THE VANASPATI INDUSTRY

A Historical Review

A.C.Chhatrapati

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BOMBAY
POPULAR PRAKASHAN

POPULAR PRAKASHAN PRIVATE LIMITED
35-C, Pandit Madan Mohan Malaviya Marg
Opp. "Roche", Tardeo, Bombay 400034

First published, 1985

(3322)

PRINTED IN INDIA

by Gidson Printing Works, C-130, Mayapuri Industrial Area, Phase II, New Delhi 110064 and published by RAMDAS BHATKAL for Popular Prakashan Pvt. Ltd., 35-C, Pandit Madan Mohan Malaviya Marg, Popular Press Bldg., Tardeo, Bombay 400034

ERRATUM

Page No.	Table No.	Correction
61	9.1	From December 1948 under Zone 'D' zonal freight Rs. 30
78	9.8	May 1968 Oil base for vanaspati price West Zone Rs. 2683
79	9.8	July 1968 Vanaspati price per tonne South Zone Rs. 3226
80	9.8	October 25, 1968 North & East together 'no change'
81	9.8	June 23, 1969 4 kg price West Zone Rs. 21.69
85	9.8	June 1, 1971 Vanaspati price per tonne Zone 'C' Rs. 6321
86	9.8	June 1, 1974 Vanaspati price for 2 kg Zone 'A' Rs. 16.56
98	10.1	In South Zone for Andhra Pradesh licensed capacity in 1978 52800 tonnes
98	10.1	In East Zone for West Bengal licensed capacity in 1970 126414 tonnes
98	10.1	

	1967	**1970**	**1978**	**1983**
East Zone Total:	1,21,212	1,53,414	1,73,100	2,33,100
West Zone:				
Gujarat	51,000	70,500	97,500	1,62,000
Maharashtra	1,77,939	2,50,210	2,59,350	2,59,350
Madhya Pradesh	18,600	39,000	54,000	97,500
West Zone Total:	2,47,539	3.59,710	4,10,850	5,18,850
All India Total:	6,61,154	9,76,425	12,63,075	15,57,225

144	2	Vanaspati production in 1973 East Zone 55395

THE VANASPATI INDUSTRY

To

My

Wife KUSUM

Daughter ASMI

Son MANAN

Preface

THE VANASPATI INDUSTRY is the second largest food processing industry—next only to sugar. It is over 55 years old of which more than 40 have been under a maze of controls. Yet there are few published studies on this industry.

The object of this book is to provide a historical account of the industry as known to the author who was witness to most of the developments in the industry over the last 33 years. It is thus in the nature of personal commentary rather than a scientific analysis. To help future students of such studies an attempt has been made to include all available facts and figures.

On reflection on events in the industry one cannot but help conclude that industrial policy making in the country remains largely an ad hoc affair, national commitment to rational economic planning notwithstanding. The principal influence on policy making is the personal attitude of the minister in charge and the political milieu in which he functions. Next in importance is the opinion of the key officials framing the policy. Under planning their primary concern should be healthy growth of the industry under their charge. But in day to day policy making this rarely figures as a consideration. Their sole concern appears to be a tight rein on the industry. Attending unending meetings and disposing files leave little time to think of pros and cons, particularly in long term measures they are considering.

Industry is rarely consulted in advance of the declaration of policy. It is left with the only option of lobbying for amendment of the declared policy to iron out difficulties of compliance. Retracing even imprudent steps entails loss of face for policy makers. Hence redressal of genuine grievances can hardly be in full measure. If industry seeks out loopholes to mitigate rigors of the controls, its public image is tarnished through political criticism. And bureaucrats get busy imposing more controls to plug such loopholes. In the prevailing social belief that 'profit is sin' industry attempting to create public opinion against oppressive controls can evoke little sympathy.

A planned mixed economy needs a constructive cooperative relationship between government and industry to achieve goals of development. Instead we are a witness to the spectacle of gendarme controllers and errant industries playing roles of adversaries.

Another aspect of policy making is the fragmented thinking which persists in considering vanaspati as a distinct industry instead of a segment of the vegetable oil industry. Oil refining and hydrogenation are to oil production what bleaching, dyeing and printing are to cloth. The latter are part and parcel of the textile industry. But hydrogenated oil or vanaspati is sought to

be treated as a distinct industry capable of being disciplined in disregard of the trends in oil. Results of such attempts have been largely infructuous. But in Government policy precedence dies hard.

A system of controls evolved over years gathers lot of deadwood. It is a source of harassment and corruption and often a positive hindrance to innovations. A well intentioned government keen on liberalisation of controls may succeed in removing them in respect of a few industries in crisis but inertia of the vast bureaucracy is too strong to achieve a clean sweep in respect of all industries. One must await a revolution for such a clean sweep. Till then industry can only hope for relaxation at the hands of a dynamic forward looking bureaucrat—a rare breed these days.

In the interest of healthy growth of industry it is imperative that there should be regular, say every five years, independent evaluation of controls by outside experts. And Government should make a commitment to remove obsolete and ineffective controls and modify those that are necessary, but in the existing form needlessly restrictive.

Bombay
September 18, 1985

A.C. CHHATRAPATI

Acknowledgement

THE AUTHOR is grateful to The Vanaspati Manufacturers' Association of India for permission to use information available in its records. The views expressed in the book are only of the author and not of the Association. The author acknowledges with thanks the suggestions made by Mr. R. Gopalakrishnan and the assistance of Miss Radha, secretary, for typing and collating the information required for the book.

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1

What is Vanaspati?

VANASPATI means vegetation in the Sanskrit-based Indian languages. But since the late 1940's it has come to denote hydrogenated edible oil, known earlier as vegetable ghee.

So far no worldwide common name has been found for the hydrogenated edible oil used in cooking and as shortening—as in the case of other products of technological innovations such as radio, rayon, nylon. In North America it is known as shortening, a word derived from its prime usage property. In the U.K. it is known as compound cooking fat. However, the substitute for butter produced from hydrogenated oil is universally known as margarine. The laws, however, affecting vanaspati in general continue to refer to it as a vegetable oil product.

The outcome of the process of hydrogenation of vegetable oils is, perhaps, one of the most important result-oriented research products of the last century. Europeans traditionally consumed animal fats—butter and lard—and also olive oil as on the Mediterranean Coast. But after the Industrial Revolution the population of Europe increased rapidly, and their living standards rose. Consequently fat consumption nearly quadrupled in the second half of the last century. Production of butter, based on only about 5 per cent of fat in milk, could not keep pace with the demand. The rise in demand for lard was met increasingly through imports of beef tallow from the U.S.A.

To mitigate the shortage of butter, attempts were made to convert beef fat into a butter like spread. In France, Mege Mourier first produced such a butter substitute in 1869 and named it margarine, meaning pearl like. Soon its production spread to Germany and Italy (1870), Netherlands (1871) and Denmark (1883). Imports of beef tallow and lard from the U.S.A. increased substantially to meet the raw material needs of the new margarine industry. The supply of these fats, however, could not keep pace with the fast growing demand since they too were by-products of the animal slaughter industry for meat.

Industrial chemists had begun to research for a process that would convert liquid vegetable oils into solid fats. The difference between liquid or unsaturated glycerides of fatty acids and solid or saturated glycerides of fatty acids was in the content of hydrogen in their molecules. In 1897 Paul Sebatier discovered that nickel catalyst facilitated absorption of hydrogen by

unsaturated organic materials. In 1903 Normann invented the process of hydrogenating fatty oils in liquid phase; and the potentialities of producing cheap butter like fat from the easily expandable tropical vegetable oil resources like coconut, groundnut, cottonseed became a reality. In 1911 Proctor and Gamble Company of the United States of America first placed hydrogenated cottonseed oil shortening in the market.

Besides margarine or butter substitute, the hydrogenation of unsaturated oils helped to meet the growing need of cooking fat like lard or edible tallow and also the valuable solid fats for industries like soap. The process of hydrogenation helped to upgrade poor quality oils like marine oils into acceptable food and industrial fats.

The process of hydrogenation requires liquid oil, hydrogen gas and nickel catalyst to come together at a suitable temperature and pressure. In a pressure vessel called autoclave, hydrogen is dissolved in oil and brought in contact with the catalyst through agitation. The rate of hydrogenation depends upon the nature of the oil, the temperature, the pressure, the activity of the catalyst, the concentration of the catalyst and the rate at which hydrogen and unsaturated oil molecules reach the active catalyst surface.

Primarily hydrogenation is a means of converting liquid oils into semi solid plastic fats. Hydrogenation decreases iodine value, increases molecular weight, raises melting point, enhances oxidative stability and reduces colour of the fat.

The manufacture of hydrogenated oils entails subjecting raw oils to the process of refining, bleaching, hydrogenation, post-refining and deodorisation.

The process of refining consists of degumming by heat and water treatment, with or without addition of chemicals such as mineral acids. The object is to remove gums or resinous compounds and mucilaginous substances. Groundnut oil that contains a very small quantity of such matter does not need degumming. But soyabean and ricebran oils do require this treatment. The next step is the process of neutralising with alkali to remove free fatty acids. These acids interfere with the process of hydrogenation. They have a disagreeable smell and flavour and are sensitive to oxidation, thereby reducing quality retention property of the product. Neutralisation also helps in bleaching deep coloured oils like cottonseed.

The principal method of neutralisation in vogue in India has been the use of caustic soda. Traditionally, it has been the batch process. This process served its purpose well when vanaspati was made from groundnut oil. In the last 20 years, however, many factories have installed continuous process plants which are more efficient when oils with high free fatty acid contents are to be refined. Physical refining or steam distillation process is a recent innovation found economical with oils like palm oil. Currently, with the increasing use of high f.f.a. oils like palm, ricebran and mahua, the imperative need to minimise losses of expensive oils, to save energy and the modernisation of refining and deodorisation processes has become an absolute necessity for all plants of more than 20 tonnes per day capacity.

The by-product of neutralisation with alkali is soap stock. It largely consists of soap, neutral oil, water and small quantities of impurities present in the oil. To minimise loss of good edible oil in settling soap stock, centrifugal soap-stock separators are used to recover neutral oil from soap stock. Soap stock is a good raw material for soap making. To remove water from dilute soap stock for transportation, it is split with mineral acids like sulphuric acid to form acid oil. Bulk of the oil lost in neutralisation is recovered through fatty matter in soap stock or acid oil. Recovery of neutral oil and the price of hard soap stock or acid oil are important elements in the cost efficiency of vanaspati production.

The next step is bleaching or decolorisation. A certain reduction in colour occurs in the process of neutralisation as stated earlier. Hydrogenation and deodorisation also help bleaching the oil. Oils have yellow, orange and greenish shades imparted by the pigments present in the oil bearing materials from which they are extracted. The principal natural colouring materials are carotenes, chlorophylls, xanthophylls, gossypols etc.

The common method of bleaching is to mix small amounts of natural or acid activated earth and/or activated carbon under vacuum, and heat the oil. The earth and carbon are very porous materials and absorb the colouring matter to a large extent. Carbon is generally more efficient in removing colour, and hence a must for deep coloured oils. Often combination of earth and carbon is used. The oil is passed through filter presses to separate the earth and/or carbon. Continuous bleaching processes are of recent development not yet widely used in this country.

The key process of hydrogenation requires nickel catalyst and pure hydrogen gas. At present most manufacturers prefer to buy ready made catalyst. Previously they had to undertake the process of reducing nickel formate to catalyst. This was cheap to produce but the efficiency of the catalyst varied a lot, depending upon the skill of the operator manufacturing catalyst.

Hydrogen is generally produced by the electrolytic process. A few manufacturers do produce hydrogen by the steam-iron process. This requires imported spathic iron ore, and hydrogen gas is not as pure as that produced by the electrolytic process. The steep rise in electricity charges in recent years has, however, led to a significant increase in the cost of hydrogen. On current usags of oils (soyabean, cottonseed, ricebran with 10 per cent palm) consumption of hydrogen is about 50 M^3 per tonne and consumption of power is nearly 375 KWH, if the efficiency of hydrogen generation unit is 90 per cent.

The process of hydrogenation is brought about by agitating oil and catalyst in the presence of hydrogen gas under pressure and high temperature. The approximate range of commercial operating parameters is as under:

Temperature	:	110°-190°C
Pressure	:	0-100 psig
Catalyst	:	0.01 to 0.15 per cent by weight as nickel
Agitation	:	Mechanical/hydrogen gas bubbling through liquid oil.

In advanced countries normally hydrogenated cooled oil is filtered through filter presses and bleached. The Vegetable Oil Product Control Order, however, requires that in post-refining the hydrogenated oil should be both alkali refined and bleached so that no traces of nickel are left. According to experts post-neutralising is wasteful and unnecessary.

The last step is deodorisation to remove natural characteristic odour and taste of oils present in fresh oils plus any unpleasant odours picked up during the earlier processes of alkali refining, bleaching with earths and hydrogenation. This process requires removal of odoriferous compounds by steam distillation. It entails passing drysteam at high temperatures (180-250°C) under good vacuum. The old plants installed for groundnut oil are not able to ensure high vacuum and temperatures necessary for difficult oils like soyabean. Now continuous deodorisation is coming increasingly in vogue because of obvious advantages, though its initial cost is high.

Hydrogenated oil has to be mixed with 5 per cent fully refined sesame oil to ensure the required colour reading according to Baudouin Test as specified under the V.O.P. Control Order. Then appropriate quantities of vitamin A and vitamin D are added to the blending tank containing hydrogenated oil and sesame oil.

The last step in the process of vanaspati manufacture is to fill vanaspati into tins or polyjars while still liquid (about 50°) and allow to cool slowly in cooling rooms with controlled temperatures with the object of obtaining a granular structure with homogenous and firm consistency. The prime object of granular structure is to make vanaspati resemble ghee.

A few manufacturers produce non-granulated vanaspati mainly for bakery. Here vanaspati oil is chilled by passing over refrigerated chilled rolls. To improve shortening property of such bakery product, nitrogen or air is incorporated. Such aerated product requires larger space and is packed in tins at the rate of 15 kilogramme against 16.5 kilogramme of the normal vanaspati.

In the process of vanaspati manufacture oil losses occur in neutralisation, in the form of fatty matter in soap stock and oil retained in spent bleaching earth, carbon and catalyst. There is inevitable invisible loss through leakage in handling oil in bulk at the time of its receipt and settlement of sludge in the oil in storage tanks. Total loss of oil in processing is a major criterion in determining plant efficiency.

Economies of scale operate over a large range. Large plants are in a position to take effective steps in minimising losses in oil and achieving economies in the use of chemicals, utilities (power, steam, water) and labour. During the enquiry by Tariff Commission detailed costs were collected for the period 1968-69 which clearly established these economies of scale of operation.

2

Vanaspati Economics

VANASPATI is an edible oil processing industry. As shown earlier the process is relatively simple and short.

The value added by the process as return to factors of production is very small. Recent cost studies estimate the total cost of conversion from oil into bulk vanaspati at only 7 per cent of the cost of vanaspati, the balance 93 per cent being the cost of oil. The conversion cost includes chemicals and energy input costs of 4.4 per cent. Thus labour and overheads account for hardly 1.6 per cent. The gross profit margin allowed under price control has not exceeded 2 per cent of the price of vanaspati. The fact that the individual manufacturer has under his control indirect costs and profit margin of only about 5 per cent has great bearing on the economic behaviour of the industry.

Profitability of vanaspati is so closely intertwined with the behaviour of the oil market that it is futile to distinguish it as a distinct industry. In fact it is only in India that, largely through government policies regulating vanaspati prices, quality, oil usage etc., a deliberate attempt has been made to divorce vanaspati from the vegetable oil industry.

In all advanced countries the vegetable oil industry encompasses all processes of extraction of oil from oilseeds, either by expeller or solvent extraction, to refining and hydrogenation. For achieving economies of scale not only individual unit size of seed crushing/extraction has increased but subsequent refining and hydrogenation processes have been fully integrated. The product range of such an undertaking includes extracted meal, raw oils, fully refined cooking oils and, partially to fully, hydrogenated oils. The hydrogenated oils are sold as raw material for margarine besides for cooking fats; and as shortenings tailor-made for confectionary and convenience food industries. Despite the increase in soyabean production in the U.S.A. from about 10 million tonnes in 1955 to 60 million tonnes in 1982 the number of processors has declined from 147 to 93.

In India the vegetable oil industry has been fragmented into distinct sectors of oil mills using expellers, sovent extraction plants extracting oil largely from oil cakes produced by oil mills or low oil bearing seeds (soyabean, sal, etc.) or materials (ricebran) and vanaspati manufacturers producing vanaspati, refined oil and industrial hardened oils for soap, fatty acid etc. Recent-

ly many independent oil refining and a few industrial oil hydrogenating units have also come into existence.

Interestingly, most vanaspati factories established in the 1930's and 1940's had attached oil mills. They could not follow the world trend of vertical integration and increasing scale of operation offsetting the rising cost of urban labour and the relatively higher transport cost of seed over oil. The process of disintegration began in 1956 when the Central Excise duty was imposed on vegetable oil at a rate exceeding the total cost of crushing. As the administration of the levy on small mills was difficult it was replaced by a compound levy. This led to closure or break up of large oil mills. Even after the abolition of the excise, the small scale size of the oil expeller industry has been preserved by its inclusion in the list of industries reserved for small scale.

Solvent extraction plants came to be established from the mid 1950's to take advantage of the heavy demand for deoiled meal as cattle feed from Europe. They too found it economical to buy oilcakes for extraction instead of having their own expellers. Availability of solvent extracted oils which have to be refined for human consumption, ban on the use of even solvent extracted groundnut and mustard oils in vanaspati, restrictions on refining of oils by vanaspati factories and large scale imports since 1977 encouraged establishment of independent oil refineries. Thus, instead of one integrated oil industry we have four distinct industries. Nevertheless, they all function as interconnected segments of the oil economy.

A major consequence of this compartmentalisation of oilseed processing industry has been the near total stagnation of technology. Expellers copied from imported Rosedown expellers of pre-war make, solvent extraction plants copied from De'Smet design of 1950's and batch type refineries and vanaspati plants of pre-war vintage predominate. Indigenous fabrication of continuous refineries and recently of deodorisation and bleachers have helped some large vanaspati units to update their technology. However, few have been able to take advantage of the economies of scale, particularly in the saving of energy as in advanced countries.

In a tradition bound society like ours there are strong regional preferences for food fats; coconut oil on the Malabar Coast, groundnut oil in the west and south and mustard oil in the east. Ghee was the traditional fat in the northwest. Vanaspati as a ghee substitute could thus find acceptance only in the north. Elsewhere it has to compete with raw and refined edible oils for a share of the market. Therefore it faces a highly elastic price market. On the supply side, its cost is determined overwhelmingly (93 per cent) by the cost of oils used in it.

In a free market the price of vanaspati moves with the prices of oils both ways. The latter fluctuate heavily not only from year to year, depending on crop outturn, but within a crop season itself. A rise of the order of 80 per cent or more in a season is not uncommon. What is more, despite the seasonality in crop arrivals it is difficult to predict when prices will reach the

peak and the bottom. The reasons are many. Some oilseed crops are harvested in autumn and some in spring. Export import policy decisions of the Union Government and intervention in inter-state movements by State Governments occur anytime in the year. Like all agricultural commodities oilseed markets are subject to heavy speculative hoarding/dishoarding on the basis of expectations of next crop prospects.

Vanaspati was one hundred per cent groundnut oil from 1930 upto February 1947. From March that year incorporation of 5 per cent refined sesame oil was made compulsory to facilitate detection of the adulteration of ghee with vanaspati. In 1957 the industry decided to use voluntarily increasing proportion of cottonseed oil to encourage cottonseed crushing. And from 1965 imported oils were made available. Nevertheless, groundnut oil remained the primary raw material till 1975 when its use was restricted by law to 25 per cent. Its use has been totally banned since 1977.

Groundnut oil accounting for nearly 60 per cent of the total indigenous edible oil supply was and remains the market leader. Its behaviour was therefore of overwhelming importance to the growth and financial viability of the vanaspati industry.

Table 2.1 shows the magnitude of maximum and minimum price fluctuations within a calender month and during a crop year over the last thirty years. The price per tonne of groundnut oil has risen from the lowest level of Rs. 800 in 1955 to Rs. 19200 in 1983—24 times increase. This is reflected in the magnitude of fluctuations within a month of the maximum of Rs. 380 in the 1950s, Rs. 1700 in 1960s and Rs. 3050 in 1970s. Similarly in a crop season the maximum range of price variation was Rs. 1010 in the 1950s, Rs. 2660 in 1960s and Rs. 7100 in 1970s. In terms of percentage changes minimum fluctuations in a month remained of the order of 1 to 5 per cent throughout the 3 decades and maximum in the range of 10 to 20 per cent in the first two decades. In the last decade this range widened to 20-30 per cent. The range of annual fluctuations was generally 60 per cent or more. Fluctuations are determined by size of crops or anticipations of crop size during an erratic monsoon after a good crop.

A vanaspati manufacturer is thus faced with a situation of working on a profit margin of about 2 per cent and bearing the price fluctuation risk of 4 to 23 per cent a month of his 93 per cent raw material cost. This heavy risk of oil price fluctuation is a universal phenomenon. Even in the U.S.A. where soyabean crop failure is rare and production is well in excess of domestic and sometimes world needs, the processor is faced with the same risks. Normally he hedges his risks in the futures market. The giant corporations having several plants for crushing and oil processing of capacities of 1000 to 3000 tonnes a day buy seeds and sell meal and oils in forward to ensure working on reasonable margins. They do not like to bear such risks even on export trade. Hence the State Trading Corporation, purchasing soyabean oil through tenders, is given offers by the American sellers valid only between the closing time of one day and the opening time on the next working day of