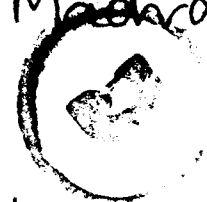


359

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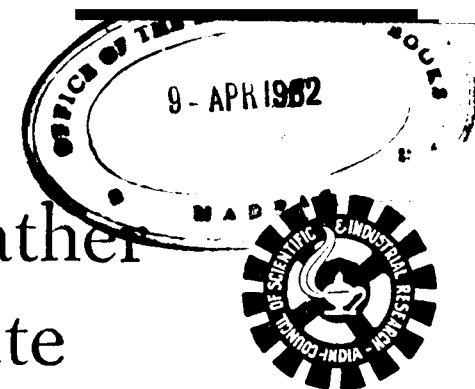
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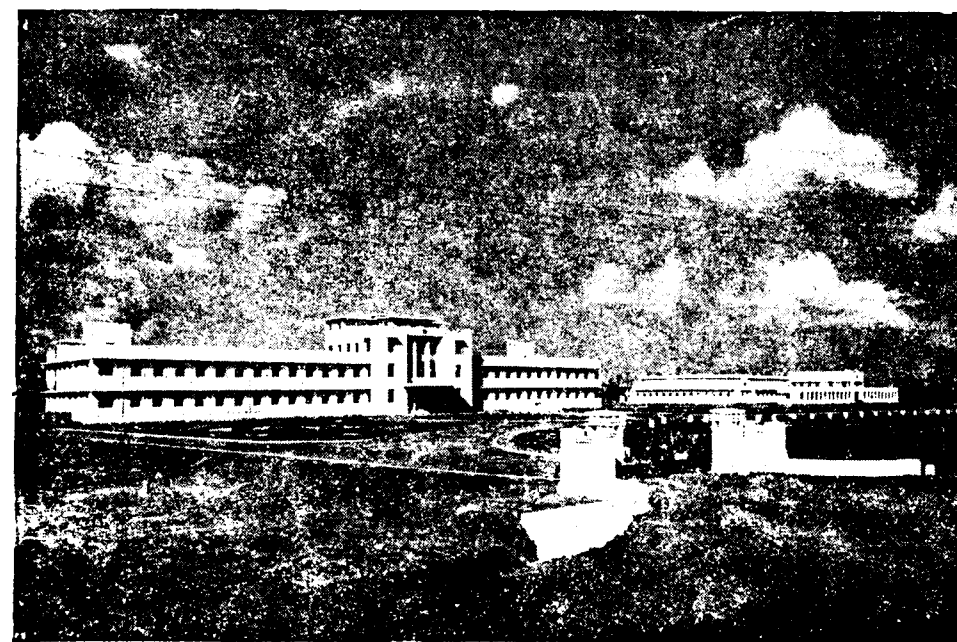


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359



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Bulletin of The Central Leather Research Institute

Vol. VIII

FEBRUARY, 1962

No. 7

CONTENTS

A Comparative Study on the Action of Elastase on Elastin and Thermally Contracted Collagen —K. Thomas Joseph ..	301
An Analysis on the Pattern of India's Export Trade in skins —P. N. Chowdhury ..	307
Research Bears Fruit—Process for the manufacture of grain-garment leathers from raw sheep skins —T. S. K. Mahadevan, et. al. ..	336
Technical Seminars:	
(1) A rapid procedure for E.I. tanning —R. Selvarangan ..	342
(2) Nonionic chrome tannage —D. Ramaswamy ..	343
(3) Technique of the manufacture of suede garment leather from E.I. skin —P. S. Venkatachalam ..	343
Tanners' Corner ..	345
Classified Abstracts ..	347
Notes & News ..	349
C.L.R.I. News (Seminar on Vegetable Tannins) ..	351

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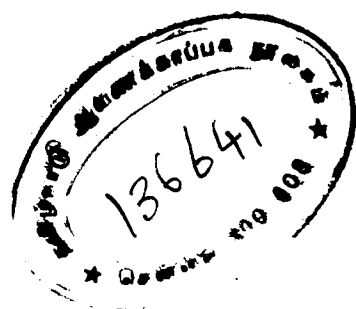
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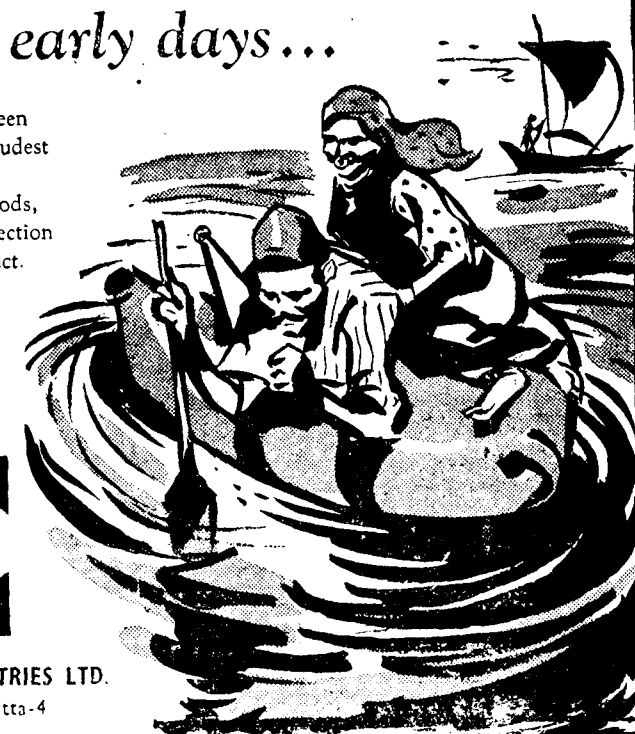
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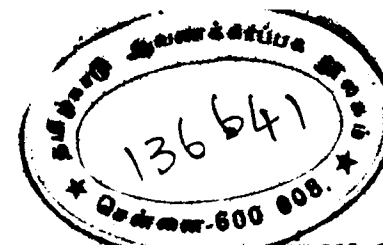
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**A COMPARATIVE STUDY ON THE ACTION OF ELASTASE
ON ELASTIN AND THERMALLY CONTRACTED COLLAGEN**

BY

K. THOMAS JOSEPH
Central Leather Research Institute, Madras

Received on December 2, 1961

SUMMARY

Elastin and heat-shrunk collagen were digested with elastase and the N- and C-terminal amino acids released by the action of the enzyme were determined quantitatively. The major sites of action of elastase on collagen and elastin were found to be the same. A number of bonds of different type were attacked by elastase in elastin and thermally contracted collagen, the greater number being derived from peptide bonds involving the amino and carboxyl groups of neutral amino acids. Even though both collagen and elastin contain a high concentration of proline, in the case of collagen alone it has been found that proline is released as a C-terminal residue by the action of elastase. It is suggested that in these two proteins, proline may probably be linked in different ways.

Introduction

The interaction between elastase and elastin has come in for a good amount of study and it is now fairly well established that the enzyme not only solubilises the substrate, but also functions as a proteolytic enzyme.¹⁻³ Later investigations have shown that potent elastase preparations would hydrolyse heat shrunk collagen and a wide variety of peptides and proteins.⁴⁻⁶ However, very little information is available regarding the nature of the peptide bonds broken when elastase hydrolyses elastin and other proteins. The recent work of Naughton and Sanger⁷ on the action of elastase on the A and B chains of insulin has indicated that elastase has got a specificity entirely different from that of trypsin or chymotrypsin. Partridge and Davis² showed that the complete solubilisation of elastin was accompanied by the release of a large number of amino groups.

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In recent years, many observations have been made,⁸⁻¹¹ showing some bearing on the relationship between collagen and elastin. Neuberger¹² from a comparison of the amino acid composition of collagen and elastin has suggested that these two proteins which are so closely associated in connective tissues are formed in the same cell and share certain peptides with the same amino acid sequence. In view of these various reports, a comparative study on the action of elastase on heat-treated collagen and elastin was undertaken.

Experimental

Preparation of proteins: Collagen was prepared from the butt portion of a fresh buffalo hide.¹³ The thermal denaturation of the protein was carried out by keeping an aqueous suspension of the protein on a boiling water bath for 45 minutes. Elastin was prepared from cattle *ligamentum nuchae* as described by Partridge, Davis and Adair.¹⁴

Elastase: Crystallised elastase (Sigma Chemical Co., U.S.A.) was used in the present study. Enzymic hydrolysis of the proteins was carried out as described by Banga¹⁵ in carbonate-HCl buffer (pH 8.8). 10 mg. of crystalline elastase was used for digesting 1 gm. of the protein. The hydrolysis period was 48 hours.

N- and C-terminal residue determination: The preparation of dinitrophenyl derivatives, their subsequent hydrolysis and identification and estimation of N-terminal residues were all carried out using the methods previously described.^{13, 16} The C-terminal amino acids were identified by the hydrazinolysis method of Akabori¹⁷ as modified by Bradbury.¹⁸ None of the results given in this paper are corrected in any way for losses that occur during hydrolysis, chromatography etc. Further the estimate of the N- and C-terminal amino acids liberated by the enzyme is subject also to an error due to the possibility of autohydrolysis of the enzyme itself; since only 10 mg. of enzyme was used for hydrolysis of 1 gm. of protein, the error can be taken as insignificant.

Results and Discussion

The quantitative results obtained from the analyses are given in table I. From the table, it is seen that the major sites of action of elastase on collagen and elastin are almost the same. A number of bonds of different types are attacked by elastase in elastin and

thermally contracted collagen, the greater number being derived from peptide bonds involving the amino and carboxyl groups of glycine and alanine. The values obtained for the N-terminal amino acids of enzyme treated elastin are slightly lower than those reported by Partridge and Davis.² The variations may be attributed to differences in the enzyme preparations used and the conditions of hydrolyses followed.

TABLE I

Release of N- and C-terminal amino acids from elastin and heat-shrunk collagen by elastase. (Values are given as moles per 1000, 000 gm. protein)

	N-terminal amino acids		C-terminal amino acids	
	Elastin	Collagen	Elastin	Collagen
Aspartic acid	1.2	1.4	—	10.4
Glutamic acid	2.3	5.2	0.5	15.7
Serine	1.7	5.9	0.6	3.1
Threonine	1.5	1.1	0.8	3.6
Glycine	27.4	40.4	28.5	33.4
Alanine	42.3	32.5	26.3	22.2
Leucine + Isoleucine	8.7	11.2	19.5	8.3
Valine	12.7	8.6	22.5	3.1
Phenylalanine	—	—	3.2	2.1
Proline	—	—	—	5.2
Others	—	—	2.4	4.7
Total	97.8	106.3	104.3	111.8

The N- and C-terminal amino acids released by elastase from heat-treated collagen are almost the same as those found in gelatin¹⁹ even though the quantities are much higher in the former case. The same N-terminal amino acids have also been found^{20, 21} to be released when gelatin is degraded with pepsin, trypsin, chymotrypsin and papain and also during aqueous hydrolysis at high temperatures in the presence of acid or alkali. Partridge and Davis² found that oxalic acid solubilised-elastin contains much larger amounts of N-terminal residues than the native elastin.

The N-terminal amino acids of oxalic acid-solubilised elastin² were identical with those of the enzyme digested elastin noticed in the present study from which it is deduced that oxalic acid and elastase exert their hydrolytic actions at similar loci. These various observations therefore lend support to the suggestion of Courts²⁰ that proteolysis occurs in two ways: one involving a random breaking of peptide bonds, which closely follows the course of thermal degradation and the other involving a specific bond breaking action. Elastase may first probably act as a true catalyst enabling aqueous hydrolysis of certain labile peptide bonds to occur at greatly reduced temperatures and only the second mode of action may probably involve enzyme specificity. From the results obtained in the present study, it is therefore not possible to conclude that collagen and elastin share any peptides with the same amino acid sequence.

Both collagen and elastin contain a high concentration of proline. But only in the case of collagen, it has been found that proline is released as a C-terminal residue by the action of elastase. It appears therefore that proline is linked in different ways in these two proteins. The sequences -gly-pro-hydro and -gly-(hydro, pro)-gly- have been postulated as important in collagen.²²⁻²⁴ Linkages of this type, however, may not occur in sufficient frequency in the case of elastin, as the hydroxyproline content of this protein is very low. It is therefore not very clear, whether proline as a C-terminal residue in the enzyme digest of collagen has arisen as a result of random cleavage or whether a larger amino acid sequence of the above type has contributed to the specificity of elastase in splitting this amino acid bond in collagen and not in elastin. Further work on the action of elastase on a number of synthetic substrates and longer peptides of known amino acid sequence is being carried out to clarify this point.

Courts²⁰ has reported that when gelatin is degraded with papain, chymotrypsin, pepsin and trypsin, the total amounts of N-terminal amino acids released are 39.34, 15.5, 9.49 and 47.1 moles respectively per 100,000 gm. gelatin. In the present study, it has been observed that when heat-shrunk collagen is digested with elastase about 106 moles of amino groups are released per 100,000 gm. of protein. So far as observations from the amino end can discern, it is apparent that the proteolytic activity of elastase towards heat-treated collagen is greater than that of the other proteolytic enzymes. Of these various enzymes, papain has also been reported²⁵ recently to have elastolytic action. In a separate

experiment, elastin was therefore digested with crude papain and the total amino groups released were estimated by the DNFB-technique, but the values were found to be lower than those obtained with elastase. Partridge and Davis² also found that the proteolytic activity of elastase when tested against haemoglobin was 1.8 times that of crystalline trypsin. Naughton and Sanger⁷ reported that elastase brought about a rapid initial split between leucine and tyrosine in the B-chain of insulin. When the reaction was allowed to proceed further, more peptide bonds were broken involving a variety of amino acids. Grant and Robbins¹ have demonstrated that elastase possesses esterase activity towards ATEE (acetyl-L-tyrosine ethyl ester). These various observations therefore show that elastase possesses a much broader and less predictable specificity compared to certain other well defined enzymes like trypsin or chymotrypsin.

Acknowledgement

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AN ANALYSIS ON THE PATTERN OF INDIA'S EXPORT TRADE IN SKINS

BY

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Central Leather Research Institute, Madras

SUMMARY

The development of India's export trade in goat and sheep skins during the last decade has been traced with the aid of statistical tables based on export figures. The classified data reveal certain characteristics relating to the pattern of export of raw goat skins. The value of goat and sheep skins exported from India amounts to Rs. 25.97 crores and it constitutes 4.17 % of India's total export earnings in 1960. However, the volume of these proceeds may be increased by a substantial extent, if the present structure of export of skins undergoes a change. After a complete analysis of the field, a policy of stricter restriction as regards the export of raw goat skin is advocated and the economic implications of following such a policy have been carefully examined. The success of the execution of a more rigorous export restriction hinges upon finding out alternative modes of utilisation of raw goat skins. Further the issues relating to the development of export market of finished skins have been pinpointed in the course of discussions. A brief survey also has been made of the direction of export trade in skins in recent years and the question of United Kingdom's entry into European Common Market and its probable impact on India's external trade in skins has been touched. The entire discussion is concluded with some short and long-term recommendations for the development of a stabler export market.

1. INTRODUCTION

1.1. The foreign trade structure of a backward economy reflects, on the one hand, most of the weaknesses of its internal socio-economic milieu and retards its economic growth on the other. In order to fulfil the aim of rapid industrialisation, an underdeveloped country must grapple with this problem with clear perspectives. Fundamental changes in the character of foreign trade are desired not only for the sake of immediate improvement in the balance and terms of trade but, at times, they may appear to have

more direct bearing on the industrial development within the country.

1.2. Under foreign rule, the basic structure of India's foreign trade was manifested in the form of export of mainly raw materials and semi-manufactures to the industrially advanced metropolitan centres and in the import of finished goods from those places. Due to such a trading relationship with the developed countries, the primary producer countries like India had to put up with unfavourable terms of trade, i.e., as consumers of final products the latter countries had often to pay monopoly prices and their own supplies were subjected by the overseas buyers to recurrent trade fluctuations and artificial restrictive purchase policies. During the years following independence, a progressive reorientation in the foreign trade policy has been ushered in, forced primarily by the need for conserving foreign exchange. One of the two major planks of this foreign trade policy is the attainment of self-sufficiency regarding imported goods and the other is the promotion of export of finished commodities as far as possible in lieu of raw and semi-manufactured ones.

1.3. However, an analysis of foreign trade of India in general, is not the subject matter of the present enquiry. Rather, an attempt will be made here to examine in some details the existing pattern of export trade in skins — mainly those of goats and sheep. It may be mentioned in this connection that in recent times, the Government, a section of public opinion and those directly interested are evincing growing concern for the development of the leather and leather goods industries in India. Not only do these industries earn 4%-6%¹ of the total foreign exchange of the country, but also they, together with the footwear industry, provide employment to more than half a million persons.² Above all, the importance of this group of industries from the point of view of domestic consumption needs to be stressed. It is the source of one of the most basic human necessities, viz., footwear which ranks next only to food and clothing in the order of priority of essential consumer goods. At present, the per capita availability of shoes in India stands at about 0.25 pair. To raise this level of consumption, the target for shoe production in the Third Five Year Plan has been increased from 102 million pairs to 140 million pairs³ (including exports).

1.4. The first systematic attempt to organise a skin trade in India (by the Dutch) dates back to the middle of the seventeenth century. The old records are full of authentic facts that trade in

this commodity was stabilised about one hundred years ago. But the development of a full-fledged export trade in goat skins has been comparatively of recent origin and received an impetus only when the U.S.A. and other developed countries started manufacturing glazed kids by chrome tanning processes for which Indian skins were found to be very suitable. Indian goat and sheep skins are favoured in these countries for their good substance, fine grain and well-built structure. Right from an earlier period the growth of E.I. tanning industry in Southern India caused a substantial part of raw skin supply to undergo treatment in vegetable tanning processes. In course of time, raw and E.I. tanned skins came to be considered very useful for the production of light leathers used for shoe uppers, linings, garments, gloves and for the manufacture of other fancy leather goods. Of late, the foundation for the production of finished leathers from skins has been laid in India. Some large scale leather factories in the South have been manufacturing finished suedes, glazed kids and chamoises etc. from goat and sheep skins and have started exporting these commodities. Thus, it is found that three sectors in skin trade, e.g. raw, semi-manufacture and finished have emerged and started to coexist in India.

1.5. The demand for these commodities has been high, specially in the countries of North America and Europe, where the standard of living of the population is fairly high. Some social and historical factors that would account for the continued maintenance of high quality of available skins within the country and lead to their appreciation abroad may be referred to here. While the main characteristics of hide supply in this country (specially after the partition of the Sub-Continent) are low yields, low slaughtering rate and a considerable amount of low grade hides, the economy of skin husbandry reveals an opposite trend. Sentiment against slaughter of goats and sheep is not so strong as in the case of slaughter of cattle. On the other hand, among certain religious sects in India, slaughtering of goats is a part of some religious ceremonies. Secondly, in this country goats and sheep have always been the main sources of meat supply. Thirdly, skins yield sizable returns amounting to about 20% of the cost of animal while hides yield generally about 4%-6% only.

1.6. The predominance of the unorganised sector in the leather, footwear and leather goods industries renders difficult the systematic collection of statistics relating to the various facets of this group of industries and this acts as one of the serious limitations for the development of economic research in this field. Moreover,

it is well known that there exist various shades of opinion on the subject of skin export and efforts are being made in the Governmental and industrial circles for finding out a clear unified policy on this issue in the best interests of the industry and the nation at large. Under the circumstances, a critical review of the present structure and direction of the foreign trade in skins as a guide to policy formulations has been considered fruitful.

2. ANALYSIS AND INFERENCES

2.1. Production and import of skins

In order to meet domestic and export markets, India also imports raw hides and skins. As a result of the partition of the country, some of the important centres of the sub-continent for the regular supply of good quality hides and skins were included in Pakistan and since then, the Indian leather industry has been vexed with the problem of raw hides shortage. Fortunately, the problem regarding skin supply is not so serious. The target of 26.5 million pieces of skin production (goat and sheep) for the Second Five Year Plan was surpassed; the estimate for skin production in 1960-61 is 28.1 million pieces.⁴ On the other hand, actual production of hides lagged behind the targets during the two Plans⁵. The following table will throw some light on the import of raw skins during the last ten years ending in 1960.

TABLE 2.1.
Value of annual import of skins (goat & sheep).
Period: 1950-51 to 1960

Year	Value in Rs. ,00,000		
	Raw	Tanned or dressed	Total
1	2	3	4
1950-51	36.57	6.34	42.91
1951-52	29.02	6.86	34.88
1952-53	15.22	6.95	22.17
1953-54	24.51	8.79	33.30
1954-55	17.27	7.30	24.57
1955-56	23.27	8.16	31.43
1957	34.92	0.13	35.05
1958	27.31	0.28	27.59
1959	34.92	0.23	35.15
1960	47.71	0.51	48.22

2.1.2. It is found that there is a clear overall rising trend in the value of imports of raw skins, so that even after a sharp fall in the import of tanned skins from 1957 onwards, the value of the total import remains more or less the same and has reached the peak level in 1960.

2.2. Export of skins

2.2.1. In 1951, 83% of the total available goat skins was exported out of India in raw as well as tanned conditions.⁶ Table 2.2. (vide next page) reveals the relative importance of skin as an exportable commodity vis-a-vis total hides and skins exported.

2.2.2. In the above table, only tanned hides, raw skins and tanned skins other than finished leather have been taken into account. In this case, skins include all types of skins, viz., goat, sheep, reptile and fur, and hides include skins from cattle calves. Col. 2 and col. 5 respectively show that, during the period under review, there is no distinct trend in the quantity exported but that there is a general upward swing in the value of the hides and skins exported. So it may be generally concluded that a rise in the price levels of exports is responsible for the major part of this increase in value. Both the quantity and the value of the items of export under observation received a set-back in 1958 due to a slight recession in the economies⁴ of the Western countries; but in the year 1959, this downward movement was not only arrested but there was also an appreciable rise in both the quantity and value of the commodities, specially of hides exported, though the quantity level of 1957 was not reached in the case of skins. This is the result of the world-wide boom in the price of hides and skins in 1959 when even the Korean-war peak levels were surpassed. Under the impact of a favourable turn in price levels, the quantity of export rose from a low level to a peak in 1959, but fell down sharply in 1960.

2.2.3. The relative position of skins in the total exports of hides and skins is indeed unique. Throughout the whole period, percentage share of skin in the total export both in quantum and value registered an increasing trend with a downward swing in 1959 only. During this time, covering roughly the Second Five Year Plan period, the value of skin export rose absolutely by more than Rs. 80 million and about 9% more compared to that of hides and skins taken together. It may be mentioned in this connection that in spite of an overall rise in quantity and value of

TABLE 2.2.

A Comparison of exports of skins in relation to those of hides and skins taken together. Period: 1954-55 to 1960

Year	Quantity in 00,000 cwt.		% of Col. 3 on Col. 2	Value in Rs. 000,000		% of Col. 6 on Col. 5
	Hides & skins	Skins		Hides & skins	Skins	
1	2	3	4	5	6	7
1954-55	6.59	3.79	56.30	276.76	188.89	68.25
1955-56	6.48	3.67	56.34	290.51	197.55	68.00
1957	6.69	4.34	64.84	271.64	208.61	76.81
1958	5.81	3.98	68.50	242.27	190.89	78.79
1959	7.02	4.13	58.33	367.21	269.16	73.29
1960	6.10	3.82	62.62	343.05	266.44	77.67

skin export, year to year fluctuations within the period are also evident. It will be observed subsequently how this characteristic in the skin export is the source of both strength and weakness in the whole export structure.

2.2.4. India is the world's largest producer and exporter of skins, particularly of goat skins. The figure for world production of goat skins in 1952-53 is 115.00 million pieces and India's share is 21.30 million pieces, i.e., 18.5% of the world production. The relative strength of Indian supply will be further appreciated when it is considered that the Commonwealth countries including South Africa and British Empire are responsible for about 40% of the world's supply of goat skins and India's share in the Commonwealth supply is 46%.⁷

2.2.5. Goat and sheep skins are exported from India in raw, tanned and finished forms; the first two types are more important for the present. The table that follows presents the figures for sheep skin export during the ten year period ending in 1960.

TABLE 2.3.

Export of tanned sheep skins as percent of total sheep skins exported. Period: 1950-51 to 1960

Year	Quantity in (000 cwts)		Value in Rs. (000,000)		Price per cwt. in Rs.
	Total (Tanned & Raw)	Tanned or dressed	Total (Tanned & Raw)	Tanned or dressed	Tanned or dressed
1	2	3	4	5	6
1950-51	56.78	56.72	54.79	54.14	954
1951-52	59.12	55.48	58.05	56.98	1027
1952-53	79.07	70.37	53.27	51.36	730
1953-54	75.41	73.75	69.50	69.07	936
1954-55	60.65	58.42	55.04	54.54	933
1955-56	59.84	57.95	55.05	54.61	942
1957	69.36	63.06	63.44	62.15	985
1958	52.37	48.99	48.92	47.39	967
1959	74.72	68.94	77.58	74.38	1079
1960	65.81	61.62	77.10	75.83	1231

Exports of raw sheep skins has been virtually stopped; only *Pa-pras* are exported without restriction. For other raw export, there is a size specification of what "cannot be exported". From Col. 2, it is found that wide cyclical fluctuations are present in the quantity of sheep skins exported during the period under study. The average price in 1951-52 per cwt. of tanned sheep skin is calculated as Rs. 1027. There is a sudden drop in price from this figure to Rs. 730 in 1952-53. This violent shift in price was caused by the post-Korean war slump. As a result of this abrupt fall in price of tanned sheep skins, the world demand for Indian skins would have gone up resulting in purchase of 73,750 cwt. in 1953-54 which is the highest quantity exported during the whole period under observation. In Table 2.2, it is observed that there was a sudden fall in the export of skins in 1958. Of the decrease of 36,000 cwt. for all skins, sheep skins accounted for 17,000 cwt. This somewhat disproportionate fall in the demand might have been caused by a sharp rise in the Australian supply of tanned sheep skins in 1958. Australia increased her export from 21.29 million pieces in 1957 to 23.94 million pieces in 1958, i.e., about 12% increase in a year.⁸

2.3. Export of goat skins:

2.3.1. A completely reverse picture emerges out when the export of goat skins is taken into consideration. While the export of raw sheep skins scarcely rose above 10%, the number of goat skins exported in raw condition has scarcely fallen below 55% of the total number exported over the last three decades. The record of relative export performance of tanned goat skins will be revealed in Table 2.4. (on facing page).

It is observed from col. 5 in the above distribution that the percentage of the number of pieces of tanned skins exported ranges between 34.44 in 1950-51 and 46.77 in 1955-56; the range is slightly more than 11% and it may hardly be considered as too high. So it may be concluded roughly that the demand for tanned skins follows more or less a stable pattern for all these years. From 1957 onwards, as the export of total quantity of goat skins rises, the proportion of tanned export begins to fall. While a rise of 9.6% in the total export is registered in 1957 compared to 1956, the volume of tanned goat skin export fell by slightly less than 1% absolutely and 4.4% relative to raw export, the entire increase marked above being due solely to the appreciation in raw goat

TABLE 2.4.

Export of tanned goat skins as per cent of total goat skins exports. Period: 1950-51 to 1960.

Year	Quantity* ('000 pieces)		Value (Rs. '000,000)					% of col. 7 on col. 8
	Raw skins	Tanned or dressed skins	Total	% of col. 3 on col. 4	Raw skins	Tanned or dressed skins	Total	
1	2	3	4	5	6	7	8	9
1950-51	17612	10454	28066	37.24	81.35	69.08	150.43	45.92
1951-52	15525	8525	24050	35.44	69.65	51.00	120.65	42.27
1952-53	15559	10573	26132	40.46	47.83	48.61	96.44	50.40
1953-54	14357	11864	26221	45.25	54.23	63.93	118.16	54.10
1954-55	15784	10833	26617	40.69	65.88	61.31	127.19	48.20
1955-56	14300	12563	26863	46.77	58.32	75.81	134.13	56.52
1957	16980	12485	29465	42.37	64.50	75.73	140.23	54.00
1958	16746	11153	27899	39.97	68.04	69.36	137.40	50.48
1959	18070	11151	29221	38.16	100.71	84.29	185.00	45.56
1960	17085	10414	27499	37.87	99.14	83.44	182.58	45.70

*Following conversion ratios have been used (Source Reference 7):

- (i) 1 cwt. of goat skins (raw) = 74 pieces.
- (ii) 1 cwt. of goat skins (tanned) = 130 pieces.

skin export. The upward trend in international demand for goat skins in relation to supply was being felt from the year 1957 and the entry of U.S.S.R. and other Eastern European countries as important buyers in the world skin market tended to push up price levels. However, there was a slight drop of goat skin export by 15,66,000 pieces in 1958, though the export in this year was maintained at a much higher level than in the previous period of 1951-56. The average price indices show that the index for raw skin price was lower absolutely and relative to that of tanned skin in 1957 and this might explain to some extent, the rise in the demand for Indian raw goat skin in 1957 (vide Appendix: Table No. A II).

2.3.2 In 1959, India exported raw skins valued at Rs. 10.07 crores which constituted about one-fourth of the total value exports of hides, skins and leather goods (including footwear) in that year. A study based on the export statistics of raw goat skins during the ten years ending 1960 is presented in the following table.

TABLE 2.5.

Export of raw goat skins from India during the period 1950-51 to 1960

Year	Quantity ('000 cwt.)	Three year moving average of quantity ('000 cwt.)	Value (Rs. '000,000)	Price (Rs. per cwt.)	Three year moving average of price
1	2	3	4	5	6
1950-51	238.00	—	81.35	341.81	—
1951-52	207.00	218.42	69.65	336.46	301.92
1952-53	210.26	203.76	47.83	227.48	281.16
1953-54	194.02	205.97	54.24	279.54	271.87
1954-55	213.30	200.19	65.82	308.59	296.64
1955-56	193.24	211.99	58.31	301.78	297.16
1957	229.44	216.33	64.45	281.12	294.52
1958	226.30	233.31	68.01	300.67	331.40
1959	243.30	233.49	100.71	412.44	380.85
1960	230.87	—	99.14	429.43	—

The pre-war (1937-38 to 1939-40) annual average for the quantity of raw goat skins exported from undivided India stood at 374.20 thousand cwt; during the war, this average dropped down to 337.80 thousand cwt. and the quantity slid down to a still lower level of 276.80 thousand cwt. in 1947-48.⁹ If the factor of trade dislocation during the war is excluded, growing consumption of this raw material by the domestic tanneries for the manufacture of E.I. tanned leather seems to be responsible for this declining trend over the decade. In the post-Independence period, the Korean war trade boom started in 1949 and continued until middle of 1951 leading to an increase in the quantum of raw goat skin export from 198.80 thousand cwt.¹⁰ in 1948-49 to 238.00 thousand cwt. in 1950-51. With the petering out of the boom, the demand gradually diminished, until the rock-bottom for raw goat skin export was reached in 1953-54 (vide the Table above). The average price of raw skins continued its downward movement in 1951-52 and touched its nadir in 1952-53. But a revival was noticed from 1954-55 in demand and in price and an upward swing continued more or less unabated until recent times. 1959 is a year of abnormal rise in the world price-levels of hides and skins; prices of prime quality Indian skins rose to unprecedented heights and the average of price for all types of skins surpassed the Korean-war peak level by about Rs. 70 per cwt. Col. 3 and col. 6 in the above table give the three-year moving averages of the quantity of raw goat skins exported and the average price fetched by them from world market. The moving average is a statistical device which is used for smoothening out short-period fluctuations and for giving to the data an overall trend (upward or downward) effect over a longer period. Some pertinent inferences may be drawn from the above table.

(i) Considering the moving average values of the price variable (col. 6), it is revealed that the range between the highest value, i.e., Rs. 380.85 in 1959 and the lowest value, i.e. Rs. 271.87 in 1954-55 is Rs. 108.98, i.e., expressed in terms of percentage of lower limit, it is about 40. Roughly speaking, it may be concluded that the degree of average cyclical fluctuation in price as given by the above measure is substantially high.

(ii) As regards the quantity exported col. 3 gives the moving average. The lowest limit of this series is given by the value in 1954-55 as 200.19 thousand cwt. and the highest limit is 233.79 thousand cwt. reached in 1959; the range in this case works out as 33.60 thousand cwt. and expressed as percentage of the lower

limit, the degree of average variation in the quantity is about 15 for the whole period. Hence, in a broad sense, it may be stated that the rate of increase in the supply of raw skin (goat) lags behind that of export price, i.e., the export of raw goat skin is not price-elastic. This price-inelasticity is explained by the fact that goat skin is the by-product of meat-industry. The supply of skin rises with the rise in the meat-supply and may not increase proportionately with the rise in the demand and price of raw skin. Due to this characteristic in the nature of supply, all other conditions remaining the same in the periods of downward movement in prices, quantity supplied does not diminish proportionately leading to a greater fall in prices and in phases of rising demand and prices, price-rise becomes cumulative due to unresponsiveness in the quantum of supply. Raw skins, unlike jute, cotton and tea constitute a perishable commodity and cannot be stocked for a long time in raw and cured condition without putrefaction. These features on the supply side combined with deficiencies in internal marketing system are the sources of basic structural weakness present in India's skin export.

2.3.3. Though complete ban on the export of raw hides was imposed five years ago, yet until recent years, no restrictive policy was pursued in regard to raw goat skin export. However, as the internal price-level continued to soar and become stable at higher levels in response to a sharp rise of export prices, the Government of India considered it wise to declare a policy of restriction regarding the raw goat skin export. The quota system of export came to be introduced from June 1959 and it is expected that in 1960, there would have been substantial reduction in the volume of export. The following table will give some idea as regards the effect of such a policy of restriction.

TABLE 2.6.

Monthly average of raw skin export. Period: 1957-1960

Year 1	Monthly average of quantity ('000 cwt.) 2	Index 3
1957	19.12	101.37
1958	18.86	100.00
1959	20.35	107.37
1960	17.36	92.04

Monthly average for 10 months, i.e. January to October has been used for the foregoing table. It is known that Shri Lal Bahadur Shastri, the then Union Minister for Commerce and Industry, declared at the Export Promotion Advisory Council meeting held in February 1960 at New Delhi, that there would be a curtailment in the export by 50% of the average annual export of the last quinquennium; the present quota system was introduced with the expectation that there would be at least 33% reduction. But the actual performance during the period of restrictions warns one not to be so optimistic. In the above table the year 1958 has been chosen as the year previous to the year in which restrictions were imposed. From col. 3 of table 2.6, it is seen that there is a rise of 7% in the quantity exported in 1959; as there was a talk of a policy of restrictions to be executed in the second half, it is expected that more than average had been exported in the first half of the year. Again, it is seen that in 1960, there is a drop in the quantity exported by 8% (approx.) only compared to the base year. If it is desired to have a substantial curtailment in the volume of export of raw goat skins, a re-examination of the letters of the regulation may be necessary and a more drastic measure in this direction may be adopted.

2.3.4. It would appear that the major economic rationale behind the imposition of a ban on the export of raw hides and sheep skins was to introduce greater stability in their internal prices and to make them available in sufficient quantity to the leather industry in India at reasonable cost. To enable export industries to sell in the foreign market at competitive prices, their costs of production should not be allowed to rise beyond certain levels. The most important means to achieve this objective is to keep the price of the basic input within corresponding limits. Though, no such study which has isolated from other factors, the effect of the ban on the export of raw hides and sheep skins upon the changes in their internal price-structure is available, yet it may be presumed that the Indian leather industry has gained, if not by a fall, at least by a slower rate of rise in the internal prices of these raw materials than that which might be conceived in the context of a free outflow of these raw materials. Increasing volume of export-earnings from E.I. tanned hides and skins would be unthinkable, except in the background of such a ban. Along with this gain in foreign exchanges, employment of increased manpower and greater utilisation of installed capacity was effect-

ed in these industries. The forces which determine the internal price-structure of hides and skins are varied and interrelated. During the past quinquennium, they might have exerted pressure in the opposite direction, neutralising the effect of the ban. But it may be stressed that the policy of banning the raw export has been successful at least in warding off the foreign competition and placed the indigenous tanners in a favourable position. Now it is beyond one's comprehension why a similar line of argument will not be applicable in the case of goat skin and why the problem will not be tackled from a similar direction.

2.3.5. A hypothetical case may be examined in this connection. Assuming that (i) there is an enactment for a ban on the export of raw goat skins and India almost completely ceases to export them, (ii) a sizable part of the raw skins hitherto exported is available for being tanned as E.I. tanned skins or as finished leather like full chrome and semi-chrome suedes, lining, glazed kids and others, (iii) facilities—economic and technical—are made available on easy terms to the tanners and finishers in the country and (iv) the tanned and finished leathers are marketed (externally), Indian economy may score the following gains in terms of foreign exchanges (*vide* Table 2.7.).

As the detailed breakdown of the data is available for the above mentioned years only, the foregoing analysis is restricted to this very short period. It is found that during the four years under study, only 15% of the total raw stock was exported with wet salted cure and the rest was exported as dry-salted. For estimating the yield of leather as given in col. 3 of the above table, conversion rates of 70% hide substance for dry salted and 20% hide substance for the wet salted skins have been adopted. Figures in col. 5 are arrived at by multiplying those of col. 3 by the average export price per cwt. of tanned or dressed skins and those of col. 7 are built up by multiplying figures in col. 3 by the average export price of one cwt. of glazed kid leather. The table shows that the margin of expected value varies between Rs. 46 million and Rs. 54 million in the case of the export of skins as tanned and that, in the case of glazed kid, it ranges between Rs. 228 million and 243 million. The figures for net additional returns accruing from export may be deduced by subtracting from the above figures the cost of tanning and finishing auxiliaries to be imported for such manufactures. Thus, it is seen that if India is capable of producing finished leathers and can compete with foreign countries as regards quality and price, she can earn

TABLE 2.7.

Additional value in gross from the volume of goat skins (raw) exports, if exported as E.I. tanned or as glazed-kid leather. Period: 1957-1960.

Year	Quantity of goat skins (raw) exported ('000 cwt.)	Expected yield of leather from raw skins exported	Value realised by export (Rs. '000,000)	Expected gross value by tanned export	Margin col. 5 minus col. 4	Expected gross value by glazed kid export (Rs. '000,000)	Margin (col. 7—col. 4)
1	2	3	4	5	6	7	8
1957	229.44	147.10	64.50	115.97	51.47	293.39	228.29
1958	226.30	141.01	68.04	114.01	46.97	299.88	231.84
1959	243.30	148.75	100.71	146.16	54.55	344.20	243.51
1960	230.87	119.00	99.14	123.89	24.75	254.24	229.49

Rs. 243 million more by way of foreign exchange, i.e. 60% of the value of her total exports of skins, leather and leather goods including footwear in 1959. However, there are two implicit assumptions behind the working out of the above example: (i) that all the raw skins (dry and wet salted) hitherto being exported can be converted into glazed kid leather, (ii) that there will be no shift downwards in the average unit price of tanned or finished leather in case almost all the raw material is processed at home for export. It is true that 100% of raw skins exported cannot be used for glazed kid production and that an allowance will have to be made for excluding the lower grade skins. As regards the second assumption, the average price of tanned and finished skins may tend to fall in future due to probable changes in the proportion of primes, seconds and thirds on the total export. But, there is another possibility. With the ban on export, sufficient quantity of good quality skins will be available to Indian tanners at price not higher than the present ones; consequently, the tanners may be able to secure better selections for catering to a selective demand. The above table just give an example. Similar estimates may also be made for other types of finished leathers.

2.3.6. Now the validity of the assumptions (para 2.3.5) made at the beginning of this section, may be tested one by one. First, the effects likely to follow in the wake of implementation of restrictions on the export of raw skins may be stated as follows:

(i) There will be an immediate drop in the foreign exchange earnings; but it is expected that this exchange deficiency will be more than compensated in the long run by an appreciation in foreign exchange earnings as the industry will start exporting finished leathers.

(ii) The internal price of raw skins will go down jeopardising the interests of the producers and traders in raw skins. This may have further effect on the quantity and quality of the raw stock supply. At present, the internal market for finished or semi-manufactured leathers from skins, is very limited and the skin trade is almost wholly export-oriented. In future, the internal demand for lining from inferior selections may develop. Over and above, in the absence of a world wide trade depression, the foreign demand for finished leathers and for E.I. tanned skins for the manufacture of garments, lining, uppers and gloves etc. is expected to grow at an accelerated rate. So the effect of competition among the domestic tanners and finishers who will cater

to foreign markets will tend to keep up the price levels of raw goat skins. Historically speaking, a similar development was experienced as regards the behaviour of internal price structure of raw sheep skins after the imposition of restrictions on its export. Secondly, since as already stated, goat skin is a by-product of meat industry and is more or less price-inelastic, there is almost a negligible chance for a shrinkage of the quantity supplied even in case of a slight fall in the price-level. Again, considering the present marketing structure, a positive correlation between a smaller change in prices with that of the quality of raw skins in the supply side hardly exists. So no substantial fall in the quality standard of raw skin is expected, unless there is an appreciable fall in the price of raw skins.

2.3.7. As the home consumption of goat skins as raw (e.g., as parchment) is negligible, there is no snag in the fulfilment of the second hypothesis, when the first one is realised.

2.3.8. The third assumption made above is very important. It is well known that the production of sole and upper leathers in the country has reached the stage of certain maturity. The manufacture of E.I. tanned hides and skins (semi-manufactured) possesses a very rich and old tradition. Some large units in Madras have already been producing finished leathers out of goat and sheepskins. The production of industrial leathers has already made some headway in some large concerns. But, in spite of this development, the large and small sectors (both in chrome and vegetable tanning) have been passing through a chronic under-utilisations of existing capacities due mainly to the scarcity of raw materials. The word 'scarcity' in this case should be understood as having an economic sense; it is not that there is always an absolute physical scarcity, but sometimes the supply price of raw goat skins is so high and prohibitive that the tanners are forced not to purchase them upto the desirable maximum limit and consequently let the plant capacities remain idle. Again, one of the most important hurdles in the manufacture of finished leather is the difficulty experienced by the finishers in importing a very few important finishing auxiliaries. It may be confidently stated that once goat skins of suitable specifications are made available to the domestic tanners and finishers at moderate prices and if the import rigidities regarding some chemicals required for finishing are relaxed to some extent, enterprises to expand the present volume of semi-manufactured and finished production out of skins will definitely be forthcoming. Liberal release of foreign

exchange for the import of finishing auxiliaries is remunerative in the long run as this will enhance the export of finished leather and augment the country's earning of foreign exchange.

2.3.9. The fourth hypothesis deals with the question of finding out world market and is the most crucial and controversial aspect of the whole problem. The forecast of future demand of these commodities in the world market must necessarily be very tentative in nature for want of proper data on the subject. The observations on this point may be presented from two standpoints: (i) demand in the world market and (ii) Indian supply vis-a-vis world supply.

(i) Since 1930, the first year when a world survey on footwear was conducted, the present-day world output has risen by 107%.¹¹ A 10% gain has been noted by the U.S. Department of Commerce in the production of shoes during 1958-60. A rapid increase in the Soviet Union's production is considered as the main cause of this big gain. The figures show that the production of leather shoes is rising faster than world population. The world per capita output during 1959 rose to 0.78 pair which is 11% ahead of the figure of 0.70 pair two years ago. Since 1930, the per capita output has risen by 66% from 0.47 pair. As the world population is rising fast and there is a swing everywhere towards higher standard of living specially with the progress of planned economic development of the three of the most populous countries of the world viz., China, India, U.S.S.R., a rise of at least 6% per year in the rate of foot-wear production may easily be envisaged. This is true not only for footwear which is the most important of all the end products of leather but also for other leather goods. It is observed that in Great Britain 80% of the tanned hides and skins¹² is used for footwear production and it may safely be assumed that on the average 60% of the leather out of skins produced in India will be used by the footwear industry in the world.

2.3.10. To study the growth of demand for Indian products and to analyse from consumers' standpoint the factors affecting it, a series of market surveys regarding the price and income elasticities of demand in the overseas countries for leather goods made out of Indian raw materials may have to be conducted. The Leather Export Promotion Council may take initiative for moving the Indian Trade Commissions abroad in this matter.

2.3.11. In the event of India switching her pattern of production more in favour of finished leather, the developed coun-

tries which specialise in the production of finished leathers may protect their own home and foreign markets (i) by raising tariff wall and (ii) through price-competition. It is the experience, though on a very limited scale, gained from the export of tanned and finished leathers and footwear, that because of the unique quality of Indian raw material and comparatively lower cost of production at home, Indian producers have been able to sell at competitive price in the export market. Attempts at executing trade agreements with special emphasis on the finished leather should be made so that this cost advantage may not be wiped out by high tariff.

2.3.12. Lastly, the problem of recurrent change in fashions and tastes specially in the ladies' ware should be considered carefully. A widely held opinion is that it is very difficult to keep a close watch from India on the nature of changes in the demand as regards colours and styles of finished products and even if that is made possible, there is the question of time lag, i.e. time required for the shipment of goods. Though no scientific study on this problem is available, yet this opinion is shared by an important section of the industry. But first of all, the question of fashion-change is relevant for some selected items and not for all; secondly fashions do not fluctuate every month but change at best twice in a year. Moreover, private trade agents in foreign territories may disseminate in no time information regarding changes. India Government Trade Commissions may help much in this direction. Through suitable market studies, it is possible to know about the proportions of the Indian skin export which is used for the production of garment leather, ladies' shoe upper and other goods which are generally subject to fluctuations due to fashion changes. There are other goods manufactured out of Indian skins which are not so much sensitive to fashion changes. The country may export a part of her raw skins in the form of crust leather to suit the need of the first category products. The finishers abroad may, in their turn, render appropriate finishes to meet the tastes in a particular season. For the second type of products, a policy of progressive export of finished leathers from skins may be followed. However, a fuller appraisal of this problem may be made only through empirical studies as suggested above.

The supply aspect may be taken up next. India's main competitors in the world market for raw goat skins are Pakistan, China and African countries. In case India withdraws her supply

of raw goat skins from the world market, a vacuum will be created. These competitor countries may try to fill it up. But it is well known that in the present period of exorbitant rise in the prices of raw skins, they are already supplying the world market to the maximum extent possible and it is very difficult for them to increase the quantum of supply appreciably unless they starve their domestic tanneries. Moreover, most of these countries have been so long underdeveloped and are trying to build up their own leather industry (Kenya and Pakistan for example) and the tendency to cut down raw skin export will appear in them also in the long run. If it is not possible for these countries to meet the deficiency, the consumer countries must necessarily have to look to Indian leather industry ultimately for the supply of finished leather.

2.3.13. The problems connected with the development of finished leather industry in India constitute, by themselves, the subject-matter of a separate study. It should be remembered that the measures suggested above are not necessarily meant for immediate implementation, but the whole discussion is primarily motivated for focussing attention on the perspectives. What is urgent at the present moment is to explore the possibilities of evolving a new policy on skin export in order to lay the foundation for the building up a full-fledged finished leather industry in India.

2.4. Direction of export trade

2.4.1. Table Nos. V, VI, VII in the appendix give the direction of foreign trade in goat and sheep skins (raw and tanned or dressed). As the volume of raw sheep skins export is very insignificant, no separate analysis for it is considered fruitful.

2.4.2. As regards raw goat skin export, it is found that U.S.A. has been giving way to U.S.S.R. as the most important importer for last five years. In 1960 U.S.S.R. purchased Indian raw goat skins amounting to more than Rs. 52 million, i.e., nearly 53% of the total exports of this commodity. The target for higher rate of production of footwear and leather garments in the successive seven year plans in that country may be responsible for this enhanced demand. Moreover, trade agreements on the basis of payment in rupee facilitated such bulk purchases. U.K.'s share in the total value of export has dwindled from 16% to 2% in the course of the six years ending in 1960. The individual shares of West Germany, Italy and U.S.A. in the export have dropped and that of Czechoslovakia and other countries has improved.

2.4.3. As regards tanned goat skins, the United Kingdom has maintained her position as the foremost buyer though there is a drop by 23% in its share during the period under review. West Germany started her purchase from 1957 and has within a period of three years gained a position next only to U.K.; U.S.A., though increasing the percentage share, imports slightly more than 11% of the total value of exports in 1960.

2.4.4. Five countries with U.K. having a leading position used to import tanned sheep skins upto the year 1955-56. Gradually, the number of importing countries increased and U.K.'s share in the total export decreased from 75% in 1954-55 to 51% in 1960. During this period, West Germany has improved its position as buyer purchasing as much as 13% (approx.) of the value of total export.

2.4.5. Certain broad conclusions may be derived from the above analysis:

(i) With the decline in the importance of London auctions which operated as the nerve-centre of the Continental purchases and strengthening of the c.i.f. basis of the trade, there has been more and more diversification in the direction of skin export. As the monopoly of U.K. got challenged, India as seller started gaining more in the form of a rise in the price caused by the growing competition among buyers.

(ii) To the extent trading relations are extended with countries belonging to different social systems, viz., U.S.A. and U.S.S.R. the insurance against risk of being caught in trade depression has increased and the restrictive import policy of importing countries is likely to be felt less virulently on the quantum and value of Indian exports. In 1960, the U.S. purchase of tanned sheepskin was nil; however, 12% of the total value of tanned goat skin were imported from India. Also it showed some inclination towards the purchase of Indian raw goat skins. U.S.S.R. does not purchase tanned or finished skins but ranks as the biggest importer of raw goat skins in 1960. Under the circumstances, every effort should be made to popularise tanned and finished skins in U.S.A., U.S.S.R. and other European countries. Attempts should be made to persuade the U.S. Government to scale down the present rate of tariff against Indian tanned skins.

(iii) India's dependence on the U.K. as regards export of skins, though dwindling is still enormous. In 1960, U.K. imported nearly 47% of the total value of tanned sheep and goat skins ex-

ported. So the entry of the U.K. in the European Common Market (ECM) without executing tariff safeguards for Indian export of skins will reduce the competitive strength of Indian tanned hides and skins in relation to those exported from the African dependencies of ECM countries. But the prospects as regards hides and skins do not seem to be as bleak as in the case of some of the main Indian items of export. In 1958 India was able to export 42% of the value of her tanned goat skin export to four ECM countries (West Germany, France, Belgium, Netherlands) and in 1959 the figure dropped slightly to 36%, but the figure again rose to 39% in 1960. The position is slightly different as regards sheep skins (tanned) export. India supplied 29% (approx.) of total value of exports of tanned or dressed sheep skins to ECM countries in 1960. In case Great Britain decides in favour of the entry into the European Common Market, India must necessarily press for safeguard in tariffs for hides and skins exports.

2.4.6. But the ultimate solution lies in finding out alternative markets and in order to sell Indian goods in different parts of the globe, the industry must improve its competitive strength regarding price and quality. But it has been indicated earlier that one of the principal means to achieve lower cost of production is to put a ceiling on the price of basic input, i.e. raw skins.

2.4.7. In the present section, attempts have been made to diagnose the drawbacks inherent in the existing structure and direction of the export trade in skins and it is also shown how they serve as inhibiting factors for the growth of the leather industry in India. Moreover, some suggestions have been given for changing the pattern of export trade and for emphasising certain broad outlines for the development of finished leather industry in India.

3. CONCLUSIONS: LEATHER INDUSTRY NEEDS A PERSPECTIVE PLANNING

3.1. The questions relating to export should not be considered in isolation from the general problems of the industry. Promotion of export means in the final analysis, finding out new external markets, but it involves the problem of balancing various sets of economic factors. The aim of balancing is to accept one or more economic or noneconomic norms for the industry and it results in the evolution of a set of priorities. Only then, the questions regarding targets for investment, production, internal consumption, export, prices of inputs and outputs of an industry may be resolved. Again, the planning for all or any of the economic

variables for a short period must follow the outlines evolved through long term planning (perspective planning).

3.2. This theoretical dissertation is made only to emphasise the need for a perspective planning for leather and leather goods industries in India. The industries may be called upon to fulfil different objectives, viz., raising the standard of living, earning of foreign exchange and increasing the employment. Once a balance is struck among them it will be easier for one to fix up the various target levels and the problem of adjustments between the short and long term targets may also be studied in this connection. It is only when the economic problems of the industry are considered as a whole and viewed from a long-term perspective that the individual issues like the question of export can be tackled with greater advantage.

3.3 Having considered the above methodology to some extent, the following short and long term recommendations may be evolved from the foregoing analysis of India's export trade skin.

(a) *Short term:*

- (i) 50% cut in the export of raw goat skins from 1962.
- (ii) Introduction of redrawing system of the import duty on wattle bark and extract.
- (iii) Liberal grant of users' licence for import of some finishing auxiliaries.
- (iv) Exploring the possibilities of expansion of the manufacture of finished leather (skin) in the existing units, starting of new units, if necessary with foreign collaboration and with the participation of State Governments.
- (v) Conducting market surveys on the possibilities of the existing and potential foreign markets.

(b) *Long term:*

- (i) Imposition of ban on the export of raw goat skins at a progressive rate as the conditions for internal consumption mature and the position of foreign market improve.
- (ii) Dispersion of the direction of the external trade specially with reference to Middle East, U.S.S.R., U.S.A. and Eastern European countries.
- (iii) Promotion of exports with special emphasis on finished leather (skin).

The first set of recommendations may be implemented within a very short period. On the basis of assessment of the results of such an implementation and having acquired information on some other relevant factors, the other set may be given effect to.

APPENDIX

TABLE No. A. I

Variation of export prices of skins (Rs. per cwt.)
Period: 1950-51 to 1960

Year	Raw goat skin	Tanned or dressed goat skin	Tanned sheep skin
1	2	3	4
1950-51	341.81	865.68	953.19
1951-52	336.46	784.01	1028.55
1952-53	227.48	596.67	729.82
1953-54	279.54	700.50	936.54
1954-55	308.59	735.71	933.64
1955-56	301.78	784.44	942.41
1957	281.12	788.35	985.55
1958	300.67	808.50	967.85
1959	412.44	982.58	1078.98
1960	429.43	1041.48	1230.66

N.B.: Skins "otherwise cured" not included.

TABLE No. A. II

Comparative study of the fluctuations in international demand for raw and tanned goat skins. Period: 1950-51 to 1960.

Year	Demand indices		Price indices	
	Tanned	Raw	Tanned	Raw
1	2	3	4	5
1950-51	122.62	114.97	145.08	150.26
1951-52	100.00	100.00	131.39	147.91
1952-53	124.97	101.56	100.00	100.00
1953-54	140.23	93.73	117.40	122.88
1954-55	128.04	103.94	123.30	135.66
1955-56	148.49	93.35	131.47	132.66
1957	147.60	110.84	132.12	123.58
1958	131.82	109.32	135.50	132.17
1959	131.81	117.96	164.68	181.31
1960	123.10	111.53	174.55	188.77

TABLE No. A. III

Value of export of hides and skins (raw, tanned or dressed and finished) as percentage of total exports from India.
Period: 1950-51 to 1960

Year	All commodities (Rs. '000,000)	Hides & skins raw, tanned or dressed & finished (Rs. '000,000)	% of col. (3) on col. (2)	Goat & sheep skins (Rs. '000,000)	% of col. (5) on col. (2)
1	2	3	4	5	6
1950-51	6078.79	346.95	5.71	205.22	3.38
1951-52	7171.56	331.71	4.62	178.70	2.49
1952-53	5610.27	255.06	4.55	149.71	2.67
1953-54	5248.57	309.58	5.90	187.66	3.58
1954-55	5917.00	276.73	4.68	182.23	3.08
1955-56	5943.06	290.51	4.89	189.18	3.18
1957	6428.48	286.75	4.46	203.67	3.17
1958	5850.51	255.47	4.37	186.32	3.18
1959	6257.74	394.76	6.31	262.58	4.20
1960	6232.42	365.00	5.86	259.68	4.17

TABLE No. A. IV

Export of glazed kid (chrome) from India

Year	Quantity cwt.	Value Rs.	Price per cwt.
1	2	3	4
1957	320	6,38,232	1,994.51
1958	392	8,33,638	2,126.63
1959	622	14,39,257	2,313.92
1960	396	8,46,038	2,136.46

TABLE No. A. V

Distribution of the value of raw goat skins imported from India by different countries of destination during the last five years (Value in millions of rupees). Period: 1950-51 to 1960

Importing countries	1954-55		1955-56		1957		1958		1959		1960	
	Value	% of total value	Value	% of total value	Value	% of total value	Value	% of total value	Value	% of total value	Value	% of total value
United Kingdom ..	10.95	16.64	7.31	12.53	4.64	7.15	4.78	6.99	2.22	2.19	2.11	2.13
United States ..	24.83	37.72	23.49	40.28	18.14	27.97	21.11	30.86	21.42	21.13	19.00	19.16
U.S.S.R. ..	12.03	18.27	12.78	21.91	26.83	41.37	27.24	39.82	55.10	54.35	52.35	52.80
West Germany ..	5.89	8.95	3.98	6.82	3.33	5.13	3.72	5.44	4.04	3.98	3.81	3.84
Italy ..	1.89	2.87	4.35	7.46	5.56	8.57	3.80	5.56	4.23	4.18	2.16	2.18
Czechoslovakia ..	3.39	5.15	2.45	4.20	2.38	3.67	4.25	6.21	5.62	5.55	8.20	8.28
Others ..	6.85	10.40	3.97	6.80	3.98	6.14	3.50	5.12	8.74	8.62	11.51	11.61
Total ..	65.83	100.00	58.33	100.00	64.86	100.00	68.40	100.00	101.37	100.00	99.14	100.00

TABLE No. A. VI

Distribution of the value of tanned goat skins imported from India by different countries of destination during the period 1954-55 to 1960. (Value in millions of rupees)

Importing countries	1954-55		1955-56		1957		1958		1959		1960	
	Value	% of total value	Value	% of total value	Value	% of total value	Value	% of total value	Value	% of total value	Value	% of total value
United Kingdom ..	41.42	67.56	46.44	61.26	44.43	58.67	35.32	50.92	40.15	47.63	36.45	43.68
United States ..	3.93	6.41	4.73	6.24	3.62	4.78	2.69	3.88	7.77	9.22	9.81	11.76
West Germany ..	—	—	—	—	14.59	19.27	14.79	21.32	21.43	25.42	20.78	24.90
Belgium ..	3.10	5.05	4.21	5.55	4.56	6.02	6.16	8.88	3.84	4.56	3.21	3.85
Netherlands ..	0.04	0.07	0.11	0.14	0.47	0.62	0.56	0.81	1.84	2.18	2.00	2.40
France ..	5.39	8.79	7.25	9.56	6.41	8.46	7.87	11.35	6.54	7.76	7.31	8.76
Others ..	7.43	12.12	13.07	17.25	1.65	2.18	1.97	2.84	2.72	3.23	3.88	4.65
Total ..	61.31	100.00	75.81	100.00	75.73	100.00	69.36	100.00	84.29	100.00	83.44	100.00

TABLE No. A. VII

Distribution of the value of tanned sheep skins imported from India by different countries of destination during the period 1954-55 to 1960. (Value in millions of rupees)

Importing countries	1954-55		1955-56		1957		1958		1959		1960	
	Value	% of total value	Value	% of total value	Value	% of total value	Value	% of total value	Value	% of total value	Value	% of total value
United Kingdom ..	40.97	75.12	40.45	74.07	42.65	68.62	31.23	65.90	43.46	58.43	38.94	51.35
Japan ..	8.73	16.01	9.63	17.63	10.35	16.65	6.65	14.03	9.04	12.15	9.74	12.84
West Germany ..	1.78	3.26	1.77	3.25	5.25	8.45	3.20	6.76	9.74	13.09	9.63	12.70
France ..	—	—	—	—	0.83	1.32	1.37	2.89	3.44	4.62	4.64	6.12
Italy ..	—	—	—	—	0.63	1.02	1.23	2.59	3.06	4.11	5.08	6.70
Netherlands ..	—	—	—	—	0.69	1.11	1.19	2.54	2.37	3.19	3.08	4.07
Others ..	3.06	5.61	2.76	5.05	1.75	2.83	2.52	5.29	3.27	4.41	4.72	6.22
Total ..	54.54	100.00	54.61	100.00	62.15	100.00	47.39	100.00	74.38	100.00	75.83	100.00

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N.B.: The data presented in the tables are from the relevant issues of Monthly Statistics of Foreign Trade.—Ref. 1.

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RESEARCH BEARS FRUIT

Process for the manufacture of grain-garment leathers from raw sheep skins*

BY

T. S. K. MAHADEVAN, T. S. KRISHNAN, A. GANESAN AND
P. S. VENKATACHALAM

Raw material:

Thin spready wet salted sheep skins of 6 sq. ft. area (0.557 sq. m.) without any grain damage are used.

Soaking:

The skins are given a thorough soaking in two changes of water for about 3 hours. They are drained and weighed.

Liming:

The skins are given a fairly long liming so as to effect a good opening up of the fibres. The soaked stock is put in an old lime liquor containing 10% lime (about 35% available CaO content) and 3% Na₂S of 50% purity (on soaked weight). The skins are kept in this for 6 to 7 days with periodical handling; they are then unhaired, fleshed and relimed for about 2 days with 5% lime and 400% water (soaked weight). They are then taken out, weighed and delimed.

Deliming:

Deliming is done in a drum using about ½% ammonium sulphate with 250% float of water (on pelt weight). After deliming and scudding, the skins are taken for bating.

Note: For the demonstration, a lot of 25 sheep skins was taken from the regular lot of the tannery, in the delimed stage. The processes followed earlier were as for the regular lot of the tannery.

*Process demonstrated at Govt. Tannery, Shalteng, Srinagar, Kashmir.

Washing and bating:

The delimed sheep skins are washed in cold water for ½ hour, then given a warm water wash for 10 minutes and then taken for bating.

Bating:

(*Note:* All processes were carried out in small wooden vats as the drums available were too big.)

Warm water (at 35°C)	300%	} weight on delimed pelt	
Pancreol 3AS	equal parts		1½%
Pancreol 5AS			

The above are mixed well and the stock handled in this bath for 10 minutes and left overnight. Next day, the skins are taken out from the bath, washed in warm water at 35°C for 20 minutes and then scudded. The adhering flesh on the skin is scraped out.

Pickling:

Water	200%	} on delimed pelt weight	
Sulphuric acid	}		2%
sp. gr. 1.74			
Salt	8%		

The skins are handled in a tub containing the pickle bath and left overnight, taking care to spread the skins within the bath. Next day, the skins are taken out, checked for completion of pickling using bromophenol blue indicator and then piled over a wooden horse, the skins being spread flat and tight. The skins are kept piled for 3 days. Each day, a small quantity of the pickle liquor is poured over the skins to avoid their drying up. Then, the sammed and drained weight of the skins in the pickled stage is noted.

Degreasing:

The grease and fat in the skins are removed using kerosene.

Kerosene = 12½% on sammed weight.

Triton X-100 (Rohm & Haas Co.) } 1 to 1¼% on the weight
(Non-ionic emulsifier) } of kerosene.

The skins are dipped one by one in this mixture, kept for 15 minutes and the excess kerosene is squeezed out by hand; the fat comes out as a whitish emulsion. This operation is repeated thrice more. Since the bath would become very greasy, it is changed and another bath is made up as mentioned before. The skins are dipped in this one by one, the fat is squeezed out by hand and then the skins are left overnight in the same bath so as to remove the last traces of fat.

Next day, the skins are taken out and the excess fat is squeezed out. Now the skins are degreased (the bath is greasy).

Note: If not much grease is coming out in the second degreasing bath (as most of the fat is likely to be removed in the first bath itself), the quantity of kerosene used in the second degreasing bath can be reduced to half the quantity mentioned. 2. Also degreasing can be done in a drum, when the lot is bigger, using about 12½% to 20% of kerosene depending upon the fat content of the stock. The mixture and the stock can be put in the drum which is run for ¾ to 1 hour; most of the fat will be removed by this time.

Brine washing:

Note: Actually it is only a washing in water. Salt is used to depress the swelling as the stock is in a pickled condition.

The skins are dipped in a 10% solution of common salt in water; the stock is kept in this for ½ hour. The skins are taken out, squeezed to remove the salted out fat and taken for chrome tanning.

Preparation of chrome liquor:

Sodium dichromate (commercial)	5%	} since the acid is too dilute	} (on pelt weight)
Sulphuric acid (1.74 sp.gr.)	4½ to 6%		
Saw-dust (Local Safeda, Bodhulu saw-dust)	4%		
Hot water at 40°C	15%		

The dichromate, water and acid are mixed together and the moist saw-dust is added slowly. The mixture is stirred. After all the saw-dust has been added, it is kept overnight to allow the reaction to be completed.

Note: The saw dust-reduced liquor thus prepared was found to give a very light whitish leather.

Next day, the liquor is tested for completion of reduction. The chrome liquor thus prepared is kept for one day before use. It is filtered through gunny bag before using the same.

Chrome tanning:

In a tub are taken:

Water	=	300%
Common salt	=	5%

Half the quantity of chrome liquor is first fed in and mixed well. The degreased skins are put in and trampled for 10 minutes; the second half of the chrome liquor is now added and the skins handled for ½ hour and then piled grain to grain over a horse tightly stretched. Next day, the skins are again dipped in the chrome liquor, handled for 10 minutes and piled stretching well over a horse. In the afternoon, they are checked for completion of penetration. Then 1% sodium bicarbonate is added and mixed well; the skins are handled. pH of the bath is about 3.5. Then the skins are put back, handled for ½ hour and are then taken out and piled over a horse. Next day, ¼% soda bicarbonate is added and the skins handled for 4 hours. pH of the bath is 3.7. In the evening, they are taken out and piled. Next day, another ¼% soda bicarbonate is added (pH about 3.8). The skins are handled for 4 hours, taken out and piled over a horse, after carrying out the boiling test.

Note: Chrome tanning can also be done in a drum using 10% of B & C basic-chrome extract. The salt bath used can be the same as mentioned earlier. In this case, the chrome-tanning and basification upto a pH of 3.8 can be done over a period of 3 hours. After chrome tanning, the skins are taken out and piled over a horse.

The chrome tanned skins are kept piled over a horse for a day. Then they are taken from the pile, sammed and worked on the flesh side over a beam so as to remove any loose tissue on the adipose layer. Alternatively, the skins can be shaved on a shaving machine to level the substance. The shaved weight is noted.

The shaved skins are washed in cold water (500%) for 10 minutes in a tub. Then the water is changed and 1% soda bicarbonate dissolved in 500% float is added. The skins are left overnight in the same bath. Next day, the completion of neutralisation is tested using bromocresol purple. The cross-section should be blue.

The neutralised skins are put in a drum with 600% float of cold water; the drum is run for 10 minutes. Then the skins are washed in warm water (40°C) for 10 minutes, drained and dyed.

Dyeing:

Naphthalene leather brown 2DS	=	2% (on shaved weight)
Hot water at 45°C	=	250% -do-

The skins are first put in hot water; the drum is run for 2 minutes. The dye is dissolved separately in hot water (6 times the weight of dye) and the pH of this dye solution adjusted to 7 using ammonia. Then this dye solution is added to the drum in two instalments at 10 minutes interval. The drum is now run for 20 minutes. A small piece is cut from a skin and it is ensured that the dye has penetrated half the thickness of the skins.

Fatliquoring :

The fat liquor is prepared with

B.O.C. leather oil	.. 10%
Hot water	.. 50%

The oil is emulsified in hot water and the pH of the same is adjusted to 7.5 using acetic acid (since the pH of the emulsion would be initially above 10). Then the same is added in two instalments to the dye bath itself at 10 minutes interval. After the second addition, the drum is run for ½ hour. By this time, the dye would have almost completely penetrated. Then ¼% acetic acid (diluted four times) is added and the drum run for 10 minutes.

Retanning :

4% myrobalan extract powder is dissolved in 3 times its weight of water and the pH of the same is adjusted to 4.5 using soda bicarbonate. This is fed in one feed into the drum which is run for 45 minutes. The retanned skins are taken out and piled over a horse. Next day, they are fatliquored again with:

B.O.C. leather oil	.. 3½%
Castor oil	.. 1%
Hot water at 40°C	.. 400%

The oils are emulsified, the pH is adjusted to 7.5 and the skins are drummed for 30 minutes by which time, the whole of the fatliquor is taken up. The skins are taken out and hooked up to attain sammed condition. In the sammed state, they are oiled off on the grain with a mixture of:

Gingelly (til) oil	.. 1%
Glycerine	.. ½%
Tallow (soft)	.. ½%
Kerosene	.. ½%

The above are mixed well; the mixture is applied on the grain as a very thin light coat and allowed to dry slowly, the skins being put in an open room.

In the sammed condition, the skins are given a light staking. Then in order to effect a dry drumming action, the skins are beaten over a wooden horse for ½ hours, or the skins can be dry drummed for 2 hours for better effect. They are again given a good staking, shaved lightly on the flesh side; alternately a good buffing can be done. The skins are now taken for finishing.

Finishing :

The skins are lightly cleaned on the grain side with water and taken for finishing.

Season coat

Dark brown pigment	} in equal parts	.. 1 part
Black pigment		.. ¾ "
Black pigment		.. ¾ "
Primal S1 (Rohm & Haas Co.)		.. ¾ "
Primal B41 (-do-)		.. ¾ "
B.O.C. leather oil (Burmah Shell Co.)		.. ¼ "
Water		.. 8 parts

The season is mixed and filtered; one brush coat is applied and allowed to dry. Then the skins are staked well; the second coat is applied after adding 1 oz. (28.4 g) of formalin to the same. When the second coat is well dried, the skins are staked and fixed with:

10% casein solution	.. 1 part
Formalin	.. 1 "
Water	.. 6 parts

The above are mixed well and filtered. The fixing coat is applied with a soft cloth. The same can be sprayed as two light coats if a spray booth is available. This is found to produce reasonable good degree of fastness to wet-rubbing. Where greater water proofness is desired, a top spray can be given using a mixture of:

Spartan N.C. lacquer (Addison & Co.)	.. 1 part
Dibutyl phthalate	.. 0.02 "
Castor oil	.. 0.04 "
Spartan thinner (Addison & Co.)	.. 3.00 parts

Two top cross coats are sprayed. This gives greater water-proofness, on drying.

TECHNICAL SEMINARS

A rapid procedure for E.I. tanning*

BY

R. SELVARANGAN

Attempts have been repeatedly made to cut down the duration of East India tannage of skins. The process outlined hereunder is the result of investigations carried out at the Institute. For arriving at a quicker process, several variations in the procedure and durations employed in liming, deliming and tanning were tried:—(1) short and long liming; use of chemicals like sodium sulphide, sodium chloride, ammonium chloride, ammonium sulphate, calcium chloride; mode of liming, i.e., in a pit, paddle or drum; (2) deliming with lactic acid, boric acid, ammonium chloride, ammonium sulphate, bates; (3) effect of pretreatments like pickling and depickling; calgon pickling; chrome-lignin and syntan pretreatments; (4) use of wattle extract liquor or avaram liquor of strength varying from 4° to 100°Bk; tanning in a pit or drum and (5) effect of bleaching with syntan.

The stages in the recommended process are as follows:

1st day: Soaking, applying sulphide paste and leaving overnight.

2nd & 3rd days: Unhairing, pit liming.

4th day: Scudding, reliming.

5th day: Fleshing, scudding, weighing, deliming, pit tanning with spray dried wattle extract.

6th & 7th days: Tanning and then myrobing.

8th day: Fixing with Epsom salt, piling, oiling, samming.

9th day: Setting, drying, staking and trimming.

The duration of tanning has been reduced in the process to 9 days. The process has been tried successfully on a pilot scale in a commercial tannery at Madras. The number of pits required, the labour involved and the cost of auxiliaries used have been mini-

*Summary of the talk given on November 17, 1961.

mised. The yield, colour and feel and other qualities of the leather are quite comparable with those of the good quality E.I. tanned leather manufactured by traditional process and marketed.

Nonionic chrome tannage*

BY

D. RAMASWAMY

A method of preparation of 95-98% nonionic chrome liquor using calgon for masking is described wherein the anionic chrome complex was removed by ion exchange resin. The stability of such a liquor over a range of pH from 2.0-7.0 was studied. Decomposition was noticed only beyond a pH of 5.5. Tanning experiments showed maximum fixation of 5.4 g. Cr_2O_3 per 100 g. of hide substance at a pH of 3.5; a shrinkage temperature of 68°C only was obtained using pelt as the substrate. Studies on the mechanism of nonionic tannage with different substrates like modified collagen showed that the sites for fixation were possibly the side chain nonionic groups of collagen.

Technique of the manufacture of suede garment leather from E.I. skins**

BY

P. S. VENKATACHALAM

Good quality suede garment leather should drape well, possess good fastness to either washing or cleaning and a smooth velvety nap with a pronounced 'stroke'. In addition to the above properties, it should also be showerproof.

Great care should be taken in the processing of E.I. skins for garment suedes as each operation has its own effect in influencing the above mentioned properties in the final product. Both goats and sheep can be used. Sheep are of lighter weight and yield finer leathers that have a better nap, and 'drape.' The area yield per unit weight of E.I. sheep is also greater. Goats are more economical in price and less prone to defects. Levelling of the skins is best done at the end after finishing, by means of dry-splitting. If this is not possible, the skins can be dry-shaved at the 'pearl'

*Summary of the talk given on December 8, 1961.

**Summary of the talk given on December 29, 1961.

stage. Wetting and levelling are not recommended as the iron stains formed at this stage have to be bleached using sequestering agents that have an unfavourable effect on the dyeing later on. Stripping is necessary to ensure a supple feel in the final product. Besides, it helps to achieve greater fixation of chrome thereby leading to faster dyeings. Drastic stripping should be avoided as it results in a coarser nap and loss in area. Samming is next done to equalise and lower the pH of the stock in order that chrome tanning may proceed smoothly. Use of oxalic acid, calgon and 'bleach' type syntans should be avoided or cut down to the minimum as their use lessens the affinity of the chrome for anionic dyes.

In chrome tanning, a fixation of about 2.5% Cr_2O_3 on the dry weight of leather is attempted. As already pointed out higher fixation of chrome, though it helps in achieving fast dyeings, is not recommended as the area yield is less and the quality of the nap also suffers. In neutralising again, salts having anions of complexing ability are avoided. The fatliquor plays a major role in deciding the ultimate properties of the leather. It should leave the product extremely supple and at the same time nongreasy. It is very important that suppleness is not sacrificed for the sake of softness. Fish oil based compositions, while excellent from the point of view of feel, leave a residual odour. Vegetable fats leave the leather dry though lecithin is a notable exception. Sperm oil based liquors have proved the most satisfactory.

Loose toggle drying has much to be said in its favour as the area-yield is appreciably raised thereby. One should however take care to see that it does not lead to 'boardy' leather. Buffing is best done on the over-shot wheel, though the initial cut may be effected using the drum-type machine. Wet-grinding, if done after shaving would considerably help in cutting down the 'dry' buffing besides helping the correct assortment prior to colouring.

Wetting back is done using only ammonia. Dyeing is done with metallised dyes. (1:1) metal complex dyes are used for lighter shade with (1:2) dye topping for full shades. Cationic fixatives containing complexing metal atoms have been found to be the best after treatment agents. Chrome stearato-chloride is used for showerproofing suedes meant for washing and basic aluminium sulphate topping method for leathers that are to be solvent cleaned. Reactive dyes have better fastness to solvents. Whatever the dye used, repeated washing is necessary to remove unfixed dye and make the leather really fast to washing or cleaning.

TANNERS' CORNER

The Central Leather Research Institute has been since its inception rendering technical aid to the leather industry through answering technical enquiries on specific problems. The number of such enquiries has been increasing year by year. In order that the information contained in the replies to the technical enquiries may be made available to all those who have similar problems, this new feature "Tanners' Corner" is being inaugurated. Typical questions will be reproduced herein with the relevant answers. It is hoped that the industry will fully utilise this new feature and bring more and more of its problems for solution by this Institute.

Q. XI. (i) How are "liquid glue" and "pasting gum" prepared from hide glue? (ii) Due to increased pH (approximately 9) of the glue liquor arising from insufficient deliming, the jelly strength of hide glue goes down. What are the suitable additives for raising the same?

Answer: (i) *Liquid glue:* Liquid glue is generally made from fish offals. The method of preparation is more or less the same as that for hide glue except for the process of prolonged liming. Liquid glue may also be prepared from hide glue by treating the hide glue solution with suitable quantities of acetic, hydrochloric, formic, boric, nitric or salicylic acid. Addition of calcium chloride, calcium sulphate, urea and/or chloral hydrate is also sometimes made. Such additions result in loss of the gelatinising property, but the adhesiveness of the glue solution is retained. The exact amount of these additives will depend on the nature of the hide glue to which such additions are to be made as well as on the kind of resultant liquid glue that is desired. The exact quantity has to be fixed by experiment depending on the characteristics of both the starting and the resulting materials.

Pasting gum: Plastic glue may be used for pasting purposes. This is obtained by adding suitable quantity of glycerine to hide glue. Equal amounts of glycerine and glue may give a suitable product. For most commercial and household purposes, gums and pastes prepared from cellulose, starch, dextrin etc. are used now-a-days. Formulations incorporating suitable quantities of hide glue into these constituents, also are available.

(ii) There does not appear to be any additive suitable for increasing jelly strength of pure hide glue. Jelly strength is a property dependent on the history of the precursor as well as on the extracting conditions. Extraction on rather acid side is desirable and for this, suitable acid treatment during, and after deliming, if necessary, should be carried out. Jelly strength is an inherent property of glue and gelatine and it is not increased artificially by addition of other substances.

Q. XII. In resin finishing of goatskins, it is found that the finish does not fix well. A suitable process for the same may be given. (The formulation used consists of pigment, synthetic resin, T.R.O., glycerin and ammonia; clear lacquer is used for the final coat).

Answer: It has generally been found that the adhesion of resin finishes to leather can be improved by using a fairly dilute pad coat. This will aid the penetration of the finish into the grain and secure better anchorage. The details are given below:

Correct the grain with 240 grit paper followed by 320 grit paper. Then brush well and stain as follows:

½ part suitable basic dye.

1 part acetic acid.

Water to make 100 parts.

Brush stain with this and air off.

Composition for pad coat:

Pigment paste 1 part .. Resin emulsion 1.5 part.

Wax emulsion 0.1 part .. Water 6 parts.

Pad two coats with this.

Composition for spray coat:

Pigment paste 1 part .. Resin emulsion 1.2 parts

Casein 10% dispersion .. 0.3 part. .. Water 3 parts.

Spray two cross coats or until a good coverage is obtained. Air-off, hot plate and spray lacquer-top.

CLASSIFIED ABSTRACTS

Vegetable Tanning

Polymerisation of flavans. Part V. The stereochemistry of 2,3-trans-flavan-3,4-diols.

M. M. Bokadia, B. R. Brown, P. L. Kolker, C. W. Love, J. Newbould, G. A. Somerfield and P. M. Wood (Dyson Perrins Laboratory and Physical Chemistry Laboratory, Oxford University) *J. Chem. Soc.* 4663 (1961). The *cis*- or *trans*-arrangement of the hydroxyl groups in eight 2,3 *trans*-flavan-3,4-diol racemates has been established by consideration of their isopropylidene derivatives, their rates of reaction with lead tetra-acetate, and the proton magnetic resonance spectra of their diacetates. This necessitates a revision of the existing assignment of relative stereochemistry to the two racemates of 4'-methoxyl-6-methyl 2,3-*trans*-flavan-3,4-diol. The most convenient preparative method for the 2,3-*trans*-flavan-3,4-*cis*-diols makes use of the reduction of 3-hydroxy-2,3-*trans*-flavan-4-ones with a mixture of lithium aluminium hydride and aluminium chloride.

Plant polyphenols. 4. Hydroxycinnamic acid-sugar derivatives.

J. B. Harborne & J. Janet Corner (John Innes Institute, Hertford, Herts.) *Biochem. J.* 81, 242 (1961). Fifteen hydroxy cinnamic acid-sugar derivatives have been isolated from plants or produced by feeding plants with cinnamic acids. They are the glucose esters of cinnamic, *o*-, *m*- and *p*-coumaric, caffeic, ferulic, sinapic and 3:4:5-trimethoxycinnamic acid, caffeoyl and *o*-coumaroyl-gentiobiose, *p*-coumaroylrutinose and caffeic acid 3- and 4- β -glucoside. The remaining two cinnamic acid derivatives contain glucose and different unidentified residues. 1-*p*-Coumaroyl, 1-caffeoyl- and 1-feruloyl-glucose occur widely in the leaves and flowers of many plants. In contrast, caffeic acid 3-glucoside is known only in the berries of wild potato species. Free cinnamic acids, when fed to plants, are generally converted into the corresponding glucose esters. Caffeic acid is also converted in some plants into aesculin or scopolin or into a mixture of its 3- and 4- β -glucoside. The hydroxylation and methylation of cinnamic acids

has been observed *in vivo*. It is suggested that the simple hydroxycinnamic acid glucose esters may be important biosynthetic intermediates in plants.

Aromatic biosynthesis in higher plants. 2. Mode of attachment of shikimic acid and dehydroshikimic acid to dehydroshikimic reductase.

Doris Balinsky and D. D. Davies (Botany Department, University of London King's College, London) *Biochem. J.* **80**, 296 (1961). A number of aromatic and hydro-aromatic compounds of similar structure to the natural substrates of dehydroshikimic reductase, shikimic acid and dehydroshikimic acid, were examined for possible inhibition. Several of the compounds found to cause inhibition were examined further and were shown to inhibit competitively. The inhibitor constants for these competitive inhibitors were calculated. Since these compounds presumably inhibit by occupying the site normally serving for attachment of shikimic acid and dehydroshikimic acid, a theory of the mode of attachment of the substrates to the enzyme is discussed. It is suggested that shikimic acid and dehydroshikimic acid are attached to the enzyme by means of the carboxyl and 3- and 4- hydroxyl groups.

Aromatic biosynthesis in higher plants. 3. Preparation and properties of dehydroquinase.

Doris Balinsky and D. D. Davies (Botany Department, University of London King's College, London) *Biochem. J.* **80**, 300 (1961). An enzyme catalysing the interconversion of dehydroquinic acid and dehydroshikimic acid was extracted from cauliflower buds and purified 7.6-fold by ammonium sulphate fractionation. The enzyme was found to be active over a broad range of pH, with no marked peak between pH 7.0 and 9.0. The Michaelis constant for dehydroquinic acid at pH 7.4 was 61 μ M. The enzyme did not catalyse the dehydration of malate or citrate. No inhibition was observed by sulphhydryl reagents or by compounds related in structure to the natural substrates. There appeared to be no dialysable cofactor.

NOTES & NEWS

Council of Scientific & Industrial Research

Recruitment to the Pool for temporary placement of well qualified Indian Scientists and Technologists

The next bulk selection of candidates for the Scientists' Pool will be made shortly by the Council of Scientific & Industrial Research in consultation with the Union Public Service Commission. The Pool is intended primarily for the temporary placement of well qualified specialists returning from abroad until they are absorbed in suitable posts. Persons with Indian qualifications who have outstanding academic records are also eligible for appointment to the Pool.

Officers of the Pool will be ordinarily paid a salary between Rs. 400/- and Rs. 700/- per month, on the basis of qualifications and experience. In exceptional cases salary in excess of Rs. 700/- may also be offered with the prior approval of the Government of India.

Officers of the Pool will be attached or seconded to a Government Department, State Undertaking, National Laboratory, University, Scientific or Technical Institution, or such other organisation as the Council may decide.

All persons who have enrolled themselves in the Special Section (Indians Abroad) of the National Register of Scientific and Technical Personnel who have either returned to India or will be returning in 1962 will be considered automatically for appointment to the Pool and need not apply afresh. All such persons are however requested to furnish full and up-to-date particulars of qualifications, experience, employment status, address etc. All Indian Scientists and Technologists, trained or under training abroad, who have not enrolled themselves in the National Register so far and wish to be considered for appointment to the Pool should send immediately their full particulars in the form prescribed for registration in the National Register for Scientific and Technical Personnel. Such forms may be obtained from the Indian Missions abroad or from the Secretary, C.S.I.R. National Register Unit,

Council of Scientific and Industrial Research, Rafi Marg, New Delhi-1.

Persons with high Indian qualifications in Science, Engineering, Technology or Medicine who wish to be considered for appointment to the Pool should also send their particulars in the prescribed Form. Persons in employment in India should have their applications forwarded through their employers.

All applications should be addressed to the Secretary, Council of Scientific & Industrial Research (National Register Unit), Rafi Marg, New Delhi-1, and bear the superscription "Pool". They should be received by the Council on or before the 3rd March, 1962 (in the case of persons residing abroad on or before the 31st March, 1962.).

Popularisation of Science

Forming of Clubs in Schools Urged

A seminar organised by the Science Club of India under the auspices of the 49th session of the Indian Science Congress on popularisation of science in schools through the science club movement at Cuttack, in a resolution, urged the State Government and Universities to take active steps to ensure the formation of science clubs in every secondary school in the country by the offer of financial help, allocation of time in the school routine and suitable remuneration to the teachers in charge of the science clubs in schools.

Another resolution said that as public opinion must be created to foster scientific interest in the progressive industrialisation of the country, a National Science Museum at an all-India level and in every State, with dynamic demonstration models, might be permanently created for stimulating, propagating and disseminating scientific ideas throughout the country.

The Hindu: January 7, 1962.

C.L.R.I. NEWS

Seminar on Vegetable Tannins

A three-day seminar on "Vegetable Tannins" was held at the Central Leather Research Institute, Madras, from 21 to 23 January, 1962. The seminar was inaugurated by Prof. M. S. Thacker, Director-General of Scientific & Industrial Research, and Secretary, Ministry of Scientific Research & Cultural Affairs, at a function which had Shri M. Bhaktavatsalam, Minister for Home & Agriculture, Madras State, as the Chairman; the welcome address was by Dr. S. K. Barat, Chairman of the Seminar Committee and the vote of thanks by Dr. Y. Nayudamma, Director of the Central Leather Research Institute.

In his welcome address, Dr. Barat drew attention to the key role of Shri Bhaktavatsalam, who was also the Chairman of the Madras State Forest Advisory Board, in drawing up a very comprehensive scheme of farm forestry covering many of the tanning materials of commercial importance and also referred to how befitting it was that Prof. M. S. Thacker "the high priest of the modern temples of research" should inaugurate the Seminar.

In his inaugural address, Prof. Thacker made a reference to the Central Indian Medicinal Plants Organisation (CIMPO), which had been recently set up by the C.S.I.R. to act as a catalyst in the building up of cultivation of Indian medicinal plants. He said that the CIMPO would be quite happy to give financial aid for development of areas now growing these plants and also to bring new areas under cultivation; there were great potentialities for this type of development in the country. The Director-General took the opportunity to announce that realising the need for scientists and research workers to work unhampered by handicaps of a procedural character, the C.S.I.R. had decided to provide greater facilities and latitude to those engaged in certain fields. Addressing himself to Indian scientists and technologists returning after working abroad, Prof. Thacker exhorted them to continue their work with a spirit of application and devotion and to realise the economic disparity between the advanced foreign countries and their motherland.



Shri M. Bhaktavatsalam (centre) arriving for the inaugural function.



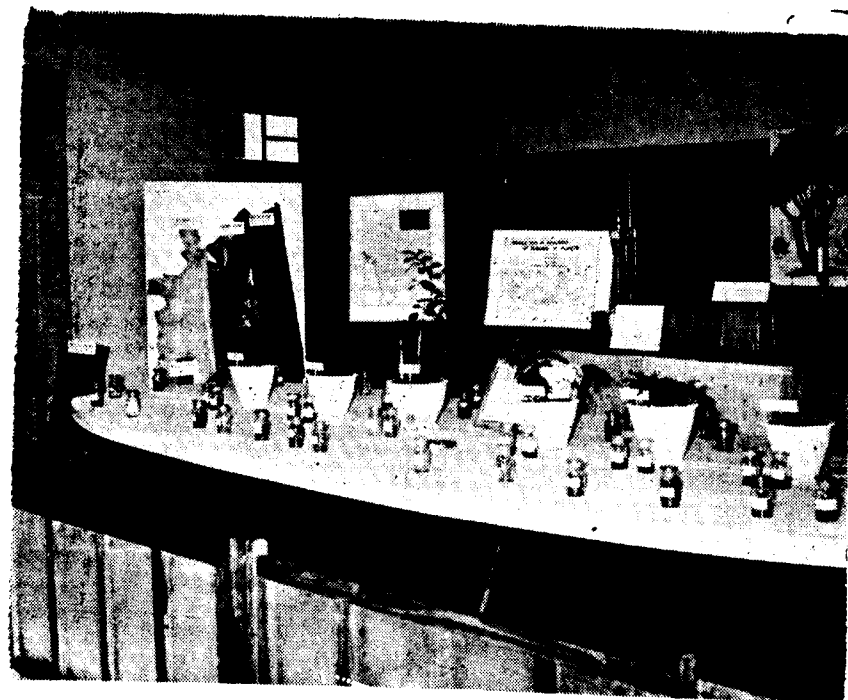
A view of the gathering at the inaugural function.

The Chairman, in his address, welcomed the offer of aid from CIMPO for cultivation of medicinal plants in suitable areas and assured all possible help from the Madras Government in this regard. The Minister also gave the assurance that the Forest Department of Madras State would extend the fullest cooperation to the C.L.R.I. in its work on vegetable tannins and tanning materials.

The scope of the seminar, which was the first of its kind in India, included consideration of the chemistry of tannins and their biogenesis in plants as well as that of the chemistry of vegetable tannage. Actually, of the seventeen papers received, ten were on the chemistry of tannins and related compounds (four of these dealt with biogenesis also); four were concerned with the chemistry of vegetable tannage; one related to the enzyme system present in indigenous tanning materials; the other two papers dwelt with the contiguous fields of cationised vegetable tannins and of retanning chrome leather with lignin sulphonic acid, a tanning material of vegetable origin, derived as a bye-product of the paper industry.

The papers were presented in the course of three technical sessions held on the forenoon and afternoon of January 22, and on the forenoon of January 23. The first two sessions which were devoted mainly to the chemistry and biogenesis of vegetable tannins were presided over respectively by Prof. O.Th. Schmidt of the Heidelberg University and Visiting Professor, Central Leather Research Institute, and Prof. T. R. Govindachari of the Presidency College, Madras; the third one in which the chemistry of vegetable tannage figured had Dr. Ing. K. Wolf, UNESCO Expert, Central Leather Research Institute, as the Chairman. Dr. K. S. G. Doss, Director, Central Electro-Chemical Research Institute, Prof. G. N. Ramachandran of the Physics Department, Madras University, Prof. S. Swaminathan of the Department of Organic Chemistry, Madras University, Prof. B. C. Guha of the Department of Applied Chemistry, University of Calcutta, Dr. J. S. Chaddha of the Delhi University as well as the staff of the Central Leather Research Institute, participated in the discussions.

The technical sessions began appropriately with the paper of Prof. O.Th. Schmidt of the Heidelberg University, the distinguished delegate from abroad, on myrobalan tannins. The Professor reported the isolation of three new components by the Heidelberg School, viz., terchebin, 1,2,3,4,6-pentagalloyl glucose and 1,3,6-



The Exhibition of indigenous tanning materials.



Prof. Thacker delivering the inaugural address.

trigalloyl glucose and presented an elegant picture of how the various polyphenolic components hitherto obtained from myrobalan nuts could be built up from the simple molecules gallic acid and glucose. The analogous paper from this Institute while confirming the presence in fresh myrobalan nuts and divi-divi pods, of some of the components reported earlier by Schmidt and co-workers, drew attention to the occurrence of the same in the leaves of the plants also—a point of biogenetic significance. The paper by Ramachandra Row touched upon the types of chemical compounds in the plants of the *Terminalia* species to which myrobalan belongs. Freudenberg's paper dealt with the hydroxyflavonols or catechins and the hydroxyflavandiols or leucoanthocyanidins of natural origin and discussed the mode of formation of flavonoid tannins from these. While Chaddha's paper listed the different leucoanthocyanidins isolated by Prof. Seshadri's school from various plant materials, a few of them containing tanning also, the second paper from the Institute gave an account of the leucoanthocyanidins and other polyphenolics isolated from the indigenous materials like babul, konnam, kodukkapuli and also arecanut. The note by Ramaswami brought out the difficulties in estimating the leucoanthocyanidins. The only paper of its kind in the seminar, Madhavakrishna's paper characterised the essential groups and terminal amino acids of tannase from divi-divi pods. The Russian papers which were available only as abstracts related to investigations on the phenolic components of tea leaves.

The papers on the chemistry of vegetable tannage evoked considerable discussion. Rao's paper represented the first attempt at studying myrobalan tannage in the light knowledge about the components of the tannin extract, paper chromatographic analysis of the exhaust liquor being the analytical technique used. Prof. Gustavson concluded that his studies of the comparative resistance of vegetable tannin irreversibly fixed by collagen and a modified type of polyamide to reagents like 8M urea and phenol appeared to indicate hydrogen bonding reactions between vegetable tannins and collagen to be governing the fixation of tannins—a point reinforced by his studies on the effect of addition of urea to the vegetable tanning bath, with tanning periods of the order of several weeks. Interactions due to dipolar forces of the π -electron type could not be proved to occur. Scaria's paper discussed the changes in isoelectric point of leathers tanned individually with myrobalan, avaram, babul and goran in relation to the degree of tannin fixation, pH of tanning, the water solubles content and shrinkage temperature.



Prof. Schmidt speaking at the At Home to the delegates.



Prof. Guha delivering
the B. M. Das Memorial Lecture

Shri Sampath receiving
the B. M. Das Memorial Prize.

Vago's paper recapitulated three methods for cationising vegetable tanstuffs and also the applications for these cationised materials. Siddiqui and Sykes reported, pending large scale investigations, that alkali lignin, freshly precipitated by acidification and then dispersed with a relatively low molecular weight syntan, was preferable as a retanning/filling agent for chrome tanned leather.

The Chairman of the third session, in his concluding remarks, said that the time had come now for the leather scientist and technologist to sit together and to correlate and evaluate mutually the results obtained in their respective fields. The seminar concluded with summing up by Dr. V. S. Padmanabhan and a vote of thanks by Dr. Barat.

An exhibition of the various indigenous tanning materials was got up on the occasion.

Social:

The delegates to the seminar were entertained to a delightful luncheon by Shri Vasantalal Harilal, Director, Shree Laxmi Chemicals & Industries Private Ltd., Kharagpur on January 21, 1962.

The staff of the Central Leather Research Institute were "At Home" to the delegates to the seminar on the evening of January 22, 1962. Prof. O.Th. Schmidt was the Chief Guest and Dr. Ing. Kurt Wolf presided on the occasion. Prof. T. R. Govindachari welcomed the gathering. Shri S. Sankaran of the Tanners' and Leathers Traders' Association, spoke on behalf of the industry, Dr. V. S. Padmanabhan proposed a vote of thanks.

The seminar in retrospect:

Seminars of the kind provide opportunities and common platforms for bringing up-to-date one's knowledge in a particular field and to compare notes with one another. From this view point, it could be modestly claimed that the seminar has been fruitful for it has projected the results achieved at the Institute against the background of knowledge gained from analogous studies elsewhere. However, the most significant feature of the seminar was the presence and participation of Prof. Schmidt.

The pièce de résistance of the seminar would be naturally the paper by the Visiting Professor which had a value not only on account of the stature of the author but also because of the results reported. The participants in the seminar had the privilege of hearing Prof. Schmidt report on the isolation of three new com-



Group photo of the delegates and members of the Seminar Committee.



(Left to right) Dr. Wolf, Prof. Schmidt and Prof. Govindachari who presided over the technical sessions.

Prof. Schmidt presenting his paper.

pounds—the two oligogalloyl glucoses and terchebin. The significance of these lies in that they are believed to be present in myrobalans as such and not to be formed by degradation or secondary processes and that it has become possible to give an elegant picture as to how starting from glucose and gallic acid, the array of substances isolated by the Heidelberg School, is formed. Thanks to the recent work of Haslam *et al.* on synthesis of gallic acid from glucose, the path of biosynthesis of myrobalan tannins would appear to be fully known. Also the three new compounds amount to 60% of the phenolic extract of myrobalans; this coupled with the earlier work of the Heidelberg School would make it appear that the study of myrobalan tannins would soon become a complete chapter. The newly obtained results are of special significance vis-a-vis the studies carried out at this Institute which have confirmed the presence of some of the earlier reported components in the leaves and fresh nuts also; confirmation of the new components in these parts would be of great value. Also since the ellagi-tannins of divi-divi are closely similar to those of myrobalans, Prof. Schmidt's results form a good jumping off ground for studies on this plant also.

The papers by Freudenberg, Roux and Chaddha and the one from this Institute mark the steady progress made in the chemistry of flavonoid tannins particularly that of flavan-3:4-diols. The possible alternative modes of formation of condensed tannins from the flavan-3:4-diols as well as hydroxyflavans have been put down; however, the various stages in the condensation of these have to be elucidated with due consideration to the possibility of one or more of the flavonoid compounds figuring in the condensation. In view of the prolific occurrence of the leucoanthocyanins in the plant kingdom, greater attention has to be bestowed on those occurring in tanniferous trees. Also a species-by-species survey of these trees, on the lines of Bate-Smith's work, for the various flavonoids would be of great value. Here then is a rich field for investigation by the purely academic centres of research. A suitable method for the quantitative estimation of leucoanthocyanidins in the presence of tannins would be of great help in this connection.

The session on the chemistry or rather the mechanism of vegetable tannage brought out the complexities yet to be unravelled and the need for further work. Experiments on the lines indicated in the paper from this Institute, evaluating the roles of the individual tannin components would go a long way in shedding



Prof. Thacker inaugurating the C.L.R.I. Club House.



A view of the C.L.R.I. Club House.

more light. However, herein due allowance must be made for the "mob behaviour" of the tannin components which may not be just a sum of the effects due to the individual components. Also as pointed out by Dr. Wolf in his concluding remarks, there arises the necessity for a substrate capable of faithfully reflecting the changes occurring in tanning hide or skin. In other words, complete knowledge about vegetable tannage rests on complete knowledge about the two systems participating therein.

In conclusion, it may be said that the field of vegetable tannins and tannage beckons to tannin chemists, lignin chemists carbohydrate chemists, plant taxonomists and colloid chemists for a coordinated approach.

Prof. B. M. Das Memorial Function

The occasion of the seminar was utilised for holding the First Memorial Function in revered memory of the late lamented Prof. B. M. Das, the First Director of the Central Leather Research Institute. Prof. M. S. Thacker presided over the function which was held on the afternoon of January 21, 1962, and distributed the B. M. Das Memorial Prizes. Prof. B. C. Guha of the Department of Applied Chemistry, University of Calcutta, delivered the First B. M. Das Memorial Lecture on "Protein synthesis". Earlier, Dr. S. K. Barat, Chairman, B. M. Das Memorial Fund Committee, welcomed the gathering. Dr. V. S. Padmanabhan, Secretary of the Committee, proposed a vote of thanks.

In his address, Prof. Thacker said that they had gathered that afternoon in memory of "one whom we cherish and one who inspired this Institute and the work in the Institute", which had achieved a significant place of service. He recalled his unveiling of the portrait of the late Prof. Das on October 12, 1960 and reminisced on his first contact with him as also his later association in the C.S.I.R. Prof. Thacker referred to Prof. Guha as one "who has been most distinguished in his work as a scientist both nationally and internationally and one who had the same character and nobleness of devotion" as the late Prof. Das.

Prof. Guha, at the outset, associated himself with the sentiments expressed by Prof. Thacker about Prof. Das. In his memorial lecture on the synthesis of proteins, he stressed the key role of the nucleic acids and reviewed some of the latest developments in the field.

To perpetuate the memory of the late Prof. Das, the Prof. B. M. Das Memorial Fund Committee formed at the Central Leather Research Institute has instituted a Memorial Lecture and two Memorial Prizes to be awarded every year, one to the best student in the Diploma course in leather technology and the other to the best student in the Degree course, the institutions conducting the respective courses being considered in alphabetical rotation for deciding the prize winners. The prizes for the year 1961 were donated by Dr. Y. Nayudamma, Director, Central Leather Research Institute. The Diploma prize was awarded to Shri Vilas Ramesh Gagade of the Government Tanning Institute, Bombay and the Degree prize to Shri S. Sampath of the A.C. College of Technology, Madras.

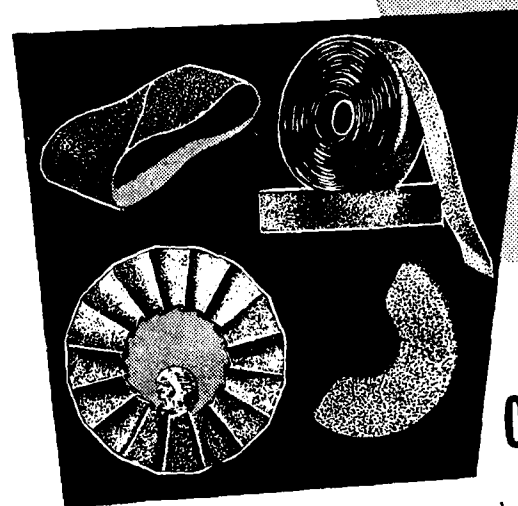
C.L.R.I. NEWS

Dr. Y. Nayudamma, Director, attended the meeting of the Ad Hoc Leather Board of the Govt. of Andhra Pradesh, on Jan. 30 & 31, 1962.

Dr. S. K. Barat, Assistant Director, attended the meeting of the Panel for Salt and Marine Products CDC 25 : PC of the Indian Standards Institution at Bhavanagar, on Jan. 30, 1962.

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சென்ட்ரல் லெதர் ரிசர்ச் இன்ஸ்டிடியூட் புல்லட்டின்
இணைப்பு ஏடு, பிப்ரவரி, 1962.

“பை” முறையில் பதனிடுதல் (Bag Tanning)
பை முறையில் பதனிட்டுக் காலணி அடித்தோல்
தயாரித்தல்

(முறை மேம்பாடு செய்யப்பட்டது.)

எஸ். பி. கோஷ், டபிள்யூ. என். பாண்டவ், ஏ. கணேசன்

கச்சாப் பொருள் :

ஒவ்வொன்றும் சுமார் 23 கி. கிராம் (50 ராத்தல்) எடை
கொண்ட எருமை உப்புத் தோல்கள் எடுத்துக் கொள்ளப்
பட்டன.

1-ம் நாள் :—நனைவு.

தோலிலுள்ள அதிகப்படியான உப்பு, அழுக்கு முதலிய
வற்றை அகற்றுவதற்காக, சுத்தமான தண்ணீர் கொண்ட
ஒரு குழியில் இவை 5 நிமிடங்களுக்கு அரக்கிக் கழுவப்படு
கின்றன. பின்னர் போதிய அளவு தண்ணீர் நிரம்பிய ஒரு
குழியில் 6 மணி நேரத்திற்கு நனைத்து வைக்கப்படுகின்றன.
பிறகு மறுபடியும் வேறு ஒரு குழியில் 10 நிமிடத்திற்கு அரக்
கிக் கழுவப்படுகின்றன. இதன் பிறகு இவை பாளங்க
ளாக்கப்பட்டு, வடிய வைக்கப்பட்டு, நனைவு எடை கணக்
கிடப்படுகிறது.

முடி நீக்கும் பூச்சுப் பூசுதல் :

பின்வரும் அளவில் கீழ்க்கண்டவாறு ஒரு பூச்சுத்
தயாரிக்கப்படுகிறது.

(இது முதல் சல்லா சீவும் வரை கொடுக்கப்பட்டுள்ள
அளவுகள் 100 கி. கிராம் நனைவுத்தோல் எடைக்குக் கணக்
கிடப்பட்டது)

சோடியம் சல்பைடு (Sodium Sulphide)	1½ கி. கிராம்
தாளித்த சுண்ணாம்பு	5 ”
தண்ணீர்	15 ”

முதலில் ஒரு பாணியில் கொஞ்சம் தண்ணீர் நிரப்பப்
பட்டுக் கொதிக்க வைக்கப்படுகிறது. இதில் சோடியம்
சல்பைடு தூளாக்கப்பட்டுக் கரைக்கப்படுகிறது. பின்னர்
தாளித்த சுண்ணாம்பு இத்துடன் கலக்கப்பட்டு, தண்ணீரும்

உடன் கலக்கப்பட்டு, முடி நீக்கும் மருந்துப் பூச்சுத் தயாரித் துக் கொள்ளப்படுகிறது.

பாளங்கள் தரையில் பட்டறையாக விடப்பட்டு, முடி நீக்கும் மருந்துப் பூச்சு பாளங்களின் மேனிப்பக்கமும் சவ்வுப்பக்கமும் பூசப்படுகிறது. பூச்சுப் பூசப்பட்ட பாளங் கள் மடிக்கப்பட்டு, பட்டறையாக இரவு முழுதும் விட்டு வைக்கப்படுகின்றன. பட்டறையைக் கோணி கொண்டு மூடி வைக்க வேண்டும்.

2-ம் நாள் :—பாளங்கள் வழக்கம் போல் முடி தள்ளப்படுகின் றன. பின்னர் ஒரு குழியில் நனைவு எடை யைப் போல் 4 பங்கு தண்ணீர் நிரப்பப்படு கிறது. அதில் 5 கி. கிராம் தாளித்த சுண் ணம்பு கலக்கப்பட்டுப் பாளங்கள் இச்சண் ணம்புத் தண்ணீரில் போடப்படுகின்றன. இவை பலதடவை குழி திருப்பப்பட்டு இரவு முழுதும் விட்டுவைக்கப்படுகின்றன.

3, 4-ம் நாட்கள் : குழி திருப்பப்படுகின்றன.

5-ம் நாள் :—பாளங்கள் சல்லா சீவப்பட்டுக் கார் வாங்கப்படு கின்றன. சல்லா எடை கணக்கிடப்படுகிறது. பின்னர் இவை ஒரு குழியில் இரண்டு தடவை தண்ணீர் மாற்றப்பட்டுக் கழுவப்படுகின்றன. மறுபடி இவை நன்றாகக் கார் வாங்கப்பட்டு, மற்றொரு தரம் 10 நிமிடங்களுக்குக் கழுவப் படுகின்றன.

சுண்ணம்பு நீக்கம் (இளங்காரம்) :

(இது முதல் முறை முடியும் வரை கொடுக்கப்பட்டுள்ள அளவுகள் 100 கி. கிராம் சல்லா எடைக்குக் கணக்கிடப் பட்டவையாகும்.)

மறு சுண்ணாம்பிடப்பட்ட பாளங்கள் பின்வருமாறு சுண்ணாம்பு நீக்கப்படுகின்றன. ஒரு குழியில் சல்லா எடை யைப்போல் 1½ பங்கு தண்ணீர் நிரப்பப்படுகிறது. அதில் 1 கி. கிராம் அமோனியம் சல்பேட் (Ammonium sulphate) கலக்கப்படுகிறது. பாளங்கள் இக்குழியில் போடப்பட்டு ½ மணி நேரத்திற்குப் புரட்டப்படுகின்றன. பின்னர் இவை இரவு முழுதும் இக்குழியிலேயே விட்டுவைக்கப்படுகின்றன.

முதல் பட்டைத் தண்ணீர் தயாரித்தல் :

மறுநாள் உபயோகத்திற்காக முதல் பட்டைத் தண்ணீர் இன்றே தயாரிக்கப்படுகிறது. கருவேலம் பட்டைத்தூளும், தூள் கடுக்காயும் 3 : 1 என்ற விகிதத்தில் கலக்கப்படு கின்றன. இக்கலவையில் 150 கி. கிராம் எடுத்துக் கொள்ளப் படுகிறது. இதில் ½ பாகம் தண்ணீரில் ஊற வைக்கப்பட்டு

முதல் பட்டைத் தண்ணீர் தயாரிக்கப்படுகிறது. மீதி ½ பாகம் பதனிடு வேலைக்காகச் சேமித்து வைக்கப்படுகிறது.

6-ம் நாள் :—பாளங்கள் சுண்ணாம்பு நீக்கக் (இளங்காரம்) குழியில் ½ மணி நேரத்திற்குப் புரட்டி விடப் படுகின்றன. கனமான தோலின் கனமான பகுதியிலிருந்து ஒரு சிறு துண்டு வெட்டி எடுத்து, பிளாத்தின் அல்லது மஞ்சள் தூள் உபயோகித்து, சுண்ணாம்பு நீக்கத்தின் அள வைப் பரிசோதிக்க வேண்டும். மேனிப்பக்கத் திலிருந்து ½ பாகமும் சவ்வுப் பக்கத்தி லிருந்து ½ பாகமும் சுண்ணாம்பு நீக்கம் நடைபெற்றிருந்தால் போதுமானது. பாளங் கள் பின்னர் கார் வாங்கப்பட்டு, ஒரு குழியில் 10 நிமிடங்களுக்குக் கழுவப்படுகின்றன.

முதல் பட்டை : (நிறமூட்டுதல் = மால்னி)

ஒரு குழியில் 12° வீரயமுள்ள முதல் பட்டைத் தண்ணீர் நிரப்பப்படுகிறது. இக்குழியில் பாளங்கள் விடப்பட்டு, 2 மணி நேரத்திற்குப் புரட்டி விடப்படுகின்றன. பின்னர் இரவு முழுதும் இவை இக்குழியிலேயே விட்டு வைக்கப்படு கின்றன. முதல் பட்டைத் தண்ணீர் தயாரிக்கப் பயன் பட்ட கருவேலம் பட்டை - தூள் கடுக்காய் இவைகளின் சக்கை இக்குழியில் மேலாகத் தூவப்படுகிறது.

7-ம் நாள் :—பாளங்கள் 2 மணி நேரத்திற்குப் புரட்டி விடப் பட்டு, இரவு முழுதும் இக்குழியிலேயே விட்டு வைக்கப்படுகின்றன.

8-ம் நாள் :—பாளங்கள் 2 மணி நேரத்திற்குப் புரட்டி விடப் பட்டு, இரவு முழுதும் இக்குழியிலேயே விட்டு வைக்கப்படுகின்றன.

முதல் பட்டைத் தண்ணீர் தயாரிக்கப் பயன்பட்டது போக மீதி உள்ள ½ பாகம் கருவேலம் பட்டை-தூள் கடுக் காய்க் கலவை இன்று தண்ணீரில் ஊற வைக்கப்பட்டு, மறுநாள் பதனிடு திரவம் தயாரிக்கப்படுகிறது. (இப்பதனிடு திரவம் மறுநாள் உபயோகிக்கப்படுகிறது. இத்துடன் கருவே லம் பட்டை-தூள் கடுக்காய் இவற்றின் சக்கையும் உபயோ கிக்கப்படுகிறது. பதனிடு திரவம் தயாரிப்பதற்கு வேண்டிய குழி (லீச்சிங் பிட்) இல்லாவிட்டால் முன்பே உபயோகிக்கப் பட்ட, வீர்யம் குறைவான, பழைய பதனிடு திரவத்தை கருவேலம் பட்டை-தூள் கடுக்காய் கலவையுடன் பைகளில் நிரப்பலாம். பதனிடு வேலை முடிவடைந்ததும் உபயோகிக் கப்பட்ட பொருள்களின் சக்கை முதல் பட்டைத் தண்ணீர் தயாரிக்கப் பயன்படுத்தப்படலாம்.)

9-ம் நாள் :—முதல் பட்டைத் தண்ணீரிலிருந்து பாளங்கள் வெளியே எடுக்கப்பட்டு, பையாகத் தைக்கப் பட்டு, ஒரு குழியின்மேல் காலையில் கட்டித்

தொங்கவிடப்படுகின்றன. கருவேலம்பட்டை-
தூள் கடுக்காய் இவைகளின் சக்கை பைகளில்
நிரப்பப்பட்டு, இவைகளிலிருந்து தயாரிக்கப்
பட்ட பதனிடு திரவம் பைகளில் நிரப்பப்படு
கிறது. பையிலிருந்து அடியிலிருக்கும் குழிக்
குள் வடியும் பதனிடு திரவம் அவ்வப்போது
மறுபடி பைகளில் நிரப்பப்படுகிறது. பைகளில்
ஊற்றப்படும் பதனிடு திரவத்தின் வீர்யம்
13°—14° ஆகும்.

10-ம் நாள்:—குழியில் வடியும் பதனிடு திரவம் மறுபடியும்
பைகளில் நிரப்பப்பட்டு பதனிடு வேலை
தொடர்ந்து செய்யப்படுகிறது.

11-ம் நாள்:—தொங்கிக் கொண்டிருக்கும் பைகளின் நடுவில்
கயிற்றால் கட்டவேண்டும். பிறகு இவை தலை
கீழாகத் தொங்கவிடப்படுகின்றன. இதன்
மூலம் தோலின் நடுப்பகுதிகள் நன்றாகப்
பதனிடப்படும். 9 மணி நேரத்திற்குப் பிறகு
கயிறுகள் அவிழ்க்கப்படுகின்றன. திரவமும்
கருவேலம் பட்டை-தூள் கடுக்காய் இவை
களின் சக்கையும் குழியில் வடிந்துவிடும்.

12-ம் நாள்:—குழியில் வடிந்த பதனிடு திரவம் மறுபடி
பைகளில் நிரப்பப்பட்டு, பதனிடு வேலை
தொடர்ந்து செய்யப்படுகிறது.

13-ம் நாள்:—பைகள் இன்று பிரிக்கப்பட்டு, பாளங்கள் கீழே
உள்ள குழியிலேயே இரவு முழுதும் விட்டு
வைக்கப்படுகின்றன.

14-ம் நாள்:—பாளங்கள் நன்கு தேய்த்துக் கழுவப்பட்டுப்
பட்டறையாக விடப்படுகின்றன. தண்ணீர்
வடிந்த பிறகு மொத்தம் 1 கி. கிராம் இருக்கு
மாறு சரிபாதி ஆளிவிதை எண்ணெயும்,
ஆமணக்கெண்ணெயும் கலக்கப்பட்டு,
பாளங்களின் மேனிப்பக்கத்தில் தடவப்பட்டுப்
பட்டறையாக விடப்படுகின்றன. மாணியில்
சுருக்கம் (தாண) தள்ளும் பதத்திற்குக் காய்
மாறு தொங்க விடப்படுகின்றன.

15-ம் நாள்:—இரண்டு தடவை (தாண) தள்ளப்பட்டு, பாளங்
கள் காய வைக்கப்படுகின்றன.

குறிப்பு:—1 சேர் ஒப்பனை செய்யப்பட்ட தோலுக்குத்
தேவையான ரசாயனப் பொருள்களின் விலை 0.56 நயா
பைசாவாகும்.

இம்முறையில் கிடைத்த ஒப்பனைத் தோல் 46—50%
ஆகும்.

1 சேர் தோலுக்கு 2½ சேர் தாவரப் பதனிடு பொருள்கள்
தேவைப்படும்.

செய்திக் கதிர்

சேமிப்புக் கிடங்குகளிலிருந்து ஈரப்பசையை
அகற்றுதல்

தோல் சாமான்களும், காலணிகளும் ஈரப்பசைமிகுந்த
கிடங்குகளில் சேமித்து வைக்கப்படுவதால் பாதிக்கப்படு
கின்றன என்பதை அனைவரும் அறிவர். சேமிப்பு அறை
களில் ஈரப்பசை இருப்பதோடு, போதிய அளவு காற்றோட்ட
மும் இல்லாவிட்டால், தோல் சாமான்கள், காலணிகள்
ஆகியவை பூஞ்சுக் காளான்களின் தாக்குதலுக்கு இலக்கா
கின்றன. இப்பூஞ்சுக் காளான்களின் தாக்குதலால் தோல்
சாமான்கள் எடுப்பான தோற்றத்தை இழக்கின்றன. மேலும்
இவற்றில் நிலையான கறைகளும் ஏற்படுகின்றன.

சமீபத்தில் பூச்சு வேலை நடைபெற்ற கட்டடங்களில்
ஈரப்பசை மிகுந்திருக்கும். கூரையில் உள்ள வெடிப்பினி
ருந்து நீர் கசிவது அல்லது அறையில் உள்ள குழாயில் நீர்
கசிவது முதலியவையும் ஒரு அறையில் ஈரப்பசை மிகுவதற்
குக் காரணங்களாகும்.

இந்நிலையில் அறையைச் சூடு செய்து அதன் மூலம்
ஈரப்பசையைப் போக்குவதுதான் பலரும் மேற்கொள்ளும்
வழியாகும். இது அப்போதைக்குப் பலன் அளித்தாலும்
பின்பு சூடும், அதிக ஈரப்பசையும் ஒன்றாகி, பூஞ்சுக் காளான்
களின் தாக்குதலுக்கு ஏற்ற சிறந்த சூழ்நிலையை உண்டாக்கு
கின்றன. சூடு செய்வதன் மூலம் அறையிலுள்ள ஈரப்பசை
கின்றன. சூடு செய்வதன் மூலம் அறையில் சூடான காற்று
உடனே வெளியே போகவும், வெளியிலுள்ள காற்று
உள்ளே வரவும் வசதி இருக்க வேண்டும். இதன் மூலம்
சூடான ஈரப்பசை மிகுந்த காற்று எவ்வளவு சீக்கிரம்
முடியுமோ அவ்வளவு சீக்கிரம் வெளியேற்றப்படுகிறது. இம்
மாதிரி அறையைச் சூடாக்கி, ஈரப்பசையை அகற்ற முற்படு
கையில், அங்கு சேமிப்பில் வைக்கப்பட்டுள்ள சாமான்கள்
யாவும் முதலிலேயே அப்புறப்படுத்தப்பட வேண்டும்.

விஞ்ஞான முறைப்படி, குளிர் பாதுகாப்பு வசதி மூலம்
(Refrigeration) இப்பிரச்சினை தற்போது தீர்க்கப்பட வழி
கோலப்பட்டுள்ளது. சாதாரணமாக வீடுகளில் உபயோகப்

படுத்தப்படும் குளிர்பாதுகாப்புப் பெட்டி (Refrigerator) மிகக் குறைவான உஷ்ண நிலைக்கு (dew point) குளிர்விக்கப் பட்டால் காற்றிலுள்ள ஈரப்பதை அப்பெட்டியின் மேல் தண்ணீர்த்துளிகளாகப் படிவதை நாம் பார்த்திருக்கிறோம். இதை அடிப்படையாகக் கொண்டு, 'கிரின்ஹாம் எக்விப் மெண்ட் லிமிடெட்' நிலையத்தார் 'ட்ரெம்பாத் இண்டஸ்ட்ரியல் டிஹ்யூமிடிபையர்' (Trembath Industrial Dehumidifier) என்ற சாதனத்தை வகுத்துள்ளனர்.

இச்சாதனத்தை எளிதில் தூக்கிச் செல்லலாம். இதில் $\frac{1}{2}$ குதிரைச் சக்தி (Horse power) கொண்ட, காற்றிலுள்ள நீராவியை திரவமாக்கும் யூனிட் (Condensing unit) ஒன்றும், அறையிலுள்ள காற்றை, காற்றைத் திரவமாக்கும் சாதனத்தின் மீது வீசச்செய்யும் 12" விட்டமுள்ள ஒரு மின் விசிறியும் அமைக்கப்பட்டுள்ளன. இவ்வாறு நீராவி தண்ணீராக மாறியதும் இதில் அமைக்கப்பட்டுள்ள தொட்டி ஒன்றில் போய் விழுகிறது. நீண்ட நேரம் இச்சாதனம் வேலை செய்து அதிக அளவு தண்ணீரை உற்பத்தி செய்தால் அதை ஒரு இயந்திரத்தின் மூலம் இறைத்து சாக் கடைக்கு அனுப்புவதற்கும் வழி செய்யப்பட்டிருக்கிறது.

மேலும் இச்சாதனத்தில் ஹீட்டர் ஒன்றும் அமைந்துள்ளது. இது 3000 வாட் மின்சாரத்தால் இயங்குகிறது. அறையின் வெப்பநிலை 55° பாரன்ஹீட்டாக நிலையாக இருக்குமாறு இந்த ஹீட்டர் செயலாற்றுகிறது.

காலணி விற்பனை நிலையங்களில் உள்ள பாதாளக் கிடங்குகளில் பொருத்தப்பட்ட இச்சாதனம் காற்றிலிருந்து 24 மணி நேரத்தில் 5 காலன் தண்ணீரை அகற்றுகிறது என்று கூறப்படுகிறது.

உலகக் கால்நடை எண்ணிக்கையில் குறைவு

1960-ம் ஆண்டை விட 1961-ல் உலகக் கால்நடைகளின் எண்ணிக்கை 4 மில்லியன் குறைந்திருக்கிறது. 1961-ம் ஆண்டுத் துவக்கத்தில் உலகில் மொத்தம் 976,000,000 கால்நடைகள் இருந்ததாகக் கணக்கிடப்பட்டுள்ளது. 1960-ம் ஆண்டை விட இது குறைவாயினும், 1951-55 ஆண்டுகளுக்கான சராசரியை விட 15% அதிகமாகும். 1951-55 ஆண்டுகளுக்கான சராசரி 848,000,000 ஆகும்.

உலகில் கால்நடைகள் அதிகம் காணப்படும் பகுதிகளில் சில இடங்களில் வரட்சி ஏற்பட்டது இக்குறைவுக்குக் காரணம் ஆகும். கால்நடைகளின் எண்ணிக்கை வட

அமெரிக்காவில் 1 சதவீதத்திற்கும் குறைவாகவும், ரஷ்யாவில் சுமார் 2 சதவீதமும் குறைந்தது. ரஷ்யாவில் கால்நடைகளின் எண்ணிக்கை குறைவது சமீப காலத்தில் இது தான் முதல் தடவையாகும். தென்கிழக்கு ஆசிய நாடுகளிலும், சைனாவிலும் சுமார் 3 சதவீதம் குறைந்தது. ஆடுகளின் எண்ணிக்கைக் குறைவே இங்கு இக்குறைவுக்குக் காரணமாகும். ஐரோப்பாவில் 1 சதவீதமும், தென் அமெரிக்காவில் 1 சதவீதத்திற்குக் குறைவாகவும் எண்ணிக்கை அதிகமாயிற்று.

ஆதாரம்—லெதர் மான்யுபாக்சரர், ஜூலை 61.

பதனிடுவதற்கு உபயோகப்படும் தாவரங்களும் அவற்றின் உபயோகமும்

நம் நாட்டில் தோல் பதனிடுவதற்குப் பயன்படும் தாவரங்கள் பல உள். அத்தகைய தாவரங்களின் பட்டை, இலை, காய் முதலியன பதனிடு உபயோகிக்கப்படுகின்றன. இவைகளைத் தனியாகவோ அல்லது கலவையாகவோ பதனிடு உபயோகிக்கலாம். நம் நாட்டில் காணப்படும் தாவரப் பதனிடு பொருள்களில் எவை எவை சிறந்தவை, அவை எங்கு கிடைக்கின்றன முதலியவற்றைக் கீழே கொடுக்கப்பட்ட அட்டவணியில் காணலாம். இப்பதனிடு பொருள்களின் ரசாயன-பௌதிக குணங்களையும் இவற்றின் உபயோகங்களையும் இப்போது காண்போம்.

கடுக்காய், திவிதிவி, தாவா ஆகியவை 'பைரோகலால்' (Pyrogallol) இனத்தைச் சார்ந்தவை. கடுக்காயில் குறைந்த வலிமை கொண்ட அமிலம் போதுமான அளவு இருக்கிறது. இது 'காடசால்' (Catechol) இனத்தைச் சேர்ந்த பதனிடு பொருள்களால் பதனிடிப்பட்ட தோல்களை வெளுக்க உபயோகிக்கப்படுகிறது. 'காடசால்' இனப் பதனிடு பொருள்களுடன் கலந்து இதைப் பதனிடு உபயோகிக்கலாம். சில சமயங்களில் கடுக்காய்க்கு பதிலாக திவிதிவி, தாவா இவற்றை உபயோகிக்கலாம்.

வாட்டில் 'காடசால்' இனத்தைச் சேர்ந்தது ஆகும். இது ஓரளவு நல்ல துவர்ப்புள்ளது. இதில் குறைந்த வலிமை கொண்ட அமிலங்களும், உப்பும், குறைவாக உள்ளது. 'காடசால்' இனத்தைச் சேர்ந்த 'மாங்க்ரோவ்', கரடா, ஹோபியா, கொடுக்காய்புளி, சவுக்கு ஆகியவைகளின் ரசாயன-பௌதிக குணங்கள் வாட்டில் போலவே உள்ளன. இவைகளை ஆட்டுத் தோல்களைப் பதனிடு உபயோகிக்கலாம். இவற்றை ஆவாரம் பட்டை, கருவேலம் பட்டை இவற்றுடன் கலந்து மாட்டுத் தோல்களைப் பதனிடு உபயோகிக்கலாம்.

கருவேலம் 'காடசால்' இனத்தைச் சார்ந்தது. இது துவர்ப்புக் குறைவானது. இதில் அமிலங்கள் குறைவு. ஆனால் உப்புக்கள் அதிகம். 'காடசால்' இனத்தைச் சேர்ந்த வாகை, இயல்வாகை ஆகியவைகளை இதற்குப் பதிலாக உபயோகிக்கலாம்.

ஆவாரம் வீர்யம் குறைந்த 'காடசால்' இனத்தைச் சேர்ந்தது. இதில் உப்புக்கள் உள்ளன. இது அமில-கார வலிமையை ஒரு நிலையில் நிறுத்துவதற்கு பயன்படுகிறது. கொன்னம், வெள்வேல் ஆகியவை இதற்குப் பதிலாக உபயோகப் படுத்தப்படலாம்.

நிலையச் செய்திகள்

தாவரப் பதனிடு சத்துக்கள் பற்றிய கருத்தரங்கம்

(Seminar on Vegetable Tannins)

தாவரப் பதனிடு சத்துக்கள் பற்றிய முன்று நாள் 'கருத்தரங்கம்' ஒன்று சென்ற ஜனவரி மாதம் 21-ம் தேதி முதல் 23-ம் தேதி வரை இந்நிலையத்தில் நடைபெற்றது. விஞ்ஞான, தொழில் ஆராய்ச்சியின் டைரக்டர் ஜெனரலும், விஞ்ஞான ஆராய்ச்சி, கலாசார அமைச்சின் காரியதரிசியுமான பேராசிரியர் எம். எஸ். தாகர் அவர்கள் கருத்தரங்கத் தைத் துவக்கி வைத்தார்கள். சென்னை விவசாய, உள்துறை அமைச்சர் கனம் எம். பக்தவத்சலம் அவர்கள் தலைமை தாங்கினார்கள். கருத்தரங்கக் குழுவின் தலைவர் டாக்டர் எஸ். கே. பாரத் அவர்கள் அனைவரையும் வரவேற்றுப் பேசினார்கள். நிலையத்தின் டைரக்டர் டாக்டர் ஓய். நாயுடம்மா அவர்கள் நன்றி உரை வழங்கினார்கள்.

டாக்டர் பாரத் தமது வரவேற்பு உரையில், தாவரப் பதனிடு பொருள்களுக்கு முக்கியம் அளித்து அதைக் காடுகளில் வளர்ப்பதற்கு ஊக்கமளித்து வருவதும், சென்னை காட்டு இலாகாவின் ஆலோசனைக் குழுவின் தலைவருமாக விளங்கும் ஸ்ரீ பக்தவத்சலம் அவர்கள் இக்கருத்தரங்கிற்குத் தலைமை வகிப்பதன் பொருத்தத்தை எடுத்துக் கூறினார்.

பேராசிரியர் தாகர் அவர்கள் தமது துவக்க உரையில் இந்திய மருந்துச் செடிகளின் வளர்ச்சிக்காக, விஞ்ஞான-தொழில் ஆராய்ச்சிக் கழகத்தின் (CSIR) ஆதரவில் இந்திய மருந்துச் செடிகளுக்கான மத்திய நிறுவனத்தைப் பற்றி (Central Indian Medical plants organisation) குறிப்பிட்டு, இந்நிறுவனம் இம்மருந்துச் செடிகளை ஏற்கனவே வளர்த்து வருவோருக்கும், புதிதாக மருந்துச் செடிகள் பயிரிட்டு வளர்ப்போருக்கும் பண உதவி அளிக்கும் என்றும் கூறினார். அவர் மேலும் பேசுகையில் விஞ்ஞானிகளும், ஆராய்ச்சி யாளர்களும், தங்கு தடையின்றி ஆராய்ச்சிகளை மேற்கொள்ளுவதற்கென பல துறைகளிலும் அவர்களுக்கு இன்னும் அதிக வசதிகள் செய்து தரப்படும் என்றும் கூறினார். வெளி நாடுகளில் ஆராய்ச்சி முடிவுக்குப் பின் இந்தியாவிற்குத் திரும்பும் விஞ்ஞானிகள்-ஆராய்ச்சியாளர்கள் பற்றிக்

குறிப்பிடுகையில், அவர்கள் தங்கள் ஆராய்ச்சிகளில் ஊக்கம் தளராது உழைப்பதோடு, தாய்நாட்டிற்கும் இதர நாடுகளுக்கும் இடையே உள்ள பொருளாதார வேற்றுமையை உணர வேண்டும் என்றும் கேட்டுக் கொண்டார்.

ஸ்ரீ பக்தவத்சலம் அவர்கள் தலைமை உரை ஆற்றும் போது 'சிம்போ' (Cimpo) நிறுவனம் மருந்துச் செடிகள் பயிரிடுவதற்கு உதவி அளிக்க முன்வந்தது குறித்துப் பாராட்டுகளைத் தெரிவித்து, சென்னை அரசாங்கம் இத்துறையில் தன்னால் இயன்ற எல்லா உதவிகளையும் அளிக்குமென்று கூறினார். அவர் மேலும் பேசுகையில் தாவரப் பதனிடு பொருள்கள், தாவரப் பதனிடு சத்துக்கள் ஆகியவை பற்றி இந்நிலையம் செய்து வரும் வேலைகளுக்கு, காட்டுவள இலாகா முழு ஒத்துழைப்பையும் தரும் என்றும் கூறினார்.

இந்தியாவில் இக்கருத்தரங்கம் நடைபெற்றது இது தான் முதல் தடவையாகும். இக்கருத்தரங்கத்தின் நோக்கம் தாவரப்பதனிடு சத்துக்கள், அவைகளை உபயோகித்துப் பதனிடுதல் ஆகியவற்றின் ரசாயனங்கள் பற்றியும், தாவரங்களின் உயிர்த்தொழுகள் (Biogenesis) பற்றியும் விவாதிப்பதே யாகும்.

இக்கருத்தரங்கத்தில் மொத்தம் 17 ஆராய்ச்சிக் கட்டுரைகள் சமர்ப்பிக்கப்பட்டன. அவற்றுள் 10 கட்டுரைகள் தாவரப்பதனிடு சத்துக்களின் ரசாயனம் பற்றியும், 4 கட்டுரைகள் தாவரப் பதனிடுதலின் ரசாயனம் பற்றியும், ஒரு கட்டுரை தாவரப் பதனிடு பொருள்களில் உள்ள என்சைம்கள் (enzymes) பற்றியும், மற்ற இரு கட்டுரைகள் காகிதத் தொழிலில் உடன் விளைபொருளாகக் கிடைக்கும் லிக்னின் சல்பானிக் அமிலத்தை (lignin sulphonic acid) உபயோகித்து குரோம் தோல்களை மறுபதனிடுவது பற்றியும் எடுத்துக் கூறின.

மேற்கூறிய ஆராய்ச்சிக் கட்டுரைகள் மொத்தம் மூன்று கூட்டங்களில் சமர்ப்பிக்கப்பட்டன. முதல் இரண்டு கூட்டங்கள் ஜனவரி 22-ம் தேதியும், 3-ம் கூட்டம் ஜனவரி 23-ம் தேதி காலைமீதும் நடைபெற்றன.

முதல்கூட்டத்திற்கு ஹைடல்பர்க் பல்கலைக் கழகத்தைச் சேர்ந்த பேராசிரியர் டாக்டர் ஓ. டி. ஷ்மிட் அவர்களும், 2-ம் கூட்டத்திற்கு சென்னை மாநிலக் கல்லூரிப் பேராசிரியர் டி. ஆர். கோவிந்தாச்சாரி அவர்களும், 3-ம் கூட்டத்திற்கு 'யுனெஸ்கோ' வல்லுனர் டாக்டர் 'வுல்ப்' அவர்களும் தலைமை தாங்கினர். முதல் இரண்டு கூட்டங்களிலும் முக்கியமாக தாவரப் பதனிடு சத்துக்களின் ரசாயனம்,

உயிர்த்தொழுகள் பற்றிய கட்டுரைகள் விவாதிக்கப்பட்டன. 3-ம் கூட்டத்தில் தாவரப் பதனிடுவதன் ரசாயனம் பற்றி விவாதிக்கப்பட்டது.

இக்கருத்தரங்கில் காரைக்குடியில் அமைந்துள்ள மத்திய மின்சார-ரசாயன ஆராய்ச்சி நிலையத்தின் டைரக்டர் டாக்டர் கே. எஸ். தாஸ் அவர்களும், சென்னைப் பல்கலைக் கழகத்தின் பௌதிகப் பேராசிரியர் ஜி. என். ராமச்சந்திரன் அவர்களும், 'ஆர்கானிக் கெமிஸ்ட்ரி' பேராசிரியர் எஸ். சுவாமிநாதன் அவர்களும், கல்கத்தா பல்கலைக் கழகத்தின் அப்பிளாடு கெமிஸ்ட்ரிப் பேராசிரியர் பி.ஸி. குஹா அவர்களும், டெல்லி பல்கலைக் கழகத்தைச் சார்ந்த டாக்டர் கே. எஸ். சட்டா அவர்களும், மற்றும் இந்நிலைய ஆராய்ச்சியாளர்களும் பங்கெடுத்துக் கொண்டனர்.

கருத்தரங்கத்தில் முதலாவதாக பேராசிரியர் ஓ. டி. ஷ்மிட், 'கடுக்காய் பதனிடு சத்துக்கள்' (Myrobalan tan-nins) பற்றிய தமது கட்டுரையைச் சமர்ப்பித்தார். தமது கட்டுரையைச் சமர்ப்பித்துப் பேசுகையில், ஹைடல்பர்க் ஆராய்ச்சி நிலையம் 'டெர்செபின்' (terchebin), 1, 2, 3, 4, 6- 'பெண்டா கலாயில் க்ளுகோஸ்' (pentagalloyl glucose), 1, 3, 6- 'ட்ரைகலாயில் க்ளுகோஸ்' (trigalloyl glucose) ஆகிய மூன்று புதிய பொருள்களைத் தனிப்படுத்தியிருப்பதாகக் கூறினார். அவர் மேலும் விளக்குகையில் கடுக்காய்க் கொட்டையிலிருந்து இதுவரை பெறப்பட்ட 'பாலிபினோலிக்' பொருள்கள் (polyphenolic components) எங்ஙனம் சாதாரண காலிக் அமிலம் (gallic acid) க்ளுகோஸ் ஆகியவற்றிலிருந்து உண்டாகலாம் என்பதை எடுத்துக் காட்டினார்.

பேராசிரியர் ஷ்மிட் அவர்களின் கட்டுரையை ஒட்டியதாக இந்நிலையத்திலிருந்து சமர்ப்பிக்கப்பட்ட ஆராய்ச்சிக் கட்டுரை, பேராசிரியர் ஷ்மிட்டும் அவரது துணை ஆராய்ச்சியாளர்களும், உலர்ந்த கடுக்காய்க் கொட்டைகள், இங்க் காய்கள் (திவிதிவி) ஆகியவற்றில் இருப்பதாகக் கூறிய பொருள்கள் பச்சைக் கொட்டைகள் அல்லது காய்களிலும் இருப்பதை உறுதிப்படுத்தியதோடு, அவை மேற்கூறிய தாவரங்களின் இலைகளிலும் காணப்படுவதை எடுத்துக் காட்டியது.

டாக்டர் ராமச்சந்திரராவ் அவர்களின் கட்டுரையில் 'டெர்மினோலியா' இனத்தைச் சார்ந்த தாவரங்களின் ரசாயனப் பொருள்கள் பற்றி எடுத்துக் கூறப்பட்டிருந்தது.

பேராசிரியர் ஃப்ரெய்ட்ன்பர்க் அவர்களின் கட்டுரையில் 'ஹைட்ராக்ஸிப்ளா வனோன்கள்' (hydroxyflavonols) அல்லது

‘கேட்டசின்கள்’ (catechins) பற்றியும், ‘ஹைட்ராக்ஸிப்ளா வண்டியால்கள்’ (hydroxyflavandiols) அல்லது ‘ல்யூகோ ஆன்தோசயானிடின்சு’ (leucoanthocyanidins) பற்றியும், இவற்றிலிருந்து ‘ப்ளவனாயிட்’ பதனிடு சத்துக்கள் அமைக்கப்படும் விதம் பற்றியும் விவாதிக்கப்பட்டிருந்தது.

டாக்டர் சட்டா அவர்களின் கட்டுரையில் பேராசிரியர் சேஷாத்திரி அவரது மாணவர்களால் பல்வேறு தாவரப் பொருள்களிலிருந்து தனியாக்கப்பட்ட வெவ்வேறு ‘ல்யூகோ ஆன்தோசயானிடின்சு’ பற்றி விளக்கப்பட்டிருந்தது. இந்த நிலையத்தின் 2-ம் கட்டுரையில் கருவேலம், கொன்றை, கொடுக்காய்ப்புளி, பாக்கு ஆகியவற்றிலிருந்து தனியாக்கப்பட்ட ‘ல்யூகோஆன்தோசயானிடின்சு’ மற்றும் ‘பாலிபினலிக்குன்’ பற்றி எடுத்துக் கூறப்பட்டிருந்தது.

டாக்டர் ராமசாமி அவர்கள் தமது குறிப்பில் ‘ல்யூகோ ஆன்தோசயானிடின்சுகளை’ அளவிடுவதில் உள்ள இடையூறுகளை எடுத்துக்கூறியிருந்தார்.

ஸ்ரீ மாதவ கிருஷ்ண அவர்கள் கட்டுரை திவிதிவி காய்களில் உள்ள ‘டேனேஸ்’ (Tannase) என்ற என்சைமின் ரசாயனங்கள் பற்றி எடுத்துக் கூறும் வகையில் அமைந்திருந்தது.

ரஷ்யாவிலிருந்து வந்த இரண்டு கட்டுரைச் சுருக்கங்களில் 12 இலையில் உள்ள பினாலிக் பகுதிப் பொருள்கள் பற்றிய ஆராய்ச்சிகளைப் பற்றிய குறிப்புகள் இடம் பெற்றிருந்தன.

தாவரப் பதனிடுதலின் ரசாயனம்பற்றி அதிகமாக விவாதிக்கப்பட்டது. ஸ்ரீ ராவ் அவர்களின் கட்டுரை கடுக்காய் உபயோகித்துப் பதனிடுவது பற்றிக் கூறியது. ஸ்ரீ ஸ்கரியா அவர்களின் கட்டுரையில் கடுக்காய், ஆவாரம், வேல், கோரன் முதலியவைகளைத் தனித்தனியே உபயோகித்துப் பதனிடிப்பட்ட தோல்களின் வேறுபாடுகள், எவ்வளவு பதனிடுபொருள் தோலில் ஊறியது, அமில வலிமை எண் என்ன, சுருங்கும் உஷ்ணம், தண்ணீரில் கரையும் பொருள்களின் அளவு இவற்றை அடிப்படையாகக் கொண்டு விளக்கப்பட்டது. டாக்டர் வாகோவின் கட்டுரையில் தாவரப் பதனிடு பொருள்களில் உள்ள நேர்மின் அணுக்களை எதிர்மின் அணுக்களாக மாற்றுவதற்கு மூன்று வழிகள் கொடுக்கப்பட்டதுடன், இவ்வாறு மாற்றப்பட்ட பொருள்களுக்கு உபயோகங்களும் கொடுக்கப்பட்டிருந்தன.

மூன்றாவது கூட்டத்தின் முடிவில் அதன் தலைவர் தமது முடிவுரையில் தோல் விஞ்ஞானிகளும், தொழில்

நுணுக்க வல்லுனர்களும் ஒன்றுசூடி, தங்கள் தங்கள் வேலையில் கண்ட முடிவுகள் பற்றி விவாதித்து ஒரு முகமான தொடர்பு கொள்ள வேண்டுமென்று வலியுறுத்தினார். டாக்டர் வி. எஸ். பத்மனாபன் அவர்கள் கருத்தரங்க விவாதங்கள் பற்றிச் சுருக்கமாக எடுத்துக் கூறினார். டாக்டர் பாரத் அவர்கள் நன்றி தெரிவித்தார்.

இக்கருத்தரங்கத்தில் கலந்துகொண்ட பிரதிநிதிகளுக்கு கரக்பூர் ‘ஸ்ரீ லக்ஷ்மி கெமிகல்ஸ் அண்டு இண்டஸ்டிரிஸ் பிரைவேட் லிமிடெட்’ என்ற நிறுவனத்தின் டைரக்டர் ஸ்ரீ வசந்தலால் ஹரிலால் அவர்கள் ஜனவரி 21-ம் தேதி அன்று ஒரு விருந்தளித்தார். இந்தநிலைய ஊழியர்கள் மேற் கூறிய கருத்தரங்கப் பிரதிநிதிகளுக்கு ஒரு தேனீர் விருந்தளித்தனர். இவ்விருந்திற்கு டாக்டர் ஓ. டி. ஷமிட் அவர்கள் முக்கிய விருந்தாளியாக இருந்தார். டாக்டர் வல்ப் அவர்கள் தலைமை தாங்கினார். பேராசிரியர் டி. ஆர். கோவிந்தாசாரி அவர்கள் அனைவரையும்வரவேற்றார். தோல் தொழிலில் ஈடுபட்டோர் சார்பில், பதனிடுவோர்—தோல் வியாபாரிகள் சங்கத்தின் காரியதரிசி ஸ்ரீ எஸ். சங்கரன் அவர்கள் சில வார்த்தைகள் கூறினார்கள். டாக்டர் வி. எஸ். பத்மனாபன் நன்றி வழங்கினார்.

இத்தகைய கருத்தரங்கங்களின் மூலம் தான் ஆராய்ச்சியில் ஈடுபட்டோர் அனைவரும் விஞ்ஞான ஆராய்ச்சியின் இன்றைய முன்னேற்றங்களை அறிய இயலும். இதை நோக்கமாகக் கொண்டு பார்த்தால் இந்நிலையத்தில் நடைபெற்ற கருத்தரங்கம் ஓரளவு வெற்றி பெற்றதென்றே கூறலாம். இதன் மூலம் இந்நிலையத்தில் இத்துறையில் மேற்கொள்ளப்பட்ட ஆராய்ச்சிகளின் மூலம் கிடைத்த முடிவுகளை இதே துறையில் ஈடுபட்ட மற்றையோருடனும் பிற நாட்டவருடைய முடிவுகளோடும் வைக்க முடிந்தது. எல்லாவற்றிலும் இக்கருத்தரங்குக்குப் பெருமை அளித்தது பேராசிரியர் டாக்டர் ஓ. டி. ஷமிட் அவர்கள் இதில் பங்கு கொண்டதே ஆகும். இக்கருத்தரங்கில் பங்கு கொண்டவர்கள் ஸ்ரீ ஷமிட் அவர்களின் ஆராய்ச்சி முடிவுகள் பற்றி அவர் வாயிலாகவே கேட்கும் வாய்ப்புப் பெற்றனர். இவருடைய கடுக்காய் பற்றிய ஆராய்ச்சி முடிவுகள் அது போன்ற வேறு பதனிடு பொருள்களையும் ஆராய்வதற்கு வாய்ப்பளிக்கும் என்பதில் ஐயமில்லை.

பேராசிரியர் பி. எம். தாஸ் நினைவு விழா

இந்நிலையத்தின் டைரக்டராக விளங்கிக் காலஞ் சென்ற பேராசிரியர் பி. எம். தாஸ் அவர்களின் நினைவைப் போற்றும் வகையில் அன்னார் பெயரில் ஓர் நினைவுச் சொற்பொழிவு இவ்வாண்டு துவக்கப்பட்டது. இது ஆண்டுதோறும் நடைபெறும் ஓர் நிகழ்ச்சியாக விளங்கும். இவ்விழாவுக்குப் பேராசிரியர் எம். எஸ். தாகர் அவர்கள் தலைமை தாங்கினார். டாக்டர் எஸ். கே. பாரத் அவர்கள் வரவேற்பு நல்கினார்.

பேராசிரியர் தாகர் அவர்கள் பேசுகையில் பேராசிரியர் தாஸ் அவர்களின் சலியா உழைப்பையும், தோல் தொழில் வளர்ச்சியில் அவருக்கிருந்த ஈடுபாட்டையும் பற்றி எடுத்துரைத்தார்.

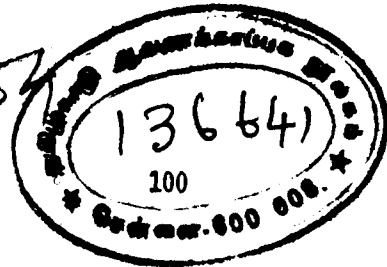
நினைவுச் சொற்பொழிவாற்றிய பேராசிரியர் பி. எஸ். குஹா (கல்கத்தா பல்கலைக் கழகம்) அவர்கள் பேராசிரியர் தாஸ் அவர்கள் பற்றி பேராசிரியர் தாகர் அவர்கள் கூறியதை ஆமோதித்தார். பின்னர் புரதங்களின் தொகுப்பு (protein synthesis) பற்றிப் பேசுகையில் நியூக்லிக் அமிலங்களின் (Nucleic acid) முக்கியமான வேலைகளை எடுத்துக் கூறி இத்துறையில் ஏற்பட்டுள்ள முன்னேற்றங்கள் பற்றியும் எடுத்துரைத்தார்.

டாக்டர் வி. எஸ். பத்மனாபன் அவர்கள் நன்றி கூறினார்.

ஆந்திரப் பிரதேசத்தின் லெதர் போர்டின் கூட்டத்தில், இந்நிலைய டைரக்டர், டாக்டர். ஓய். நாயுடம்மா அவர்கள் சென்ற ஜனவரி மாதம் 30-31 ம் தேதிகளில் கலந்து கொண்டார்.

பவநகரில் இந்தியத்தரக் கணிப்பு நிலையத்தால் ஏற்பாடு செய்யப்பட்டிருந்த உப்பு-கடல் விளைபொருள்கள் பற்றிய கூட்டத்தில் இந்நிலைய உதவி டைரக்டர், டாக்டர். எஸ். கே. பாரத் அவர்கள் கலந்து கொண்டார்கள்.

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