CHAPTER - IV

SUGAR INDUSTRY

India has been known as the original home of sugar and sugarcane. Indian mythology supports the above fact as it contains legends showing the origin of sugarcane. India is the second largest producer of sugarcane next to Brazil. Presently about 4 million hectares of land is under sugarcane with an average yield of 70 tons per hectare.

Sugar and sugar-cane have been known in our country from pre-historic times. India is the birth place of sugar-cane. In 800 B.C sugar cane was taken to China\(^1\). Alexander introduced it to the western Hemisphere in 300 B.C\(^2\). Sugar manufacture started in India between 4th and 6th century A.D\(^3\). Juice was extracted from the cane by crushing it with heavy weights. The juice was then boiled and stirred until solids were formed. These solids of uneven size and shape look like gravel and were hence called Sharkara, a Sanskrit term for gravel\(^4\). China and Persia learnt the art of sugar manufacture from India in the early part of the 7th century\(^5\).

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Sugarcane in India is used to make either sugar, khandsari or gur. However, sugar products produced worldwide are divided into four basic categories: granulated, brown, liquid sugar and invert sugar\textsuperscript{6}.

**Granulated Sugar**

There are many different types of granulated sugar. Most of these are used only by food processors and professional bakers and are not available in the supermarket. The types of granulated sugars differ in crystal size. Each crystal size provides unique functional characteristics that make the sugar appropriate for the food processor's special need.

"Regular" sugar, as it is known to consumers, is the sugar found in every home's sugar bowl and most commonly used in home food preparation. It is the white sugar called for in most cookbook recipes. The food processing industry describes "regular" sugar as extra fine or fine sugar. It is the sugar most used by food processors because of its fine crystals that are ideal for bulk handling and are not susceptible to caking\textsuperscript{7}.

Fruit sugar is slightly finer than "regular" sugar and is used in dry mixes such as gelatin desserts, pudding mixes and drink mixes. Fruit sugar has a more uniform crystal size than "regular" sugar. The uniformity of crystal size prevents

\textsuperscript{6} http://www.sugarindustry.com
\textsuperscript{7} Ibid.,
separation or settling of smaller crystals to the bottom of the box, an important quality in dry mixes and drink mixes.

Bakers Special crystal size is even finer than that of fruit sugar. As its name suggests, it was developed specially for the baking industry. Bakers Special is used for sugaring doughnuts and cookies as well as in some commercial cakes to produce fine crumb texture.

She crystal size of Superfine, Ultrafine, or Bar Sugar is the finest of all the types of granulated sugar. It is ideal for extra fine textured cakes and meringues, as well as for sweetening fruits and iced-drinks since it dissolves easily. In England, a sugar very similar to superfine sugar is known as caster or castor, named after the type of shaker in which it is often packaged.

This sugar is granulated sugar ground to a smooth powder and then sifted. It contains about 3 percent corn starch to prevent caking. Confectioners sugar is available in three grades ground to different degrees of fineness. The confectioners sugar available in supermarkets is the finest of the three and is used in icings, confections and whipping cream. The other two types of powdered sugar are used by industrial bakers.

The crystal size of coarse sugar is larger than that of "regular" sugar. Coarse sugar is normally processed from the purest sugar liquor. This processing

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8. Ibid.
method makes coarse sugar highly resistant to color change or inversion natural breakdown to fructose and glucose) at high temperatures. These characteristics are important in making fondants, confections and liquors⁹.

Sanding Sugar, another large crystal sugar, is used mainly in the baking and confectionery industries to sprinkle on top of baked goods. The large crystals reflects light and gives the product a sparkling appearance.

Sugar produced in India is mainly of granulated type. Granulated sugar is further classified into various types based on color and grain size. According to the Indian Standards Specifications there are around 20 grades of sugar based on the grain size and colors. The color series has four grades designated as 30, 29, 28 and 27, while the grain size has five grades namely A, B, C, D, E. Bulk of production in the country is of C, D and E grains, branded as large, medium and small and has color specification of 30. The D grade produced in the country is comparable to world standards¹⁰.

Brown Sugar (light and Dark) consists of sugar crystals coated in a molasses syrup with natural flavor and color. Many sugar refiners produce brown sugar by boiling a special molasses syrup until brown sugar forms crystals. A centrifuge spins the crystals dry. Some of the syrup remains giving the sugar its brown color and molasses flavor. Other manufacturers produce brown sugar by

⁹ S.V. Parthasarathy, Sugarcane in India, Madras, 1972, p.55.
¹⁰ Bepin Behari, op.cit., p. 92.
blending a special molasses syrup with white sugar crystals. Dark brown sugar has more color and a stronger molasses flavor than light brown sugar. Lighter types are generally used in baking and making butterscotch, condiments and glazes. Dark brown sugar has a rich flavor that is good for gingerbread, mincemeat, baked beans, plum pudding and other full flavored foods\textsuperscript{11}.

Muscovado sugar, a British speciality brown sugar, is very dark brown and has a particularly strong molasses flavor. The crystals are slightly coarser and stickier in texture than "regular" brown sugar. These sugars are fine, powder-like brown sugars that are less moist than "regular" brown sugar. Since it is less moist it does not lump and is free-flowing like granulated white sugar. Popular in England, Demerara sugar is a light brown sugar with large golden crystals which are slightly sticky. It is often used in tea, coffee or top of hot cereals\textsuperscript{12}.

Liquid sugars were developed before today's methods of sugar processing made transport and handling granulated sugars practical. There are several types of liquid sugar. Liquid sucrose (sugar) is essentially liquid granulated sugar and can be used in products wherever dissolved granulated sugar might be used. Amber liquid sucrose (sugar) is darker in color and can be used where the cane sugar flavor is desirable and the non-sugars are not a problem in the product\textsuperscript{13}.

\textsuperscript{11} www.Indiansugar.online.com.
\textsuperscript{12} Ibid.,
\textsuperscript{13} C.N.Babu, \textit{Sugar Cane}, New Delhi, 1979, p.75.
Invert Sugar

Inversion or chemical breakdown of sucrose results in invert sugar, an equal mixture of glucose and fructose. Available commercially only in liquid form, invert sugar is sweeter than granulated sugar. One form of liquid invert was specially developed for the carbonated beverage industry and can be used only in liquid products. This liquid sugar is actually part invert sugar combined with part dissolved granulated sugar. Another type, named total invert sugar syrup, is commercially processed and is almost completely invert sugar. It is used mainly in food products to retard crystallization of sugar and retain moisture.14

The sugar industry in India had long been a cottage industry. The development of the industry on modern lines dates from 1903, when a sugar mill was started in Bihar. Subsequently a number of sugar mills were started in Bihar and Uttar Pradesh. From 1932 onwards the sugar industry made remarkable progress when the government granted protection to it.15

The monumental work of Barber and T.S.Venkataraman in breeding new strains of canes, the so called Coimbatore varieties suitable for the country made the sugar-cane industry stay on the field.

It is believed that India is the original home of sugarcane and remains the largest producer of sugarcane in the world. Indian sugar industry is still the largest

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single employer in the rural areas and provides employment to about 3.5 lakhs workers\textsuperscript{16}. The contribution of the industry to the central excise duty is high. In addition substantial amounts are also collected by the State Government by levy of purchase tax and other levies\textsuperscript{17}. The growth of the vaccum pan sugar industry in India can be traced back to the early part of this century\textsuperscript{18}. In 1930-31 there were 29 sugar factories producing 1.22 lakh tons of sugar. This was, however, not adequate to meet the internal requirements and nearly 8 lakhs tons of sugar were imported in the year. In 1932 protection was granted to the sugar industry form competition from foreign countries. Following this there was a phenomenal expansion of the industry and the number of sugar factories increased to 137 in 1936-37 and the sugar production also increased to 11.3 lakhs tons, Sugar imports were almost stopped after 1936-37. Thereafter there was little development in the sugar industry up to 1951-52. Under the sugar Industry Protection Act of 1932 protection was granted to the indigenous sugar industry for an initial period of fourteen years ending in 1946\textsuperscript{19}. In this Act a statutory provision was made providing for an enquiry to be held before 31st March 1938 so as to enable the government to determine what measures should be adopted for the remaining period of 8 years. It was also provided that if it was found that foreign sugar was being imported into India at a price the government should have power to levy

\textsuperscript{16} Ibid.,
\textsuperscript{17} Sanjaya Baru, \textit{The Political Economy of Indian Sugar}, Delhi, 1990, p 45-47.
\textsuperscript{18} Roughly, half of the Sugarcane production in diverted to the manufacture of country sweetners such as Jaggery, gur and khandarsi
\textsuperscript{19} A.K.Bagchi, \textit{Private Investment in India}, 1900-1939; Cambridge, 1972, p. 35
additional off-setting duties on imported sugar. Accordingly, the revenue duty, which was Rs.9.06 per ton, was converted into a protective duty of Rs.7.25 plus a surcharge of 25 per cent thereof. The surcharge served as extra protection to indigenous sugar industry which began to develop very rapidly. Within a period of four years of the grant of protection the country became practically self sufficient in respect of sugar. This however resulted in a serious fall in the customs revenue from about Rs.10.8 crore in 1930-31 to Rs.3.24 crore in 1935-36. The government again reviewed the position and decided on a two fold line of action-imposition of excise duty on factory produced sugar at Rs.1.31 per ton from 1st April 1934 and the Union Government passed legislation enabling the Provincial governments to enforce a minimum price to be paid by the sugar factories to the cane growers in respect of cane supplied by them as per sugarcane act 1934.

The main object of the above act was to regulate the price of sugarcane intended for use in sugar factories and assures sugarcane growers a fair price for their produce. Section 3 of the act empowered the state government to fix by notification in official gazette the minimum price for the purchase of sugarcane intended for use in factory. In this connection the government of Uttar Pradesh Sugarcane Rules of 1943 under which they started notifying the minimum price of cane payable by sugar factories in the state. Similar action was taken by the government of Bihar and Orissa Sugarcane Rules of 1934. These two state

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governments were fixing the minimum cane price every year till the Central Government took over control of the sugar industry under the Industries (Development and regulation) act of 1951.\textsuperscript{22} The post protection scenario of Indian sugar industry is revealing. From a scanty 32 working units in 1931-32, the number of factories rose to 130 by 1934-35 and the volume of sugar output which stood at 1.72 lakhs tons rose to 9.47 lakhs cons by 1935-36. This rate of expansion over a period constitutes almost a world record. By 1938-39 the production of sugar touched 12.77 lakhs tons. During the years 1939-44 a reverse trend manifested itself, the volume of production tending to decline from 12 lakhs tons level except for 1942-43. The next seven years the industry had to pass through a difficult time for various reasons when the output fluctuated practically between 9 and 11 lakhs tons mainly caused by the government’s preference to food crops during the war years. Before 1952 the state governments, particularly of United Provinces and Bihar exercised controls under their own legislation where the sugar industry was mainly concentrated.\textsuperscript{23} The development and regulation of the sugar industry came under the control of the Government of India for the first time when the Industries (Development and Regulations) act 1951 came into force. All the 138 factories which were working before 1952 were registered under the provisions of this Act\textsuperscript{24}. New sugar factories were established thereafter under licences granted by the Central Government Similarly, substantial

\textsuperscript{22} Shahid Amin, \textit{Sugarcane and Sugar in Gorakhpur}, New Delhi, 1984, p.25.
expansions were carried out in sugar factories after obtaining licences from the Central Government and this condition has continued since then.

Under the First Five Year Plan the target of sugar production was originally fixed at 15 lakh tons against an actual output of 11.6 lakhs tons in 1950-51. However finding that consumption demand was considerably going up the production target by a mid plan revision was raised to 18 lakh tons\textsuperscript{25}.

For achievement of the same an additional plant capacity both by way of new units and increase in capacity of the existing units was sanctioned by the Government. The industry however exceeded all expectations and achieved a record production of 18.9 lakhs. The role of the sugar industry in the second Plan was also equally commendable. By 1960-61 it established a record production of 30.29 lakh tons with an installed capacity of not more than 24.47 lakh tons. In 1965-66 season the industry achieved a production of 35.37 lakh tons exceeding the target of 35 lakh tons fixed for it under the Third Plan.\textsuperscript{26} The production in 1966-67 declined sharply to 21.3 lakh tons due to decline in overall availability of cane caused by drought conditions and reduction in cane average by about 22 percent in factory area as compared to 1965-66. It was anticipated that in case the policy of total control continued, the production would register a sharp decline. With this in view the Government adopted the policy of partial decontrol on sugar with effect from 1st October 1967. With the limited flexibility available under the

\textsuperscript{26} \textit{Ibid.},
policy sugar mills paid higher cane prices which helped maximize sugar production. The production in the next two seasons 1967-68 and 1968-69 was 21.6 and 37.6 lakh tons respectively. For the Fourth Plan the Government had initially fixed the sugar production target of 47 lakhs tons and the targeted licences capacity at 48-65 tons. But owing to the slow process in the establishment of capacity target to 55 lakh tons the government issued licences. In 1969-1970, the production was 56 lakh tons. With larger availability of stocks the Government decontrolled sugar from 25th May 1971. The sugar price in the open market crashed and factories could not discharge their liability towards the cane growers. As a result, the production in the ensuring season 1970-1971 declined to 31 lakh tons and the prices showed an upward trend. Realizing the difficult situation the industry voluntarily offered to supply 60 percent of monthly released free sale quota at an all India uniform price of Rs.150 per quintal to meet the domestic requirements. The industry also offered further 3.5 percent of its production for exports, The Scheme successfully continued for 6 months which expired on June 1972. The Government had once again imposed dual control on sugar from 1st July 1972. The task force for sugar industry set up by the Planning Commission to work out the development programmes of the sugar industry during the fifth plan 1974-79 estimated the per capita domestic requirements of sugar at 8.68 kg by 1978-79 and the total requirements of sugar

27. Ibid.,
28. Ibid., p.22.
for domestic consumption was estimated at 55 lakh tons. The requirement for export and for buffer stock was estimated at 5 lakh tons. Making a total requirement of sugar at 60 lakh tons\(^{30}\). The Planning Commission, however, revised the requirement of sugar for domestic consumption at 52 lakh tons and 5 lakh tons for export and buffer stock licences were issued to 62 new sugar mills and expansion in 32 existing mills involving additional capacity of 15.7 lakh tons exceeding the target of 70 lakh tons in the very first year of the plan by 1.17 lakh tons. The industry had the distinction of exceeding the plan target with the record production of 64.7 lakh tons in 1977.78. The Government decontrolled sugar from 16th August 1978 and simultaneously withdrew the monthly release of sugar. This led to panic sales and the price of sugar plummeted to very uneconomic levels. The policy did not last long and the Government once again imposed partial decontrol with effect from 17th December 1978.\(^{31}\)

The Government of India envisaged a sugar production target of 76.4 lakh tons and the target of installed and licensed capacity were fixed at 80.4 and 96.2 lakh tons respectively for the Sixth Plan.\(^{32}\) The production target includes 10 lakh tons for export as well. Another important development during this period was the construction of high level committee under the chairmanship of L. Kumar to study the cost structure of the industry. Following the recommendations of the

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\(^{30}\) Ibid.,


committee the policy of partial decontrol was restored in true sense effective from 30th November 1980 and the cost of levy sugar was fixed on the basics of statutory minimum cane price without any linkage with free sale sugar or actual cane price paid. The Government had continued with the minimum statutory cane price of Rs.13 per quintal linked to a basic recovery of 8.5 percent in the three consecutive year 1980-81 to 82-83 disregarding the recommendation of the Agricultural Prices Commission to raise the same to Rs.15.50 Per quintal linked to a basic recovery of 8.5 percent. The phenomenon of high state advised prices also continued. Sugar production during the Sixth Plan period fluctuated widely from 39 lakh tons in 1979-80 to 87 lakhs tons in 1981-82. The industry suffered staggering losses as it failed to recover the very high cost of production and could not make timely payment of cane prices which created adverse psychology among the cane growers leading to decline in production to 55 lakh tons in 1983-84.

The Planning Commission had estimated the requirement of sugar at 98 lakh tons during the Seventh Plan period ending 1989-90 on the basics of annual growth rate of 5 percent. The installed and licensed capacity targets were put at 114.6 and 132.6 lakh tons respectively. The Government issued licences for 162.1 lakhs tons by the end of 1989-90 exceeding the target by as much as 30 lakh tons. The installed capacity however was only 93.4 lakh tons leaving the unimplemented capacity of about 70 lakh tons. The Government announced a pragmatic sugar policy with increase in the statutory minimum price of sugarcane
on the basis of the recommendations of the Commission for Agricultural Cost and Prices and change in the levy rates in 1984-85. This enabled the industry to increase sugar production substantially higher in the shortest period. Not only the dependence on imports canes to an end, but also the country generated surplus sugar for export by 1989-90.

Sugar Industry in India is well developed with a consumer base of more than billions of people. It is also the second largest producer of sugar in the world. There are around 45 millions of sugar cane growers in India and a larger portion of rural labourers in the country largely rely upon this industry. Sugar Industry is one of the agriculture based industries. In India it is the second largest agricultural industry after textile Industry.

Statistics On Sugar Production

As to the statistics there were a total number of 571 sugar factories in India as on March 31,2005 compared to 138 during 1950-51. These 571 sugar mills produced a total quantity of 19.2 million tones (MT). Sugar production in India increased from 15.5 MT in 1998-99 to 20.1 MT in 2002-03.

Sugar Production

The following table shows the level of sugar production (In Lakh Tons) in Indian States:
<table>
<thead>
<tr>
<th>State</th>
<th>2002-03</th>
<th>2003-04</th>
<th>2004-05 Estimated</th>
</tr>
</thead>
<tbody>
<tr>
<td>Uttar Pradesh</td>
<td>58.74</td>
<td>46.08</td>
<td>50.32</td>
</tr>
<tr>
<td>Maharashtra</td>
<td>61.64</td>
<td>31.99</td>
<td>22.29</td>
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<td>Karnataka</td>
<td>17.98</td>
<td>11.57</td>
<td>13</td>
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<tr>
<td>Tamil Nadu</td>
<td>17.04</td>
<td>11.9</td>
<td>9.84</td>
</tr>
<tr>
<td>Andhra Pradesh</td>
<td>11.88</td>
<td>8.81</td>
<td>9.75</td>
</tr>
<tr>
<td>Gujarat</td>
<td>12.38</td>
<td>10.77</td>
<td>8.32</td>
</tr>
<tr>
<td>Haryana</td>
<td>5.99</td>
<td>5.86</td>
<td>4.03</td>
</tr>
<tr>
<td>Uttaranchal</td>
<td>4.59</td>
<td>3.93</td>
<td>3.82</td>
</tr>
<tr>
<td>Punjab</td>
<td>5.11</td>
<td>3.88</td>
<td>3.37</td>
</tr>
<tr>
<td>Bihar</td>
<td>4.21</td>
<td>2.77</td>
<td>2.77</td>
</tr>
<tr>
<td>Madhya Pradesh</td>
<td>0.85</td>
<td>0.94</td>
<td>0.85</td>
</tr>
<tr>
<td>Other</td>
<td>0.91</td>
<td>1.09</td>
<td>1.58</td>
</tr>
</tbody>
</table>

**Source:** http://www.sugarindustry.com

**Department of Agriculture and Co-operation:**

Sugarcane production in 2004-05 was estimated at 232.3 MT from 237.3 MT in 2003-04. Sugarcane production was expected to reach 257.7 MT in 2005-06.

The sugar production in the states largely depend upon monsoon. From 1998-03 good monsoon resulted a larger production of sugar in the country.
Sugar Pricing:

Government of India fixes Statutory Minimum Price (SMP) for sugarcane according to Clause 3 of the Sugarcane Order. This statutory Minimum Price is designed through the consent of Commission for Agricultural Cost and Prices (CACP) and respective state Governments. For the year 2004-05, the rate was fixed at Rs. 74.50 Per quintal with a basic recovery of 8.5%.

Indian Government on Sugar Industry

The following policy initiatives are taken to boost the Sugar industry:

Government declared the new policy on August 20, 1998 with regard to licenses for new factories, which shows that there will be no sugar factory in a radius of 15 km.

Setting up of Indian Institute of Sugar Technology at Kanpur is meant for improving efficiency in the industry.

In the year 1982, the sugar development fund was set up with a view to avail of loans for modernization of the industry.

Department of sugar, was established in sugar 1969. Tamil Nadu Sugar corporation was established in 1974. The growth and performance of the sugar mills in Tamil Nadu are impressive and they are significantly related to the Government policies as well. The national and international scenario in terms of
production and improvement in technology also stimulated the growth factor in Tamil Nadu. The emergence of co-operative and public sector sugar mills after independence led to good performance. As early in the Pre-Independence period, state policy and intervention had helped in promoting sugar mills and the real growth of the sugar mills essentially began after the granting of tariff protection in 1932\textsuperscript{33}. This protection was itself granted because there appeared to have been no direct conflict of interest between the growth of sugar industry in India and imperial economic interests. Following the granting to tariff protection in 1932 there was almost a four-fold increase in both the number of mills and in the output of cane sugar coupled with a rapid decline in inputs. After independence under the Five Year Plans, a systematic structure of ownership location control and licensing had emerged naturally sugar policy grows to determine every aspect of sugar industry in recent decades\textsuperscript{34}.

Four factories are engaged in Tirunelveli district in refining jaggery into sugar. The oldest of these, known as the “Lakshmi Sugar Mill” Alvartrunagari (it lies actually within the limits of the village of Tirukkalur), was founded in 1890 by a native of Attur\textsuperscript{35}. Being unable to work it successfully he sold it to a Vakil of Srivaikuntam, who again sold it to a Tinnevelly vakil and from the latter it came to the nattukottai chetti who at present manages the concern. The factory is a small one employing during the working season about 40 hands. The sugar is sent to

\textsuperscript{33} Indian Sugar Year Book 1993-94 Indian Sugar Mills Association, New Delhi, 1995, p.25.
\textsuperscript{34} V. Palanichamy, \textit{op.cit.}, p.25.
Tinnevelly Pettai and Tuticorin, the molasses being bought up mostly by the
tobacco merchants of Sivakasi (Ramnad)\textsuperscript{36}.

The Pettai Sugar Mill Company Ltd whose factory is situated in Tinnevelly
was founded in 1895 by a family of Muhammadans. A dividend was declared in
one year only and in 1910, being unable to repay their loans or to raise fresh
capital, the directors closed the mill. Since then the chetti through whose financial
help the factory was kept going.

The Sarangapani Sugar Mill Company Ltd opened a factory in Tinnevelly
in 1898 and owing to financial trouble closed in 1902 since then the building has
lean laid vacant\textsuperscript{37}.

**Dharani Sugars and Chemicals Limited Dharani Nagar**

**PROFILE OF THE FACTORY GROUP**

Dharani Sugars and Chemicals Limited is one of the units of PGP Group of
Companies promoted by Non-Resident Indians based in the United States of
America under the dynamic leadership of Dr. Palani G.Periyasamy, MA.,
MA., Ph.D., a leading economist and industrialist. Dr. Palani G.Periasamy was a
tenured Professor of Economics and Director of the Graduate School of Business

\textsuperscript{36} Ibid., 
\textsuperscript{37} Ibid.,
Management at University of Baltimore, USA. Moved by a passion to bring some contribution to his motherland he established the industry in Tamilnadu.

LOCATION OF THE FACTORY

Dharani Sugars and Chemicals Ltd., is the first sugar factory set up in southern part of Tamilnadu, the most industrially backward area. The factory is situated at Naranapuram village of Sivagiri Taluk in Tirunelveli district. It is one of few heavy industries of the district and it is the first agro based industry of the district. It caters to the needs of cane growers of three districts viz. major parts of Tirunelveli, the western parts of Tuticorin and western parts of Virudhunagar\textsuperscript{38}.

CAPACITY OF THE FACTORY

The installed capacity of the sugar unit is 2500 TCD - Tons crushing per day


The DISTILLERY unit has been installed with the capacity of 30 KLD of Rectified spirit and 10 KLD of Extra neutral alcohol.


\textsuperscript{38} Profile of the Dharani Sugar Factory, 1989, p.1.
CANE PRODUCTION

The factory has commenced its maiden season in March 1989 and has successfully completed 9 crushing seasons with total crushing of around 78 lakh tons of cane.

DHARANI SUGARS & CHEMICALS LTD

MTS

A comparative study of crushing performance for the last nine seasons.

COMPARISON STATEMENT

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<tbody>
<tr>
<td>Cane Crushing</td>
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<td>245079.559</td>
<td>462193.20</td>
<td>5724.37.846</td>
<td>205319.025</td>
<td>358713.351</td>
<td>663472.902</td>
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<td>Total Sugar Bagged (in Qtl.)</td>
<td>201350</td>
<td>219900</td>
<td>415700</td>
<td>512300</td>
<td>180400</td>
<td>312190</td>
<td>600180</td>
<td>520000</td>
<td>135900</td>
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<tr>
<td>Total Molasses Produced in MTS</td>
<td>13260.253</td>
<td>11475.940</td>
<td>22091.670</td>
<td>31770.500</td>
<td>11284.300</td>
<td>18801.720</td>
<td>32548.320</td>
<td>34638.259</td>
<td>36199.200</td>
</tr>
</tbody>
</table>

Source: Dharani Sugar – Profile 1989.

CANE PROCUREMENT MANAGEMENT

Cane, an agro based raw material, is cultivated in 100 kilometer radius. Like other raw materials, one can not procure and store it in the industry and use according to requirement. The planting of cane itself has to be planned well in advance in accordance with the crushing programme of the factory for the next
year. Hence, the cane planting in the field has to be controlled by the industry to suit their requirement of cane according to the crushing programme. Dharani sugars and chemicals Ltd. has opened 14 Divisional offices with one cane officer and 4 or 5 cane assistants in each division to approach the ryots and advise them in planting of cane, development, harvesting and supplying to the factory\textsuperscript{39}.

Around 15000 cane growers are under its fold and they have been provided with crop loans through local financial institutions. The cane cultivation is completely monitored by its cane department. The ryots are advised in method of preparation of field, preparation of seed, method of cultivation, manuring, pest controlling and harvesting. The post harvesting service is also rendered to bring up the ratoon crop and registered to the factory.

**SOCIO ECONOMIC FACTORS**

The rural growth of a country is scaled at the growth of villages. The growth of the villages is scaled at the growth of agro based industries. The industry is also taking part in developing the socio economic growth of the villages in all three districts.

\textsuperscript{39} Personal Interview with M. Ramalingam, Managing Director, Dharani Sugar Factory, dated 05 January, 2006.
EMPLOYMENT OPPORTUNITY

Around 1000 employees are being directly benefited and about 10000 people are being indirectly benefited by offering themselves for the promotional operations of sugar cane production.

Nearly around 40 to 50 crore of money is generated for a season and transacted in the rural area which strengthens the economic growth of the area.

SUGAR FACTORY OPERATION

The factory is one of the modern factories in Tamilnadu and is the first one set up with auto setting mill in the world which contributes to the maximum efficiency of the industry.

MILLING

The delivered cane is weighed, sampled for cane quality and unloaded in the feeder table. The cane is prepared by means of cane preparation devices arranged in the field. A series of three roller mills crush the prepared cane and extract the raw juice. Water is added (imhibition) in the last mill to help wash the juice for extraction of residual sugar. The residue left after extraction of the juice is called bagasse and it is used as the fuel in the boilers and it can also be used for paper manufacturing.

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40 Personal Interview with M. Chandra Sekar, General Manager, Dharani Sugar Factory, dated 10 January, 2006.
CLARIFICATION

The raw juice is strained heated and lime is added to cause impurities such as mud to settle. Clarifiers separate the juice into clarified juice and muddy juice. The muddy juice is sent to filter where the juice is removed leaving mud (filter cake) which is used as manure\textsuperscript{41}.

EVAPORATION

The clarified juice is then boiled in evaporators which remove most of the water, leaving thick syrup.

CRYSTALYSATION & CENTRIFUGAL

The syrup is boiled at low temperature under vacuum to sugar. Masscult (raw sugar crystal mixed with molasses) moves to centrifugal which separates the two.

After all the commercially recoverable sugar is removed of the waste, the resulting molasses is sold as raw material to distilleries for production of alcohol as well cattle feed.

\textsuperscript{41} Personal Interview with G.R. Periya Nayagam, General Manager Works, Dharani Sugar Factory, dated 18 February 2006.
BOILER & POWER GENERATION

The power requirement of this Industry is self generated with the use of bagasse. One of the waste products of the industry is bagasse which is used in the boiler for production of steam. The steam is utilised in the turbine which is connected to an alternator to produce the power which is utilised within the factory premises\textsuperscript{42}.

PROCESS DESCRIPTION OF SUGAR MANUFACTURING

Sugar is manufactured in the field by the sugar cane. After maturity survey the sugar cane is harvested manually and transported to the sugar mills. The harvested cane is milled within 24 hrs. to avoid inversion loss.

Normally in India, juice is extracted from sugar-cane by the cells by preparatory devices like cutter, leveller, and mincer. Then, the prepared cane is subjected for milling through a battery of milling tandem of 4 Nos. to 6 Nos. depending upon the mills capacity. Normally, a milling, tandem will have 3 rollers and to improve the efficiency, accessories like underfeed Roller- or Toothed roller's will be attached\textsuperscript{43}.

The mill has four milling tandem with underfeed roller arrangements.

\textsuperscript{42} Profile of the Dharani Sugar Factory, 1989, p.3.
\textsuperscript{43} Personal Interview with S. Vdeanayagam, Assistant General Manager, Dharani Sugars, dated 10 March, 2009.
The prepared cane is crushed through the four mills and water is added in the fourth mill to improve the extraction. The prepared cane which is coming out from the last mill is called BAGASSE. The bagasse is used as fuel in cur boiler for the production of steam and the excess quantity will be taken by paper mills for the production of paper.

Normally, all sugar factories will have their own power generation plant by using the steam, which is generated from their boiler by using bagasse as fuel.
PROCESS OF FLOW FOR WHITE SUGAR

Source: Dharani Sugar – Profile, 1989.
The raw juice is weighed in the automatic juice weighing scale and then heated to 70 Deg.C. The heated juice is then pumped to a vessel called Juice Sulphitation Tank. In this tank milk of lime is added from the top and SO₂ gas is passed through the sparger at the bottom. The calcium sulphite which is produced will attract all the non-sugars and will form as precipitate. Then the sulphited juice is again heated to 102 Deg.C and pumped to vessel called 'Clarifier'\textsuperscript{44}.

In classified the precipitate will settle down and clean juice will come out at the top. The precipitate called mud will be mixed with fine powder of bagasse and the juice is separated by a vacuum filter. The pressmud from filter is transported to the bio-yard for the preparation of BIO MANURE.

The clear juice is further concentrated in continuous evaporators. Here nearly 75\% of water is evaporated. The liquid which is coming out from the last body of the evaporator is called syrup. The syrup is again pumped to syrup sulphitation tank. SO₂ gas is passed through the syrup for bleaching. The sulphited syrup is pumped to pan floor\textsuperscript{45}.

The vacuum pan is designed in such a way to evaporate further the syrup to form sugar crystal. Vacuum is created by condensers to avoid charring of sugar while concentration. The semi solid with sugar crystal, thus produced in vacuum pans is called "MASSECUIE".

\textsuperscript{44} Personal Interview with K. Baskaran, Manager Production, Dharani Sugar, dated 09 March, 2009.
\textsuperscript{45} Personal Interview with Andrew Cane, Administrative, Dharani Sugars, dated 09 March, 2009.
From the massecuite sugar is separated by centrifugal machines. The sugar is dried, weighed and bagged. The liquid which is coming out from centrifugal machine is called "MOLASSES" and is pumped to distillery for alcohol production\textsuperscript{46}.

**WELFARE MEASURES**

Family and bachelors quarters, canteen facilities and free medical aid are provided for the employees. The medical aid is extended to the employees families and the canteen facilities to the cane growers. Free uniform and shoes are supplied to all the employees. Recreation club, schools, and ITI are available for the children of the employees and cane growers. They are managed by the P.G.P. Education and Welfare Society. Departmental stores are run on a contract basis\textsuperscript{47}.

**EMPLOYERS ASSOCIATION**

The south Indian Sugar Mills Association Chennai and the Indian Sugar Mills Association New Delhi are the two employers association of the industry\textsuperscript{48}.

**PROBLEMS BEFORE INDUSTRY**

The sugar industry in Tirunelveli faces various problems. The industry is seasonal in nature and as such productive efficiency suffers considerably. Usually

\textsuperscript{46} Personal Interview with Palani Samy, Manager, Distillery, Dharani Sugars, dated 10 March, 2009.

\textsuperscript{47} Personal Interview with S. Ravikumar, Manager, Dharani Sugars, dated 10 March 2009.

the workers are employed for six months of the year and when there is no cane, and mills do not function, the worker in many areas are thrown out of employment. In the next season new workers, who are in experienced, are employed. This hinders production considerably. The development of various industries based on the by-products of sugar might improve the situation.

The most urgent problem before the sugar industry today is the improvement of the yield and quality of cane and reduction of the price of sugar with a view to bring it in line with the prices prevalent in the other countries of the world. The present high price is mainly due to the price of cane which represents about 60 percent of the cost of sugar. The solution lies in the improvements of cane cultivation to augment the yield of cane per acre and reduce the cost of its production. The quality of the cane must be improved so as to raise its sucrose content further the ryots should be induced to grow early and late ripening varieties so as to enable the mills to prolong the duration of their crushing season and thus reduce their cost of production.

Proper irrigation facilities should be provided. Adequate surplus of the proper kind of manures and fertilizers is as essential as the introduction of improved varieties for stepping up production of cane. The factories should help cane development in their respective zones and they can be induced to do so if the supplies of the reserved areas are assigned exclusively to them. Some of the

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factories in Bombay as well as in Java and other countries have their own sugarcane farms in the neighbouring areas. This enables them to grow more canes and adopt up to date methods of cane cultivation instead of depending for their cane on a large number of small growers who cannot take to progressive methods.

The ryots benefit by increase in yield per acre while the industry benefits by increase in the sugar content cane is paid according to weight and not on sucrose basis. Government have been obliged to adopt this flat rate of payment on tonnage basis because the calculation based on recovery is an elusive method and the illiterate ryots cannot understand. Payment of premium for special varieties and the adoption of varied schedule by factories are essential to encourage growers to raise quality canes with high sucrose content.

The Thirunelveli District occupies an important place in the industrial map of the State. Apart from some old time industries like handloom end weaving industries, a number of other sugar industries flourish in this district. For raising efficiency in the sector, the Planning Commission of India in the 10th Plan has formed a working group to improve sugar industry in India.

**CHEMICAL INDUSTRY**

The chemical industry is rightly considered to be the most basic of all industries. The development of various industries in a country depends upon the development of the chemical industry. The production of dyes for colours needed
for textile goods, paints and varnishes for household furniture and building materials, glass and plastics, oils and soaps, acids and alkalies for various purposes can only be possible when chemicals are available in a country in abundance. The development of the chemical industry is also necessary for the development of agriculture, defense and manufacture of drugs.

The development of the heavy chemical industry in a country may be considered as an index of its industrial prosperity. Among the heavy chemicals, sulphuric acid is the most important item necessary for the industrial development of a country. Sulphuric acid is directly used for the production of many acids and indirectly it is used for many industries including agriculture. Sulphuric acid is necessary for the production of sulphate of ammonia. Sulphur is the chief raw material for the production of sulphuric acid. But sulphur is not available in this country. Before the Second World War (1939-45) sulphur was obtained from Italy and Japan. During the war, difficulties were created in importing sulphur from these countries. The U.S.A became the largest supplier of sulphur to India at that time. Cost of production of sulphuric acid in India is still high because sulphur has to be obtained from foreign countries and many of the plants have uneconomic size.

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50. Sulphuric acid is used for leather tanning, iron and steel industry oil refining, production of explosives, textile industry and various other purposes. This acid is also used, for the production of hydrochloric, acid nitric acid, copper sulphate, magnesium sulphate, aluminous sulphate, bichromates, etc. which are used for various industrial purposes.

CAUSTIC SODA

The demand for caustic soda in 1965-66 was placed at 350,000 tons based on the requirements of the targets for various industries\(^52\).

Soda production of alkalis is an important branch of the heavy chemical industry. Caustic soda and sodium carbonate are the two alkali compounds used for the paper, textile, rayon, oil-refining, rubber reclaiming, dyestuff, ceramic, metallurgy and other purposes. Caustic soda is either prepared by the causticization process or the chemical method and the electrolytic method. The electrolytic method usually adopted for the production of caustic soda consists in electrolysis of common salt solution in special electrolytic cells with or without diaphragms. Common salt free from sulphates is the chief raw material for this industry. Among important centres of caustic soda industry, reference may be made to Rishra near Calcutta, Mithapur in Baroda, and Mettur Dam in South India. India imports caustic soda in large quantities every year and the local production is not sufficient. The development of hydro-electricity in various parts of the country will facilitate the development of this industry in those areas when brine is available within easy reach. It is proposed to meet the demand for soda ash in full from indigenous sources\(^53\).

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\(^{53}\) Soda Ash consists of causticising Soda Ash with Lime. In U.S.A and Japan this method is practiced.
With the exception of the expansion programme of Travan-core-Cochin Chemicals and the organic chemicals scheme of West Bengal, the development of these two industries depends entirely on private enterprise. The additional production required to reach the target for caustic soda is expected to be based on both the electrolytic and chemical processes.

**SODA ASH**

Soda ash or sodium carbonate is an indispensable chemical for various industries. It is used for textile, glass, soap, ceramic, paper, rubber and enamel industries. Usually the Solvay Ammonia Process is followed for the manufacture of soda ash and the raw materials required for the purpose are sodium chloride, limestone, coal, coke and ammonia which are available in the country in abundance. At Mithapur in Baroda State, a factory is in operation. India is mostly an importer of soda ash because the cost of production is high. Local production is inadequate to meet the growing requirements of the country.\(^5^4\).

**OTHER CHEMICALS**

Efforts are also being directed to produce titanium dioxide, calcium carbide, sodium hydrosulphide, sodium sulphate, potassium hydroxide and barium chemicals against the background of the expansion of demand.

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The development of dyestuff, perfumes, plastics and various other industries will depend upon the effective development of the coal tar chemical industry.

The electro-chemical industry which consists in the production of aluminium, calcium carbide, etc., has not made remarkable progress in this country. Considerable opportunities exist for the development of this industry in India\footnote{Ibid., p. 120.}

Industrial Chemicals and Monomers Limited has set up a medium sized plant at Sankarnagar in the year 1952 to manufacture chemicals with a capacity of 300 tons per annum\footnote{Report from the Works Manager, Industrial Chemicals and Monomers Limited, Sankar Nagar, dated 8 December 1993.}. The installed capacity increased to 1000 tons per annum in 1959 and 12000 tons per annum in 1979. The capital investment during the year 1993 was Rs.227.82 lakhs. Raw materials such as limestone, charcoal etc., are purchased mainly in the district itself\footnote{District Census Handbook, Tirunelveli, 1965, p.48.}. About 300 employees were employed in the factory. The amount of wages paid in 1960 was Rs. 1 lakh which increased to Rs.5 lakh in 1993. The employees have formed Industrial Chemicals and Monomers Workers Union in the factory. Employees are covered by social security acts viz., Employees Provident Fund, and Employees State Insurance scheme. A subsidised canteen is run by the management. Employees are encouraged to have saving habits. A cooperative thrift and credit society caters to
the needs of employees. To encourage family planning, employees are given a cash incentive of Rs.300/- and four days leave. All employees are covered by Janatha Insurance Policy to meet any unforeseen accidents liabilities outside the work area.

**MINERALS**

Limestone, Kankar, carnet and illuminate are available in large quantities in the district at Kurunjukulam near Kuruvikulam in the Tirunelveli district. were examined with a view to utilise them in the pencil industry. Some testing pits were put in the area. Graphite was found to be about 3 feet below ground. It was of a fairly good grade and about 1,000 tons of the material was estimated. The deposits lie in a private land.\(^{58}\) A report was submitted on this subject in continuation of the report of the Geological Survey of India.

As desired by the sub-committee for cement and medium-scale Industries, systematic investigation of the various grades of limestone in each district was decided. The first work was started in the Tirunelveli District and some boring operations were also carried out with the Diamond drill to find out the depths to which the limestones extend. The work in the Southern portion of Tirunelveli district reveals that there are subsinient lime stones in the Southern region (excluding the Coral limestones) to set up a small cement plant in the area.\(^{59}\)

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\(^{58}\) Administration Report of the Department of Industries and Commerce in Madras, 1959, p.11.

\(^{59}\) Ibid., p.12.
MINERALS AND MINERAL BASED INDUSTRIES

M/s. India Cements Limited, Sankar Nagar and Tamil Nadu Cements Corporation Limited, unit at Alangulam in Virudhunagar district are mainly consuming limestone and Kankar available in the district for manufacturing cement. There are also private lessees for mining and utilising the limestone and Kankar for manufacturing cement powder and other allied time products. There were 41 mining leases for limestone and Kankar and four leases for garnet granted by the Government in 1995. The royalty for limestone and Kankar is Rs.25/- per ton, and for Garnet it is Rs.45/- per ton. Minor minerals such as stone sand and earth (clay) are available in this district. There are a number of stone crushers, which use the stone for making jellies. There are also bricks and tiles industries which use earth for making bricks and tiles. One hundred and twenty eight lessees had been granted for quarrying stones, sand and earth (clay). Granites which are used for polishing are found in Sankarankoil, Ambasamudram, Sivagiri, V.K. Pudur, Tenkasi, Nanguneri and Radhapuram taluks.  

PIN MAKING INDUSTRY

Pins and allied products manufacturing are pioneer units in the district. Various products ranging from pins to pipes are manufactured in the industrial group. Popularly called ‘Bell Pins’, a private concern has established several units in Palayamkottai to manufacture various products such as paper pins, staple pins,

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60. Report from the Assistant Director of Geology and Mining, Tirunelveli, dated 15 April 1995.
safety pins, cotton buds, steel wires, stitching wires, concrete pipes, etc. The machines for the manufacture of these products have been developed indigenously as a measure of import substitution. Pins are of different dimensions 16mm, 18mm, 20mm, 22mm, 26mm, 32mm, and 36mm. Rustless pins are made of brass and used extensively by garment makers. The units have power operated machines which produce 400 pins per minute. Mostly women are employed for packaging.\textsuperscript{61}

The Bell Pins Company is an important industry in the District. The company was founded by A. Chelladurai in the year 1952.\textsuperscript{62} It was originally started with a small office and with less than 10 workers. The company then progressed very rapidly under his directorship and he created a brand name called ‘Bell’ the most crowned name for stationery in every home.

The company as on today is the largest manufacturer of stationery products in South East Asia, with a capacity of about 600 tons per annum. The initial technology was absorbed from companies in West Germany and slowly the technical experience led to design and manufacture of more than 400 automatic machines. The turnover as on date stands at more than 10 crore, employing 600 people within an industrial area of 40 acres. The company at one point of time realized that backward integration will be the best solution. Hence, the company today has a wire drawing unit capable of drawing copper coated or galvanized wire from 5.5 mm to 0.4 mm. Moreover, the design and printing of packing

\textsuperscript{62} Profile of the Bell Pins Company, Tirunelveli, 1952.
material, which was laborious, was made easily by the company’s own printing unit.

The company on the whole, today has a dominant role with about 32% market share in the wire leased stationery products line. The company has been regularly exporting its goods to the U.S., Europe, Africa and to the rest of Asia. The exporting products are BEA Preumatic Tools, Candles, Concrete pipes, Curtain Rods, Drawing pins, Ear buds, ID clips, Industrial Staples, Machinery, Matches, Pad Clips, Paper Pins, Power house, PVD clips, Safety Pins, S courer, Stapler and stitching wire.  

**The Bell Industrial Estate**

The Bell Industrial Estate was founded in the 1952 as a tiny industry with a total employment of 20 persons and with the connected power load of 25 HP producing paper pins, paper clips and office staples. The unit has spread over more than 30 acres of land on the Tiruchendur-Thoothukudi highway road. Later during 1960’s another unit was started to produce exclusively for safety pins. During the period there were acute shortage of steel wires, the primary raw material for these products and so another independent unit was started to produce steel wires of very fine diameter of both copper coated and zinc plated. During 1970’s, there were much restrictions to import machinery to produce these wire products, which caused a necessity to take up the manufacture of capital

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machinery. This difficulty was met by producing all the required machinery in the estate, a few more units for producing fire works, knitting needles, concrete blocks, concrete pressure and non-pressure pipes and health products like cotton buds were also set up in the estate during 1980’s. The estate is a full fledged composite unit producing the required capital machinery, raw material and the end product. The total employment in the whole of Bell Industrial Estate is more than 600 and the connected power load have crossed 1500HP. As regards employment about 70 percent of the total employees are women. The management runs educational institution, a mother and child care hospital. Pollution control methods have been adopted in the effluent treatment.64

Garnet Industry at Keerai Karanthattu in 1989 a group of complex Silicate minerals by name Garnet have physical properties of isomeric crystal formula and general chemical formula. The beach area of Radhapuram taluk contains a variety of garnets which is industrial use almandite, the occurrence of which here, is commercially attractive. Occurring in concentrated form in the river mouth of Nambiar and Anuman in the Radhapuram taluk, Garnet is of beach placer deposits of sands associated with other heavy minerals and quartz etc., in varying quantities. It is deposited in the literal zone in the coast by the waves in depths ranging from 5cm to 20cm65. The mineral could have been mainly extracted from Khondalite suite of rocks, common in the Western Ghats, disintegrated by

physical weathering, transported by the rivers draining into the sea and deposition into the sea bed. The rivers bring in a lot of these minerals during floods. Sea currents and waves help to bring these minerals to the shore and heavy minerals are deposited. As the layers of garnet sand, deposited by the waves are so removed, the place gets refilled repeatedly by the waves. The garnet is collected by labourers manually using shovels, spades and baskets. This rare mineral is collected under mining lease granted by the Tamil Nadu Government. Garnet collection a labour intensive industry and it provides employment to thousands of people in the district particularly in the drought prone area. It fetches good foreign exchange. The State Govt. earns a revenue nearly Rs.50lakh per year by way of royalty. V.V. Mineral company at Keeraikaranthattu is one of the important garnet industries in the district. Processed garnet is used as a water filtration element, the powdered garnet is used for polishing television tubes and sand blasting for surface treatment.66

V.V. Garnet Factory, Tisaiyanvilai

V.V. Mineral Company has set up a factory at Keeraikaranthattu, a tiny village in Radhapuram taluk, an industrially backward area. This factory produces garnet s ‘wonder mineral’ that has a fame in the world. The factory was started in 1989. From inception, the factory is making a good performance in exports. Garnet mineral is obtained from the sea without affecting ecology and

environment. Garnet is the right mineral which has met all the conditions-environment as well as health. The garnet is found deposited in thickness of 5mm to 30mm. No heavy machinery is involved. It is done manually with no disturbance to nature and its environment. It has all the sanction and licence from both the Central and State Governments. Two implements, spade and basket are used in the collection of garnet sand and it provides livelihood to thousands of workers in the predominantly agricultural region faced by drought often due to failure of monsoon.

Thus the Sugar Mills and allied industries of the district are impressive one. The total number of Sugar Industries are only four. They are Lakshmi Sugar Mill, The Pettai Sugar Mill, Sarangapani Sugar Mill and Dharani Sugar Mill The allied industries are of many types. Among them the most important industries mentioned in this Chapter are Chemical Industries; Mineral based Industries, Pin making Industries, and Garnet Industries. These industries flourish in small villages like Narayanapuram, Sivagiri, Kuruvikulam, Alankulam, Ambasamudram, Sankarankovil, V.K.Puthur, Tenkasi, Nanguneri, Radhapuram, Thoothukudi and Palayamkottai. Soon after establishment of the Sugar mills and other allied industries the villages mentioned above have been flourishing in many ways. People living in these villages, who slowly depended on agriculture, had to turn to the industries for their work. This led not only to make their work easy but also to get regular income. Though the salary was not much they were content to
satisfy the daily needs apart from spending sufficient money for the purpose of the education of their children. Before the establishment of these industries, these villages appeared like deserted place and later on they could be termed as big towns. The supply of chemicals, pins and other allied products, produced in this factories are sent to the other parts of Tamil Nadu as well as other States like Andhra, Mysore and Kerala. There is no doubt that the policies of the Government and its encouragement will naturally boost the industries of the district in the years to come.