread and which will soon be coming up again before the Parliament will assume a different aspect, if we will only adopt a more realistic view. We just do not have enough ghee, and there is little hope of our being able to increase the *per capita* supply. We will be doing a real public service—at least to the poorer sections of the people—if we can give them, an attractive and balanced vegetable product which will be as wholesome as, if not more wholesome, than ghee.

Packaging

In India, the main obstacle to processing has been the cost of the packaging material, usually the card-board package, the can or the bottle. Nevertheless, there is considerable scope for processing corn, oats and barley, which do not lend themselves to easy cooking. The products thus prepared can also be packed fairly in expensively. We are in close touch with all the new industries that have been started in our country and are assisting them. In most cases the main difficulty would appear to be the keeping quality of the product. This can improve only if fastidious, hygienic conditions are observed and certain additional treatments are given.

We are also concentrating attention on the canning of *chapaties* and *puris*, vegetables curries and such like products, which are required not only by the Defence Services, but also by a section of the civilian population. Canning of sweets which has, also, lately become an important industry, deserves to be developed.

Non-Alcoholic Drinks

Non-alcoholic beverages have always been of interest to us. Apart from coffee, tea and cocoa tremendous possibilities exist for new fruit juice beverages. Products like "Coca-cola" and "Pepsi-cola" have an enormous turn over in the States, and are fast finding favour with other countries, too, including India. We too can produce equally *good* if not better products which have all the digestive, carminative and invigorating qualities. If prohibition is to succeed in India, we will do well to have other products, which will fulfil the requirements of the people in other ways. In Mysore, we have developed a number of fruit juice products. One of them, the ginger cock-tail has already become quite popular. More recently, we have developed another new product, the "*Pansupari* Nectar" which contains the principles of *pansupari*, lime and spices, but which dispenses with the necessity of having to chew and to spit. This preparation does not, also, stain the lips. An ounce or so taken after a meal produces much the same effect as *pan* chewing, and such a product should find ready acceptance.

Grain Substitutes

Developments, such as those described above, only touch the fringe of the food problem of the country. Our basic requirements are starch and proteins, together with the requisite proportions of essential minerals and vitamins. Our production of foodgrains is not able to cope with the increasing demands of our rapidly growing population. Our main source of sustenance is the grain, but once we recognise that grains only consist of certain components and that if those components are put together, we can reproduce the food value of the grain, the problem is not so difficult as it may at first sight appear. It is with this object in view that we started our programme of work on the utilisation of tubers as partial substitutes for food. We were first interested in finding whether we could replace 25–50 per cent of our cereals with tubers like tapioca, without impairing the overall nutritive value. Remarkably enough, we found that such was, indeed, the case, and we have now established it, not only by exhaustive animal experiments, but also by experiments with human subjects. There is actually some slight improvement in the food value if 25 per cent of our diet is replaced with tapioca *soji* or flour.

It may be argued that the poorer sections of people might be tempted to consume entirely tapioca, which is deficient in protein. We, therefore, made up the protein deficiency by incorporating white groundnut flour and then converting the mixture into a grain. With the equipment we have at our disposal, we can now make only round grain. The preparation of the grain was demonstrated at several centres in the country. It can be cooked and consumed in the same way as rice. The only slight difference in cooking is that it should be added to boiling water instead of water at a lower temperature. The cooking is

complete in about ten minutes. The grain thus prepared costs about as. 3-6 per lb. which is less than that of rice. Its nutritive value, according to the composition that we now recommend, is somewhat higher than that of rice. We have already conducted trials with the object of giving the product a rice shape. The required type of machinery is available in Europe and America, and we will soon be sending an officer to select the equipment and install it either in Mysore or in Travancore-Cochin. We are contemplating a production unit that will make about 10 tons per day. This will suffice to feed about 50,000 people. The success of even one plant will lead to the installation of several others.

Efforts such as the above offer practical difficulties not so much on account of the basic principles, but on account of prejudice, which has got to be overcome. We have also to contend against spurious products and, not long ago, we had very considerable difficulty with an imitation product which was nothing but plain tapioca flour with a small amount of Bengal gram flour added to it!

Following the same principle, we can examine, select and utilise a variety of hitherto unfamiliar food material. One which we have found to be very promising and which is certainly more wholesome than rice is the seed of *Amaranthus paniculatus* which grows wild in some of the forest areas and which can easily be raised in much larger quantities. *Amaranthus paniculatus* which is, also, known as 'Rajgira' is best consumed after being puffed.

BANANA

Another surprisingly good source of edible starch is the plantain or banana stem. Till we first reported about it, the existence of starch in the stem was not even suspected. We now find that each stem will yield anything from 2-5 lb. of starch of good edible quality. The fibre and the salts from bye-products. The starch is formed at a particular stage in the life of the plantain or the banana. One can visualise the immense possibilities of this source when it is realised that an acre of plantain can yield anything from half to one ton of starch from the stem. Apart from its food value, starch has, also, got several industrial uses. We have a few million acres under plantain in South India alone; so the possibilities can easily be pictured. In fact, we recently made the suggestion to the Madras Government that the production of food from plantain should be taken up on a big scale to relieve famine conditions in Rayalaseema. Government showed keen interest in the proposition, and we are hoping that early action will be taken.

There are also certain types of material which are consumed by people, but which have practically no food value. The *Agava vera cruz* which grows along railway lines and which is consumed in some parts of Salem, Coimbatore, Ramnad and Tirunelveli Districts, contains certain types of fructosans having practically no food value. This apart, it contains certain harmful and irritating substances. We are advising people against the use of this kind of material.

Synthetic chemistry has made tremendous progress, but still, it has not yet made enough, with regard to the production of bulk food. Attempts at utilising the carbondioxide of the atmosphere have so far yielded results of only academic interest. It should, nevertheless, be possible to synthesis carbohydrates on a big scale. When such a synthesis is achieved, the food problem of the world would have been solved to a great extent. Today, it no more than a theoritical concept, a scientist's dream, but dreams have come true in the past. Already, we are able to utilise the algae for the synthesis of carbohydrate and fat from the atmosphere. We are able to utilise cheap carbohydrate materials, combined with inorganic nitrogen, for the biosynthesis of concentrated protein foods in the form of food yeast. The next big step forward will be the direct fixation of atmospheric carbon-dioxide, and that will no doubt be achieved one day, perhaps in our own life-time.

'OPERATION BAUXITE': Mining work in progress at Yercaud.

THE SHEVAROY BAUXITE DEPOSITS

BY
K. R. SHIVARAM*

BAUXITE is one of the most wanted ores of the present day. In spite of extensive research on the use of other aluminous raw materials, bauxite is still the almost exclusive source of Al_2O_3 required for the production of aluminium, and it will continue to be so unless the world reserves of bauxite are depleted. With the rapid increase in the use of aluminium, both for domestic and engineering purposes, and of other products such as refractories, abrasives and chemicals for which bauxite is required, a supply of good quality bauxite is a matter of national, even international, importance.

India has deposits of bauxite, chiefly in Bihar, Central Provinces, Central India Bombay, Madras (Salem), and Kashmir Bauxite deposits in Kashmir are primarily diasporic (the monohydrate of alumina) with high silica content, and those of Bihar, Central Provinces and Central India, are mixtures of gibbsite (the trihydrate of alumina) and diaspore (gibbsite content being from 80 to 85 per cent) and are rich in titania. The Shevaroy bauxite deposits are mostly gibbsitic, and are best suited for the extraction of Al_2O_3 by the Bayer Process, the cost of manufacturing alumina from Gibbsite being the lowest. Having plentiful reserves of good grade ore, the Shevaroy bauxite deposits are bound to assume importance in the years to come.

* Chemist, The Shevaroy Bauxite Products Co., Ltd., Yercaud.

History

Nothing was known about the occurrence of bauxite in the Shevaroy Hills until as late as 1925—in which year—Mr. E. K. Dickins of Yercaud discovered it. His patient, painstaking and intensive work, in subsequent years, revealed the existence of extensive deposits of bauxite, in the Shevaroys. And the sceptics were well and truly confounded! The late Dr. C. S. Fox, who was then Director of the Geological Survey of India, and who visited Shevaroy in 1940, was greatly impressed with the unique nature of the deposits.

Dr. M. S. Krishnan of the Geological Survey of India, who, also, examined this bauxite, has given a report, in detail, about it. Among others, who have, in recent years, testified to the superior quality of this bauxite are several French, German and Italian firms—in addition to the Japanese Government Industrial Technical Research Bureau. To quote Dr. P. S. Piacentini of Bergamo, Italy, who has carried out detailed tests on this bauxite in his Research Laboratories, "*The examined bauxites are just what we need for the Bayer Process, perhaps, among the best in the world, being able to undergo process safe from complications at low temperature and at low concentration; characteristics confirmed by tests, but predictable even from analyses.*"

Location and Occurrence

The Shevaroy Hills, which are about eight miles north of Salem Town, embody the bauxite deposits, as cappings on hill-tops. "The hills are composed mainly of charnockites—a group of crystalline rocks characterised by the presence of hypersthene—inter-banded occasionally with garnetiferous felspathic gneisses called leptynites and quartz-manganese garnet rocks known as gondites". One could see the typical exposure of leptynite on the flanks of the Shevaroyan peak by the side of the road leading up to it, and it is the leptynite which is supposed to be the rock that has given rise to the bauxite.

The highest peaks on the Shevaroys are the Shelakaradu (5,425 feet above M. S. L.) and the Shevaroyan. (5,359 feet above M. S. L.) both in the south central part of the hills, situated at a distance of about five miles from Yercaud. The bauxite deposits are confined to six hill-tops including the two mentioned above. "These peaks are really flat-topped plateaux, so characteristic of laterite and bauxite occurrences in India".

The bauxite deposits in the Shevaroys are formed between the dip and scarp slopes of the country rock, from which they are said to have originated, forming flat-topped cappings of the hills. The bauxite is compact and massive on the plateau areas to depths of about 20 to

50 feet, and extends to greater depths in the form of reefs and lenses, surrounded by or traversing lithomarge reefs. The lenses of bauxite are, however, clearly separate from the surrounding lithomarge. Nowhere in the deposits could one see the bauxite merging into clay. These roofs of primary bauxite on the slopes are all inclined at variable angles from the vertical and the reefs widen and converge continuing for great depths vertically below the plateau-level. The flow of water, in perennial springs, during periods of drought, draining the primary areas, suggests that the ore is of considerable depth. There is absolutely no surface indication of the bauxite veins on the slopes.

Detrital deposits consisting of bauxite varying in size from boulders to gravel, inter-mixed with surface soil, occupy areas surrounding the primary, and in places, overlying it.

General Characteristics

The general characteristics of the Shevaroy bauxite are uniform throughout, though chemical composition may vary from place to place. The primary bauxite on the plateau area is more or less compact, with only occasional coatings or inclusions of clay. Generally, this is more ferruginous than the primary deposit on the slopes. Ferric oxide and ilmenite usually decrease, and silica increases, farther away from the plateaux. Joint planes, fissures and crevices are coated or filled with lithomarge clay and/or sand. The thermogeneity of the deposits increases as one approaches the plateaux. The primary bauxite ore, when freshly dug is soft and saturated with water, but on exposure to weather, it dries out and toughens. The detrital bauxite is usually tough even when freshly mined.

The colour of the bauxite varies from near-white to all shades of pink, brown and yellow. Colours may be uniform. variegated or mottled. It is absolutely impossible to judge the iron-oxide content of a sample from the depth of its colour.

Hardness ranges from 2·5 to 3·5. The block density varies from 114 to 152 lbs. per cubic foot, this being influenced by the presence of cavities and the chemical composition of the bauxite. The specific gravity ranges from 2·36 to 2·79 in highly ferruginous material. The pisolitic structure, so typical of other Indian bauxites, is entirely absent in the Shevaroy bauxite.

Chemical Composition and Properties

Aluminium Hydroxide: Throughout the deposits, the main constituent, aluminium hydroxide, is present as gibbsite, the crystalline tri-hydrate of alumina ($Al_2O_3.3H_2O$). The percentage of gibbsite varies from over 95 per cent in picked pieces to about 76 per cent in average run-of-mine ore (corresponding to an Al_2O_3 content of nearly 62 per cent and 50 per cent respectively).

Iron-Oxide: This occurs as ferrous oxide in combination with titania as ilmenite, and as hydrated ferric oxide dispersed or diffused in the ore. The degree of hydration of the ferric oxide varies much, being more in yellows than in browns and much less in reds. The percentage of Fe_2O_3 varies from less than 2 to over 30.

Titania: This is present for the most part as ilmenite, ($FeO.TiO_2$) occurring as disseminated grains. The percentage of titania is from 0·2 to 2·0 in exceptional cases, but the average is around one. When compared with other Indian bauxite deposits containing as high as 8 to 13 per cent TiO_2, the titania in the Shevaroy bauxite is very little and even this as ilmenite is practically inert to the attack of alkali.

Silica: Most of the silica present in the bauxite is in the form of disseminated grains of quartz. Reactive silica, in combination with clay which is a serious impurity for the metal-grade bauxite, rarely exceeds 3 per cent and occurs as coatings and inclusions. The content of total silica is from under 1 to more than 25 per cent.

Small quantities of lime, vanadium oxide and traces of manganese, phosphorus and chromium are also present. Lime is usually under 0·15 per cent; vanadium oxide is of the order of 0·04 per cent; all these minor constituents total less than 0·20 per cent. Organic matter is negligibly small. The following table* gives the analysis of a few typical samples of the Shevaroy bauxite.

The outstanding quality of the Shevaroy bauxite is that the aluminium hydroxide contained in it is almost completely and easily soluble in caustic soda even at atmospheric pressure. It is this quality *plus* the very small content of reactive silica, that makes the Shevaroy Bauxite an ideal one for the production of alumina. Heating the bauxite even at low temperatures reduces the solubility of the aluminium-tri-hydrate in caustic soda.

Before ignition, the bauxite is readily soluble in concentrated sulphuric acid.

* *GRADES*

Content.	High Grade 'White'	High Grade 'Red.'	Normal 'Red.'	Quartzitic.
Combined H_2O%	31·07	29·46	27·78	24·61
SiO_2%	6·28	5·14	4·80	24·36
TiO_2%	0·31	0·71	0·94	0·44
Fe_2O_3%	2·24	8·12	13·30	3·11
CaO etc.%	0·20	0·20	0·20	0·20
Al_2O_3%	59·90	56·37	52·98	47·28
REACTIVE SiO_2%	1·43	2·02	2·09	2·38

The reaction goes to completion, accompanied by evolution of heat. Both dilute sulphuric acid and hydrochloric acid attack the unignited bauxite on digestion; with ignited bauxite the reaction is somewhat slow.

The greater part of the combined water in the Shevaroy bauxite is dissociated between 300 and 320 deg. C. the loss at 320 deg. C being 90 to 95 per cent. The bauxite, especially high grade, treated to 320 deg. C and cooled, adsorbs a good amount of water which could be expelled subsequently by heating it to 150 deg. C. It will thus serve as an excellent dessicant.

Ore Reserves

A conservative estimate of the quantity of the bauxite deposits in the Shevaroy hills, taking an average depth of 25 to 30 feet of bauxite, would nearly be six-and-a-half million tons, of which close to two million would be high grade. A good lot of high grade ore could be recovered from lower grade material by crushing and screening off the fines in which the silica and iron-oxide are concentrated. It is probable that the ore reserves are even greater than the tonnages given above.

Mining of the Ore

Mining is done in open-cast quarries with manual labour at present. If work is done on a larger scale when the proposed ropeway from the hills to Danishpet Railway Station (a distance of about seven miles) is erected, mining operations would have to be mechanised or light explosives resorted to. In any event, the problem would be to minimise the production of fragments and fines that would get scattered all over and be mixed up with clay, making recovery difficult.

Uses

The Shevaroy bauxite can be docketed into various grades—as suitable for the manufacture of alumina, abrasives, chemicals, refractories, and so on. Just at present, it is not being used by any alumina producers, the reason probably being the high cost of transport. The high grade bauxite containing over 55 per cent Al_2O_3 and under 5 per cent Fe_2O_3 is used by some refractory and chemical industries. The high grade granulated bauxite is utilised in petroleum refining. This bauxite, when activated, has good adsorbing qualities. Utilising this bauxite, the Shevaroy Bauxite Products Company, Limited, is producing a superior quality emery under the trade name of Alirox. The manufacture of aluminous cement–*Cement Fondu*– is, also, possible from this bauxite.

Conclusion

The importance of the Shevaroy bauxite for utilisation in the production of alumina—apart from its other industrial applications—cannot be too strongly stressed. A plant at the ropeway terminal, Danishpet, for producing 20,000 tons of Al_2O_3 annually in the first stage, and 40,000 tons annually in the second stage, is under active consideration. In fact, the technical aspects of such a project are under examination, and in the not too distant future, a plant might be expected to be established in Salem District.

SOCIETY OF TECHNOLOGISTS

List of Meetings held from April 1, 1951, to March 31, 1952.

Date	*Subject*	*Lecturer*	*President*
April 9, 51	Training within Industry	Mr. Sven Grabe and Mr. John Tailor of the International Labour Organisation, Geneva.	Mr. K. Ramanath.
April 26, 51	The Limits of Machine	Mr. M. Ananthanarayanan, M. A, I. C. S., Dist. Judge, Salem.	Mr. K. K. Raman.
April 27, 51	Was Mysore ever under the Sea ?	Mr. Y.N. Rama Rao, M.Sc, Department of Scientific Research, Atomic Energy Commission.	Mr. S. Vaidyanatha Iyer.
May 2, 51	General Discussion	Mr. Subramaniam and Mr. Dhoshi of D. C. M. Chemical Works, Delhi.	Mr. R. Natarajan.
May 30, 51	Power Development in the Madras State	Mr. G. S. Rama Iyer, B. E., Divl. Electrical Engineer, Hydro-electric Department Mettur Dam.	Mr. R. Natarajan.
July 11, 51	Operation of Swenson Evaporators	Mr. K. Rajagopal, Engineering Superintendent, M. C. I. C.	Mr. S. Ramaswamy.
July 19, 51	General Discussion	Mr. Thandavan of the Department of Industries, New Delhi.	Mr. R. Natarajan.
July 20, 51	Centrifugal Pumps	Mr. R. Krishnamoorthy, B. E. Assistant Engineer, Hydro-electric Department, Mettur Dam.	Mr. S Ramamoorthy
Aug. 15, 51	Practical Anthropology	Dr. U. R. Ehrenfels, Ph. D., Head of the Department of Anthropology, University of Madras.	Mr. K. Rajagopal.
Oct. 28, 51	Research and Industry	Dr. T. L. Ramachar, Indian Institute of Science.	Mr. K. K. Raman.
Nov. 24, 51	Centrifugal Pumps	Mr. R. Krishnamoorthy, B. E., Asst. Engineer, Hydro-Electric Department, Mettur Dam.	Mr. K. Ramanath.
Dec. 14, 51	Electrolytic Manufacture of Manganese and its Salts	Dr. T. Banerjee, Ph. D., (Lond.), D. Sc., F. B. I. C. Asst. Director, National Metallurgical Laboratories	Mr. K. K. Raman.
March 31, 52	Recent Developments in the Chlor-Alkali Industry.	Mr. N. Kalyanam, Senior Chemist, M. C. I. C.	Mr. K. Ramanath.

Society of Technologists Celebrate Annual Day : Seated in the centre is Mr. K. K. Raman, Director, Managing Agents, and to his left is Dr. V. Subrahmanyan who delivered the Annual Day address.

Methem News

Annual Day of the Society of Technologists : The Society of Technologists, Mettur Chemical and Industrial Corporation, Limited, celebrated their Annual Day on April 7, 1952, with Mr. K. Ramanath, President, in the chair. Dr. V. Subrahmanyan, Director, Central Food Technological Research Institute, Mysore, delivered the Annual Day address, his subject being "Recent trends in Food Processing". The full text of his speech, as also, Mr. Ramanath's welcome address appear elsewhere in this issue.

A large gathering of our staff, officials of the Government Electricity Department, Mettur, and executives of the Mettur Industries, Limited, was present.

The function started off with tea and a "group."

Presenting the Annual Report for the year 1951–52, Mr. P. N. Subramanian, Joint Secretary, reviewed briefly the activities of the society.

As part of the celebration, four technical films were, also, screened, Titles are: *Golden Hunch, The Immortal Blacksmith, Servant of Mankind and Theory and Synthesis of Plastic materials* (MGM)

The pleasant function came to a close with a vote of thanks proposed by Mr. R. V. Ramiah, Joint Secretary.

For the information of our readers, we give here a brief history of the Society.

It was in 1942, just one year after we had commenced production, that the Society of Technologists, was formed. The immediate object was to provide a forum for our technical personnel for the exchange of information about the various process operations in our factory, to develop the scientific method of investigation and to discuss, with a view to finding their solution, the several problems that affected our industry.

The Society had no written constitution. For about six years, the Society had no written constitution. In March 1948, however, a sub-committee consisting of

N. Kalyanam, N. Sundaresan, P. B. Srirengan, S. Ramamurthy and M. Padmanabhan, was formed, charged with the

Members and guests at Tea

task of framing its constitution. At the General Body Meeting held on October 9, 1948, the constitution drafted by this sub-committee was adopted, Effective from the same date, the affairs of the Society came to be administered by a committee of seven members who elected, from amongst themselves, a President, a Vice-President and two Joint Secretaries.

From time to time the Society has been arranging for lectures and addresses by eminent men of science, industrial leaders and visiting foreign experts. Amongst the distinguished personages who have addressed the Society are Sir C. P. Ramaswami Iyer, Mr. N. Gopalaswamy Iyengar, Dr. C. V. Raman, Dr. M. A. Govinda Rao and Dr. R. S. Krishnan. A list of office-bearers of the Society since its inception is given at the end.

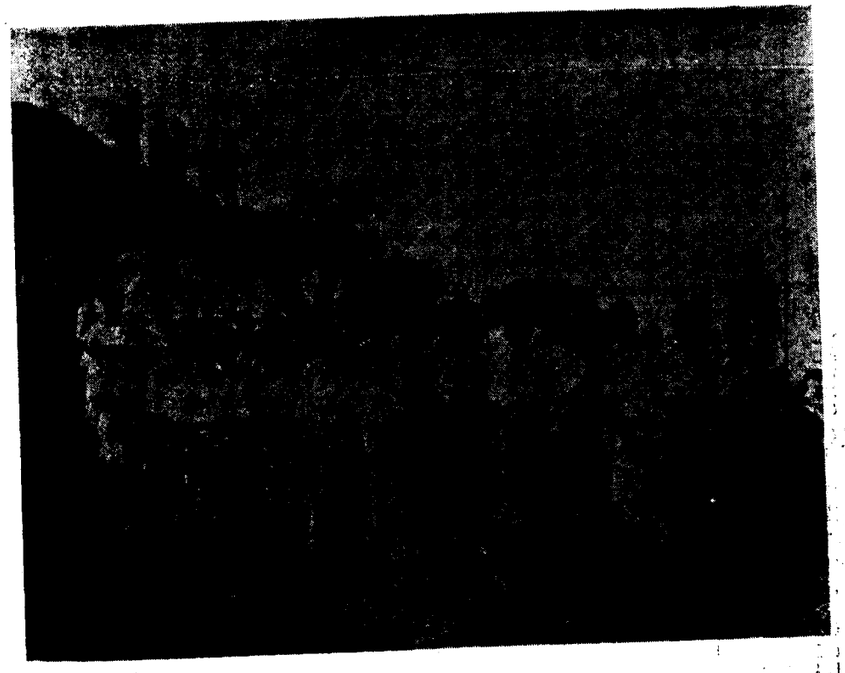
In recent years, the Society has also been arranging for excursions to places of industrial interest. Among the places visited so far are Sankaridrug (Lime-stone quarries), Bhavanisagar (Irrigation Project), Yercaud (Bauxite Mines) and Salem (Magnesite and Glass Works.)

Excursion to Salem and Yercaud : On March 15, 1952, members of the Society of Technologists went on an excursion to the Salem Glass and Enamel works, and the magnesite quarries of the Magnesite Syndicate, Limited, Suramangalam.

At Yercaud, the excursionists saw first the laboratories of the Associated Drug Company. Later, they visited the bauxite mines of the Shevaroy Bauxite Products Company, Limited, where they had the opportunity of witnessing mining operations and studying the nature of the occurence and structure of bauxite deposits.

Crushing Mills, Salem Glass and Enamel Works

"Thank you, come again": A visitor whom we were most happy to welcome for a second time was Dr. E. C. Krebs. With pardonable but justifiable



SOT Members at the Bauxite Mines

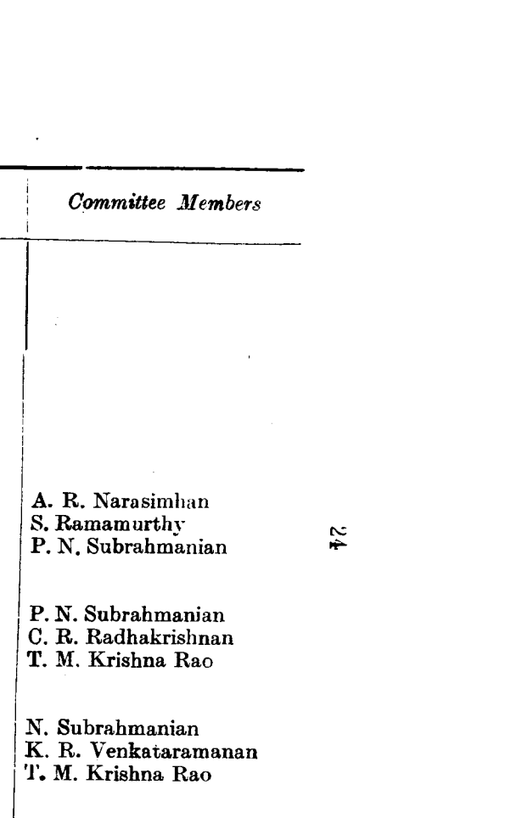
pride, we reproduce here—in English—his remarks in French, in our Visitors' Book.

"I have visited for the second time, within six years, the electro-chemical installation at Mettur. I should like to take this opportunity for conveying my felicitations to the directors and to the technical staff of this great works. I well remember the difficult conditions under which the factory was erected—World War II was on—and several were your handicaps.

The technical direction of your engineers is both first-class and strategic. Not only have they have drawn from the wealth of their accumulated expetience, but they have used quite first-rate methods. I am sure that even with regard to costs you have done wonderfully well."

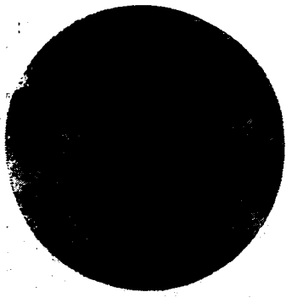
OFFICE BEARERS OF THE SOCIETY.

Year	*President*	*Vice-President*	*Secretaries*	*Committee Members*
1942–1944	C. V. Gopal Rao		T. V. Ramanathan	
1944–1946	R. Natarajan		K. Ramnath	
1946–1948	R. Natarajan		N. Kalyanam G. V. Ramaswamy	
1948–1950	R. Natarajan	S. Ramaswamy	P. B. Srirangan M. Padmanaban	A. R. Narasimhan S. Ramamurthy P. N. Subrahmanian
1950–1951	S. Ramaswamy	S. Ramamurthy	R. V. Ramani N. Subrahmanian	P. N. Subrahmanian C. R. Radhakrishnan T. M. Krishna Rao
1951–1952	K. Ramnath	R. V. Ramani	P. N. Subrahmanian R. V. Ramaiah	N. Subrahmanian K. R. Venkataramanan T. M. Krishna Rao
1952–	K. Rajagopal	P. N. Subrahmanian	N. Kalyanam A. Krishnamurthy	R. G. Raghavan C. R. Radhakrishnan T. M. Krishna Rao



THIS issue is dedicated to the Society of Technologists. Mr. K. Ramnath, the distinguished President of the Society, was introduced to you, some months ago, so we shall now present its two energetic Joint Secretaries—Messrs. P. N. Subrahmanian and R. V. Ramiah.

Marked Man: One of our Senior Chemists, P. N. Subramanian is particularly known for his steadfastness and persistence at work. Around the time our new evaporation system was giving us a series of headaches, P. N. S's mere presence was like aspirin.



P. N. Subramanyan

Prolific in the invention of theories, P. N. S. could put forward hundreds of them to the several problems, that from time to time, arise in a works like ours, even before others have had time to know what the problems were. And, sure enough, one of his theories would fit. Should P. N. S. only care to put down in writing all his theories about the leakage of lye in our agitator gland, this journal would not starve for lack of technical food, for several months to come.

Deeply religious—you'll always find on his shining, morning face a bright mark of vermillion, mercuric sulphide, if you like—and very well versed in Sanskrit, his gifts include those of palmistry, astrology and faith-cure.

Our congratulations to P. N. S. on his election as Vice-President of the Society for 1952—53.

Life-is-real, Life-is-earnest Dept.: R. V. Ramiah, the other Joint Secretary, is one of our Junior Engineers, and the Society has reasons to be grateful to him for much outstanding work during his term of office. He was, also, for some time, the librarian of the Staff Association,

Ramiah pursues all his tasks—both professional and extra-professional—with

R. V. Ramiah

quiet determination. Keen and hard-working, brisk and businesslike, Ramiah is a firm believer in the maxim, 'Fine words butter no parsnips.' Even when he tries to touch you for a donation for our Cricket Club or some such worthy cause, he dispenses with form and diplomacy, and makes a bee-line for the subject. Which is just euphemism for your pocket!

On order, in order : For a change, let us now switch over to a non 'technological' personality, Mr. V. Ramachandra Rao, our Purchase officer. Rao has developed and perfected a system for the arduous task of making the purchases of our Company, and he would like, as far as possible, to conform to his order for orders. If an indent was really urgent, it was, of course, altogether different, and the old order would change yielding place to new.

An ardent follower of Mahatma Gandhi, a firm believer in the gospel of

V. Ramachandra Rao

the *charkha*, Ramachandra Rao dons only spotless *khadi* and devotes some time every day to spinning.

—*R. P.*

"THE WORK OF SCIENCE IS TO SUBSTITUTE FACTS FOR APPEARANCE AND DEMONSTRATIONS FOR IMPRESSIONS."

JOHN RUSKIN

Mandi Salt Scheme : Preliminary drilling will shortly begin at the Mandi salt mines to estimate reserves from which it is proposed to produce yearly 66,000 tons of salt with a purity of 99 per cent according to the *Capital*, Calcutta. A scheme has been prepared by a Swiss engineering firm, Messrs. Escher Wyss, Ltd. of Zurich. On the recommendation, of the Salt Experts Committee, the firm carried out a technical survey of the Mandi mines and submitted its report last year. It recommended mining by the brine chamber method and evaporation by thermo-compression. It will supply equipment to iodise the salt before it is realised for consumption, in certain areas, such as Kangra Valley, where goitre is prevalent.

Once the Mandi deposits have been proved, work will begin on the main scheme and is expected to be completed by 1955. A salt refinery part of the scheme is proposed to be established at Jogindernagar, about 30 miles from the mines, the brine being carried by pipeline. It is also hoped that the three-mile rail link between Jogindernagar and Nagrota (about 65 miles from Pathankot), dismantle during the war, will be restored.

Research Chemicals at low Cost : The Chemical Research Committee of the Council of Scientific and Industrial Research has proposed a scheme for the preparation of research chemicals at reasonable cost, by making use of the facilities in universities and scientific institutions under the supervision of professors. The Council of Scientific and Industrial Research will finance the cost of raw materials and, also, pay a small remuneration to the workers. The National Chemical Laboratory, of India, Poona will arrange for the testing and distribution of the chemicals.

Salt Research Station for Saurashtra : The Government of India have decided to establish a Central Salt Research Station in Saurashtra under the control of the Council of Scientific and Industrial Research. The scheme will involve a capital expenditure of Rs. 1·68 lakhs and a recurring expenditure of half a lakh of rupees. Saurashtra produces practically a fifth of India's total salt production. The Research Station will assist in improving the quality of salt, reducing costs of production and utilising salt bitterns.

Salt and Soda for Burns; When a person sustains burns or is seriously injured, large amounts of salty fluid from the inner tissues and the blood exude through the injured skin and flesh. The amounts thus lost should be replenished without delay as otherwise even the person's life might be in danger. Treatment is called for the burns as well as for the shock and, as often as not, blood transfusion is arranged.

In this connection, the little pamphlet which the Federal Security Agency has brought out is of interest. This pamphlet recommends the drinking of water with salt and soda dissolved in it. The remedy suggested, it is however admitted, is no substitute for blood or blood products. In one quart of cold water, one level teaspoon of table salt and half-a-teaspoon of soda bicarb are to be dissolved and given to the patient to drink, if he is conscious. Should he vomit or show any signs of nausea, the solution might be given again, after vomitting has stopped for about an hour. The drink should not, however, be forced down on an unwilling throat, and the doctor has to be sent for immediately.

The burns have also, to be protected from getting infected and the injured person placed in as comfortable a position as possible.

Refinery in Bombay: The Government of India have given their approval to the Standard Vacuum Oil Company to build an oil refinery in Bombay costing 35 million dollars. This is one of the largest investments of U. S. capital in India.

As a joint enterprise of the Caltex and Burmah-Shell, two more refineries are also planned in India. Production on full scale is expected to commence by 1955. It is estimated that all these three plants, will produce from two to three million tons of refined petroleum products annually. The Standard Vacuum Oil Company will retain 75 per cent of the stock in the form of common shares, while Indian investors will be able to purchase preferred stock up to 25 per cent of the total investment. The Government of India have agreed not to nationalise the industry for 25 years.

Hooker Chemicals' New Plant: The Hooker Electro-Chemical Company, Niagara Falls, propose to build a new plant at Montague, (Mich.) for the manufacture of chlorine and caustic soda. The plant is scheduled to commence production by the end of 1953 with an yearly output of 1,00,000 tons of all products.

The total plant area will be over 400 acres of which 200 acres comprise the brine field. The latest development in electrolytic diaphragm cells will be used for the electrolysis of brine. From the wells near by brine will be pumped to the plant site. It is, also, reported that Hooker will have the first right to the use of natural gas—which has been discovered during drilling operations—for fuel.

Standard for Bleaching Powder: The Indian Standards Institution recently published the 'Indian Standard Specification for Bleeching Powder, Unstablised, IS : 295–1951'. In formulating this standard the ISI had to take into consideration the difficulties of the producers engaged in the manufacture of bleaching powder along with the need to prescribe a reasonably high standard for the material in the interest of the consumer.

The industry for the manufacture of bleaching powder was established as a result of efforts to overcome the shortage

of this material in the country due to fall in imports during World War II. The industry is, therefore, in its infancy, and is functioning under limitations on the methods of production in respect of plant, equipment and raw materials.

The standard prescribes the requirements and the methods of tests for bleaching powder unstabilised, manufactured from quicklime by slaking and chlorination. It is expected that the requirements will neither impose undue hardships on the manufacturers nor be considered inadequate by the consumers. The standard recommends that the bleaching powder, unstabilised, should be used as quickly as possible after its manufacture, unless it is stored in a cool, dry place.

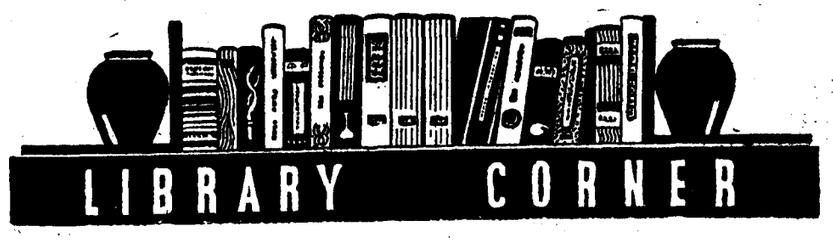
Badminton : It is now Badminton's turn to go into hiding. Excepting for Sunday mornings when the players assemble at the courts probably to remind themselves that there is a game called Badminton, the courts are practically deserted. Whoever advised the Sports Member to open a second court, should have been a building contractor in his last *avatar* or bids fair to be one in his next !

Table Tennis : This favourite indoor game was inaugurated on March 17. Membership shot up quickly to 30, at which figure, it was promptly frozen. Our embroyo Satohs and Barnas and Vanas are fighting it out on the green table. Penholder and pencilholder grips are being constantly discussed and serious questions are often asked about the usefulness or otherwise of sponge bats ! As for the table itself, criticism has veered from one extreme to the other. In some quarters, it is whispered that it is far too, fast for the ball, in others, that it is not fast enough. If the rate of replacement of broken balls is any index of the standard of play, we can boast of a very high standard indeed—or is it a very low standard—seeing that we break only one ball a day !

Chess : Nothing to report except that on April 15, our esteemed Editor was seen at play with a youngster of 10—the only chap available. Defeating the boy after one hour of gruelling play and declining the repeated requests of the boy for another game, the Editor was telling every one that the boy was a prodigy and that he was playing marvellously well and so on and so forth. We rather suspect that the editor's " game " was to impress us all with his own brilliance !

Cricket : The season came to a close with a rather modest record of 2 won, 4 lost and 3 drawn, in the matches played. Taking a short look back and a long look forward, we fear that Cricket has a dim future at Mettur. Some of our stars are definite that they would not peep out any more. It is feared that next year the Selection Committee would be hard put to *finding* a XI, leave alone ***selecting*** one.

Volley Ball : To say that this is currently the most popular game at Mettur will be to understate the case. Players crowd into the court even before the net goes up, and the Captain has often the unpleasant but necessary task of having to " ask out " one or two players for every game. The sides are made up with novices as well as veterans and the result is a lot of fun — for the spectators. Membership now stands well above 60. Practice matches are being arranged with nearby clubs to make the players come up to scratch—you get what we mean !



SURVEY OF THE INDIAN CHEMICAL AND PHARMACEUTICAL INDUSTRY — 1951 : Published by the Indian Chemical Manufacturers Association, Calcutta.

THIS publication gives a comprehensive survey of the entire chemical industry of India. The introductory section traces briefly the history of the Indian chemical and ancillary industries and post-war developments. The history of the Indian Chemical Manufacturers' Association is presented next. This section opens with the message with which the founder-President, Sri Acharya P. C. Ray of revered memory, inaugurated the Association.

The section on the Acid Industry reviews the present position, particularly with reference to sulphuric acid, and discusses the various aspects arising out of the current world shortage of sulphur.

The one on the Alkali Industry stresses the need for adequate protective tariff on caustic soda and bleaching powder, and also advocates an increasing use of chlorine. There are other important sections dealing with the fertiliser industry, the fine chemicals industry, the pharmaceutical industry, plastics, dyestuffs industry, and so on.

In pages 91-96, the freight on chemicals and chemical raw materials is discussed, and a good case made out for economical freights on raw materials and chemicals, so as to protect and encourage the indigenous industry and help it in its full growth.

The latter half of the publication contains statistical data on some important chemicals, and also a classified index of chemicals and chemical products made in India together with the names of their manufacturers. In Part B, descriptive write-ups (as advertisements) of some member-firms of the I.C.M.A. are given.

As an authentic report on the progress of the Indian Chemical Industry and as a reference book, this publication fulfills a long-felt need.

— C. S. S.

POSITION OF THE GLASS INDUSTRY IN INDIA TODAY : By Sri K. N. Desai, B. Sc.,—Published by the Bengal Glass Manufacturers Association, P—11, Mission Row Extension, Calcutta—1.

The growth and development of the glass industry in India are vividly brought out in this brochure.

The glass industry has suffered heavily in the past, and is still suffering, due to

lack of soda ash, the key chemical required. It is a pity that for lack of adequate supplies of soda ash, the industry has had to switch over to substitutes like cullets (broken pieces of glass) with detriment to the quality of the glassware manufactured.

The average buyer who, according to the author, expects Indian manufacturers to produce British quality goods at Japanese prices, does not obviously know the full facts of the case. Different glass articles require different compositions of batch mixtures and different types of furnaces. When glass manufacturers are unable to run properly one furnace each continuously, the chances are even less of more furnaces being operated with different compositions.

To reach the 1955–56 targets envisaged in the *Draft Outline* of the First Five-Year Plan, so far as the glass industry is concerned, the author gives a few practical suggestions, pressing the genuine claims of the industry for protection against foreign competition.

Referring to the heavy rates of income-tax and supertax that industry has to pay in India, the author says: "There can be no employment unless there are employers who are at present being wiped out of existence, through an inordinately heavy impact of taxes".

"I shall feel greatly rewarded even if one man who is not connected with the glass industry starts looking at it with sympathy as a result of the publication of this brochure" says the author in his preface. His booklet succeeds not merely in enlisting the sympathy of the reader for the glass industry—it compels his admiration, too. Verily, the publication holds the mirror up to the Indian Glass Industry.

— *M. P.*

STATISTICAL METHODS FOR CHEMISTS: By W. J. Youden—John Wiley & Sons, Inc., New York and Chapman & Hall, Limited, London—Price: $. 3—00.

As the importance of statistics is fast getting appreciated in our country, this publication is both timely and welcome. It provides the scientist with all the essentials of the statistical system for expressing scientific conclusions without theories and proofs. With his long experience, both as chemist and statistician Dr. Youden is ideally fitted for the work he has undertaken.

Whilst dropping out from the book, a good deal of the usual introductory material the author devotes detailed attention to some elementary topics. The treatment is such as to encourage chemists to go fully into the subject of experimental design.

The first seven chapters are devoted to a discussion of some important statistical techniques which are useful in the interpretation of experimental data. The eighth chapter deals with the requirements that data must meet, so that they can be usefully and statistically analysed. The last two chapters discuss different arrangements for improving precision in experiments and experiments with several factors.

A special merit of the techniques described in the book is that they have all been tried and found useful in actual investigation by the author. All those who make measurements and interpret experiments, and chemists, whether their field be the laboratory or industry, will find *Statistical Methods for Chemists* invaluable in their work.

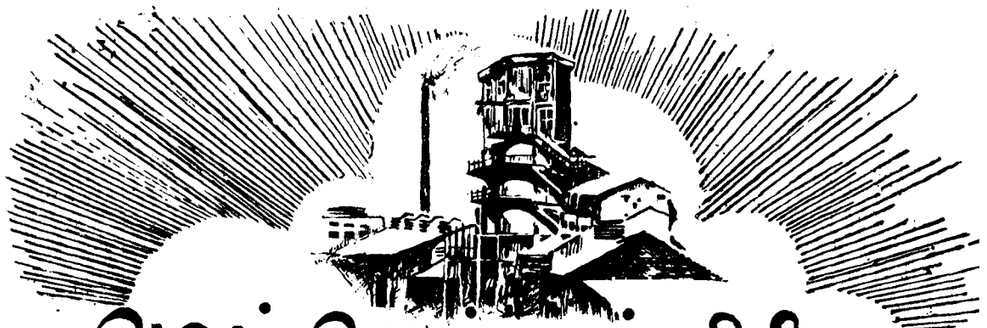
— *S. R.*

LITERATURE REVIEW ON FATS AND OILS - 1949: Issued by the joint Sub-Committee of the Vanaspati Research Advisory Committee, CSIR and the Nutrition Advisory Committee, ICMRe.

At a joint meeting of the Nutrition Advisory Committee of the Indian Council of Medical Research and the Vanaspati Research Advisory Committee of the Council of Scientific and Industrial Research held on November 23, 1949, under the chairmanship of Dr. S. S. Bhatnagar, it was felt that there was need for collecting technical and other information bearing particularly on edible oils and fats and to make it available to the Government, the public and industry. A Sub-Committee for conducting this work was accordingly constituted with Dr. G. Sankaran (*Chairman*), Dr. K. Mitra, Dr. K. P. Basu, Dr. V. N. Patwardhan, Dr. B. C. Guha and Dr. V. Subrahmanyan (*Secretary*).

The terms of reference of the Sub-Committee were: (a) to collect information from available literature on the use of fats and oils and the effect of processing on them; (b) to keep watch on public opinion with respect to these foodstuffs; and (c) to keep abreast of world developments in hydrogenated fats and oils.

The present review which is in two sections—(I) Hydrogenated Fats and (II) Edible oils and fats — covers the literature on oils and fats published during 1949. Indian production of oil seeds exceeds seven million tons annually and large quantities of oils go into Vanaspati production. The proposal of the Sub-Committee to publish periodically reviews of scientific literature bearing on various aspects of edible fats and oils is, therefore, to be welcomed.



மெட்கெம பத்திரிகை.

தாவரக் கொழுப்பு— சக்தியளிக்கும் உணவு

(C. S. ஸ்ரீனிவாஸன்)

உடலில் ரொம்ப கொழுப்பேறி விட்டதா, என்று முரட்டுத்தனம் செய்பவனைக் கேட்கிறோமே, அதன் பொருள் என்ன? தாவரங்களில் கொழுப்பு எவ்வாறு உண்டாகிறது? எண்ணெயில் F. F. A. என்றால் என்ன? உணவுப் பொருளாகவும், சோப்பு தயாரிக்க ஒரு மூலப் பொருளாகவும் தாவர எண்ணெ எவ்வாறு உதவுகிறது? கேள்விகளுக்கெல்லாம் இக் கட்டுரையில் விடை காணலாம்.

செடிகளில் கொழுப்பு உற்பத்தி :

சாதாரணமாக மனிதனுக்கு இலவசமாகக் கிடைக்கும் காற்றும் தண்ணீருமே செடி வளர்வதற்கும் அதில் கொழுப்பு உற்பத்தியாவதற்கும் தேவை. செடியின் இலைகளிலுள்ள 'குளோரோபில்' என்கிற பொருள் சூரிய வெளிச்சத்தின் உதவியைக் கொண்டு, காற்றிலுள்ள கரியமில வாயுவையும், தண்ணீரையும் சரியான விதியில் சேர்த்து 'கார்போஹைட்ரேட்'என்கிற சர்க்கரைப் பொருளாகச் செய்து செடியின் விதைப்பாகத்தில் சேர்க்கிறது. இந்த சர்க்கரைப் பொருளிலிருந்து ஒரு பாகம் கிளிசரின் என்னும் ஒரு இனிப்புள்ள பொருளாகவும் மற்றொரு பாகம் ('பால்மிடிக்,' 'ஒலியிக்', 'ஸ்டியரிக்' போன்ற) கொழுப்புத் திராவகங்களாகவும் மாற்றப்படுகின்றது.

செடிகளின் விதை பாகங்களில் விதை முற்ற முற்ற 'லிபேஸ்' என்கிற கிருமிகளால் இந்த கிளிசரினும் கொழுப்பு தாவரங்களும்சேர்க்கப்பட்டு எண்ணெயாக மாறுகிறது. முற்றுத விதைகளிலும், அழுகிப் போன அல்லது சொத்தை விதைகளிலும் இந்த எண்ணெச் சேர்க்கை சரியாக முடிவுறுமல் கொழுப்புத் திராவகம் அதிகமாக மிஞ்சி விட நேரலாம்.

செடிகளில் விதைகள் சரியாக பக்குவமானபின் அறுவடை செய்து அவற்றை தாமதமின்றி ஈரம் போகும் வரை காயவைக்கவேண்டும். இப்படிச் செய்யாமல் குவியலாகவோ காற்றோட்டமில்லாத ஓரிடத்திலோ விதைகளைக் குவித்து வைத்தால், அவற்றிலிருக்கும் ஈரப்பசையின் உதவியால்

வேறு வகைக் கிருமிகள் எண்ணெயை மறுபடியும் கொழுப்புத் திராவகமாகவும் கிளிசரினுகவும் பிரித்துவிடும். இதனால் தான் அழுகின விதைப்பருப்புகளை நீக்காமலும், சரியாக ஈரத்தைப் போக்காமலும் தயாரிக்கப்படும் எண்ணைகளிலும் அதிக தனி நிலைக் கொழுப்புத் திராவகம் (F. F. A.-Free Fatty Acid) கிளிசரினோடு சேர்க்கையடையாத தனி நிலையில் மீஞ்சி நிற்க நேரிடுகிறது.

இந்த தனிநிலைக் கொழுப்பு திராவகம் எண்ணெயோடு நன்றுகக் கலந்திருப்பதால் அதை வேருகக் காணவோ சுலபமாக பிரித்தெடுக்கவோ முடியாது. இந்த திராவகத்தில் பெரும் புங்கு ஜீரணிக்கமுடியாததாகையால் உணவாக உபயோகப்படும் தாவர எண்ணெயில் இந்த திராவகம் கூடுமானவரை குறைந்ததாகவோ, அல்லது ரஸாயன முறையில் அகற்றப்பட்டிருக்கவேண்டியது அவசியம்.

தாவர எண்ணெயின் உபயோகங்கள் :

(i) **உணவாக :** உணவில் புரொடின், கார்போ ஹைட்ரேட், கொழுப்புச்சத்து, விட்மின்கள், உப்புச் சத்துக்கள் அவசியம் என்று நாம் அறிவோம். கொழுப்பு சத்தை தாவர எண்ணைகளிலிருந்து சுலபமாகப் பெற முடிகிறது. சிறுகுடலில் பிரிக்கப்பட்டு ஜீரணிக்கப்படும் கொழுப்புப் பொருள் உடலுக்கு மூன்று விதங்களில் பயன் அளிக்கிறது. (1) 'அடிபோஸ்' (Adipose) தசைகளில் சேமித்துவைக்கப்படும் கொழுப்பு, ஆகாரத்தில் புது கொழுப்பு சத்து சேர்க்கப்படாத காலங்களில் உடல்நலம் குன்றுமலிருக்க உதவுகிறது. (2) புரொடின்களுடன் ஜீரணமாகிய கொழுப்பில் ஒரு பாகம் ஜீவநாடிக்கு அவசியமான Cellular protoplasm போன்ற பொருள்களை உண்டாக்குகிறது. (3) கொழுப்பு சத்தில் ஒரு பாகம் பிராண வாயுவுடன் சேர்க்கப்பட்டு, அதனால் கிடைக்கும் சக்தியில் வேலைகளைச் செய்யும் ஆற்றலும், உடலின் உஷ்ணநிலையை 98.4° F ல் வைக்க தேவையான உஷ்ணமும் கிடைக்கிறது. கொழுப்பிற்கு முக்கியமாக சக்தியை அளிக்கக்கூடிய உபயோகம் இருப்பதால் தான், அதிக சக்தியை சிறு விஷயங்களில் பிரயோகித்து முரட்டுத்தனம் செய்பவர்களை, ''உடலில் ரொம்ப கொழுப்பேறி விட்டதா?' என்று கேட்கிறார்கள்.

ஒரு கிராம் கொழுப்பு சத்து 9 கலோரி சக்தி அளிக்கும் என்று கண்டுபிடித்திருக்கிறார்கள். கொழுப்பு சத்து கீழ்க்காணும் காரணங்களாலும் மிக்க அவசியமான உணவுப்பொருளாக உபயோகமாகிறது.

(i) கொழுப்புப்பொருள் சேர்வதால் மற்ற உணவுப்பொருள்களுக்கு ருசியும் மணமும் அதிகமாகிறது. உதாரணமாக, எண்ணெயில் பொரிக்கப்படாத அப்பளமும், பகோடாங்களும், நல்லெண்ணெ சேர்த்துக்கொள்ளாத இட்லியும் எப்படி இருக்கும் என்று யோசித்துப் பாருங்கள்.

(ii) உணவு இரைப்பையில் ஜீரணமாவதை கொழுப்புப்பொருள் தாமதப்படுத்துவதால் உண்டபின் சில மணி நேரங்களுக்கு பசி உணர்ச்சி இல்லாமல் பார்த்துக் கொள்கிறது.

(iii) ரொட்டி, சப்பாத்தி முதலியவைகளை தயாரிக்கையில் சேர்க்கப்படும் கொழுப்புச் சத்து மாவு அணுக்கள் சேர்ந்து ஒரு மிருதுவான நிலையை அடைவதற்கும் சுலபமாக உட்கொள்ளக்கூடியதாக செய்வதற்கும் உபயோகமாகிறது.

(iv) சாதாரணமாகவும் அதிக அளவிலும் எண்ணெ ஒரு பொரியல் சாதனமாக உபயோகப்படுகிறது. எண்ணெ உஷ்ணத்தைத் தான் பெற்று பொரிக்கப்படும் பொருளுக்கு சீக்கிரமாகவும் கொடுப்பதுடன்,

பொரிக்கப்படும் பொருளில் உள்ள நீர் சேர்ந்த பாகங்களை அதிகமாக உலர வைக்காமலும் அதன் சத்தைக் குறைக்காமலும் பாதுகாக்கிறது.

சுத்தமான தாவர எண்ணைகளின் அவசியம்:

ஆரோக்கிய வாழ்வுக்கு, தாவர எண்ணை சுத்தமானதாக இருப்பது அவசியம். சாதாரணமாக நமக்குக் கிடைக்கும் தாவர எண்ணைகளில் குறைந்தது 8 சதவிகிதம் தனிநிலைக் கொழுப்புத் திராவகம் இருப்பதால், சுத்தம் செய்யப்பட்ட எண்ணைகளை (Refined Oils) உபயோகித்தல் வேண்டும். இவற்றிலிருந்து தனிநிலைத் திராவகங்கள் ரசாயன முறையில் காஸ்டிக் சோடாவை சேர்ப்பதால் சோப்பாக மாற்றப்பட்டு எண்ணையிலிருந்து பிரித்து எடுக்கப்பட்டிருக்கும். இப்படி சுத்தம் செய்த எண்ணைகளில் ஐலவாயுப் பிரயோகம் (ஹைட்ரஜனேஷன்) செய்து கெட்டியாக்கப்பட்டு வனஸ்பதி என்கிற சிறந்த பொருளாகவும் செய்யப்படுகிறது. எண்ணையிலுள்ள வர்ணம், நாற்றம் முதலியவை அறவே நீக்கப்படுவதாலும், 'ஹைட்ரஜனேஷனி'னால் அது வெகு காலம் கெடாமலிருக்க முடிவதாலும் வனஸ்பதி ஒரு சிறந்த பொரியல் சாதனமாக உபயோகப்படுகிறது.

(ii) **சோப்பாக:** தாவர எண்ணைகளை சுத்தம் செய்ய காஸ்டிக் சோடா உபயோகமாகிறது என்று மேலே கூறப்பட்டது. தனி நிலைத் திராவகங்களுடன் காஸ்டிக் சோடா சேர்ந்தால் சோப்பு உண்டாகிறது. தாவர எண்ணைகளில் இத் திராவங்களும் கிளிசரினும் ரசாயனச் சேர்க்கை அடைந்திருப்பதால், எண்ணைகளுடன் தேவையான அளவு காஸ்டிக் சோடா சேர்க்கப்பட்டால் சோப்பாக மாறும். விடுவிக்கப்படும் கிளிசரினையும் எஞ்சி நிற்கும் காஸ்டிக் சோடாவையும் கொதிக்கவைக்கும் முறைகளால் பிரித்தெடுக்கலாம்.

இந்தியாவின் தேவை:

இந்தியாவில் சுமார் 14 லக்ஷம் டன்கள் தாவர எண்ணைகள் உற்பத்தியாவதாகவும் அவற்றில் சுமார் 8 ல் ஒரு பங்கு சுத்திகரிக்கப்படுவதாகவோ, வனஸ்பதியாகவோ மாற்றப்படுவதாகவும் தெரிகிறது. இந்தியாவின் ஜனத்தொகை 38 கோடி என்று வைத்துக் கொண்டால், வெண்ணை, நெய் உற்பத்தியும் சுமார் 7 லக்ஷம் டன்கள் தான் ஆனபடியால், ஒவ்வொருவருக்கும் சராசரி அரை அவுன்ஸ் கொழுப்பு தான் பகிர்ந்து கொள்ள முடியும். ஆனால், குறைந்தது ஒவ்வொருவரும் தினசரி 2 அவுன்ஸ் கொழுப்பு சத்து உட்கொண்டால் தான் சரியாக வாழமுடியும் என்றும் கண்டு பிடித்திருக்கிறார்கள். எனவே தாவர எண்ணைகள், வெண்ணெய் இவற்றின் உற்பத்தியையும் பெருக்கி, கிடைக்கும் தாவர எண்ணைகளை சுத்தப்படுத்தி அவை கெடாமல் பாதுகாத்துக் கொள்ள வேண்டியதும் மிக அவசியம்.

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