Adishakti Dhandai Shikshan Prasarak Sanstha's,

Late Annasaheb R. D. Deore Art's And Science College,

Mhasadi Tal. Sakri, Dist. Dhule- 424304

Industrial Tour Report: 2022-23

At

Dwarkadhish Sugar Industry Pvt. Ltd. Shevre

Organized by

Department of Chemistry

Submitted by

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Class: T.Y. B. Sc. **Seat No.:** 360477

Signature of HOD: **Int. Examiner** **Inorganic Chemistry** **Organic Chemistry**

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Principal
A.D.M.S.P.Sanstha's
Late Annasaheb R.D.Deore
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Mhasadi,Tal.Sakri,Dist.Dhule.

TOUR DETAILS:

Department of Chemistry arranged one day industrial tour at Dwarkadhsih Sugar Industry Pvt. Ltd. Shevare (Taharabad), Tal. Satana, Dist. Nashik on 2nd March 2023 at early in the morning. The Managing Director Mr. Sachin Sawant had given permission to our students to observe the whole industry. The chief chemist Mr. M. D. Kacchave was given the detail plant information to our student. Therefore we all are thankful to industry.

INTRODUCTION:

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 tonnes per hectare.

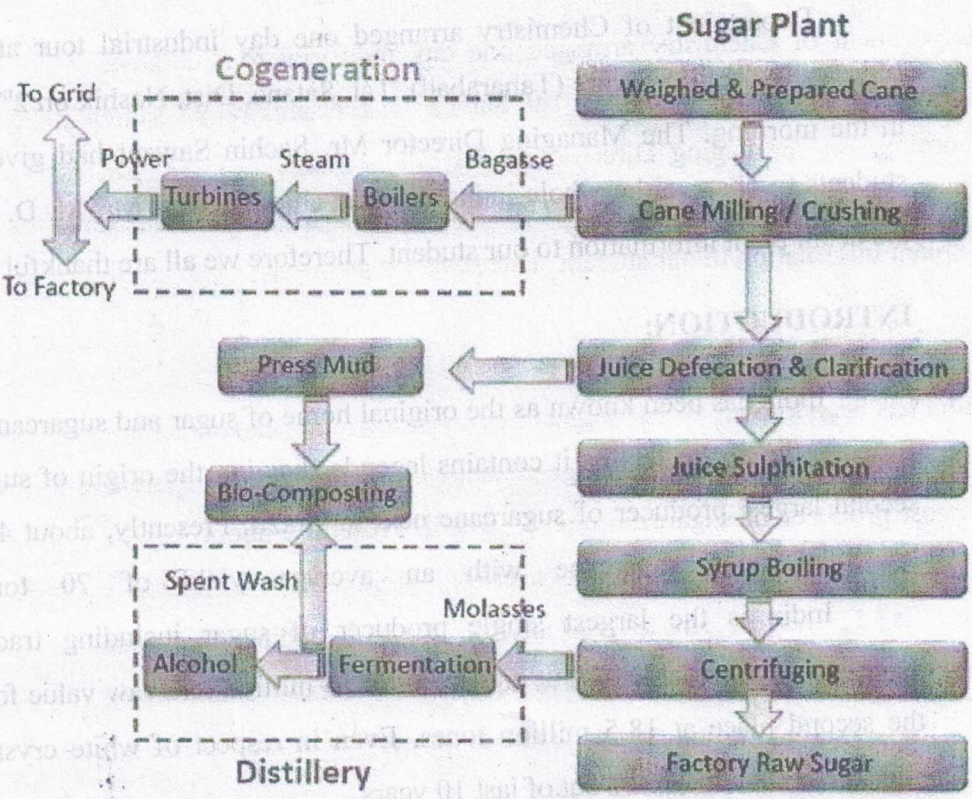
India is the largest single producer of sugar including traditional cane sugar sweeteners, khandsari and Gur equivalent to 26 million tons raw value followed by Brazil in the second place at 18.5 million tones. Even in respect of white crystal sugar, India has ranked No.1 position in 7 out of last 10 years.

Traditional sweeteners Gur & Khandsari are consumed mostly by the rural population in India. In the early 1930's nearly 2/3rd of sugarcane production was utilized for production of alternate sweeteners, Gur & Khandsari. With better standard of living and higher incomes, the sweetener demand has shifted to white sugar. Currently, about 1/3rd sugarcane production is utilized by the Gur & Khandsari sectors. Being in the small scale sector, these two sectors are completely free from controls and taxes which are applicable to the sugar sector.

The advent of modern sugar processing industry in India began in 1930 with grant of tariff protection to the Indian sugar industry. The number of sugar mills increased from 30 in the year 1930 - 31 to 135 in the year 1935-36 and the production during the same period increased from 1.20 lakh tonnes to 9.34 lakh tonnes under the dynamic leadership of the private sector.

The details of manufacture of sugar from cane sugar are as follows:

Sugar Manufacture Process:



Juice extraction from cane :

- **Sugar cane**

The cane plant consists of a stalk, roots, growing leaves, the remains of dead leaves, and a growing leafy top. The typical composition of cane is as follows:

- 15% dissolved matter (13% sucrose; 2% are other sugars -mainly glucose and fructose)
- 15% fibre (insoluble), and
- 70% water.

For every 100 tons cane crushed, 30 tons of fibrous residue (bagasse), and about 12 tons sugar and 4 tons molasses are made.

The farmers transport the cane *stalks* (i.e. cane without roots, without leaves and without tops) to the sugar mill in specially designed vehicles that facilitate easy loading and offloading.

- **Cane preparation**

Juice can be removed from cane either by repeated crushing and washing (milling) or by washing alone, with a final squeezing simply to dry the spent fibre (diffusion). Better sucrose extraction can be obtained by crushing finely shredded cane rather than intact stalks and "Preparation" refers to that step in which cane is finely shredded before juice is extracted either by milling or diffusion. Cane is prepared by passing it through one or two sets of cane knives and then through a shredder.

- **Milling**

A basic cane mill consists of three grooved rollers. Prepared cane is squeezed between the rollers, thus forcing the juice out of the fibre.The basic work of a mill is the separation of juice from fibre. Fibre,

However, has the natural property of always retaining approximately its own weight of juice regardless of the pressure applied to it. To displace retained juice, water is poured onto the cane fibre before crushing. This is called imbibition.A single milling unit would give an unacceptably low extraction. Typically, six mills are set in tandem and cane is passed in series from Mill 1 to Mill 6.

- **Diffusion**

A diffuser is an enclosed carrier through which a bed of prepared cane is slowly dragged, while copious quantities of water and juice percolate through the bed to wash out the sucrose -bearing juice.The fibre leaving the diffuser is saturated with liquid and has to be dewatered in a mill before being sent either to the boilers or to by-product processes.

- **Purification of juice**

Juice from a milling tandem contains a large amount of cane fibre that falls out with the juice between the rollers of the mills. To remove the fibre, juice is poured over a wire-mesh screen, or cascaded over an inclined wedge-wire screen). Diffuser juice, because of the screening effect of the cane bed itself, is generally not screened.

The juice is heated and lime is added to neutralise the natural acidity. It is then placed in a large settling tank called a clarifier The purpose of clarification is to produce a clear juice that is light in colour and free of suspended matter. To improve the precipitate formation, flocculent is added.

The settled precipitate, referred to as mud, is pumped out of the trays of the clarifier and sent to the filtration station where the juice it contains will be recovered. If a diffuser is used, it is sent to the diffuser and filtered through the bed of bagasse.

Crystal growth

- **Evaporation**

Before crystal growth can take place the clear juice must be concentrated to syrup by the removal of water by evaporation. To improve the efficiency of the water removal step a process known as multiple effect evaporation is used. Multiple effect evaporation is the scheme where juice is boiled in series in several vessels, with steam fed to vessel 1 only. Vapour from vessel 1 boils the juice in vessel 2, vapour from 2 boils the juice in 3, and so on until vapour from the final vessel goes to waste.

- **Sugar boiling**

The syrup produced by the evaporators is concentrated further in specially designed vessels known as pans. As the concentration rises the dissolved sugar crystallises and the work of the pans is to grow sugar crystals (from the sucrose in syrup) in several steps to maximise the amount of sucrose recovered in raw sugar.

This is typically done in three boiling steps; each step producing, after crystal/molasses separation, A-sugar and A-molasses, B-sugar and B-molasses, and C-sugar and C-molasses or final molasses.Supersaturation is the "driving force" in all sugar boiling. Supersaturation is controlled by adding water or syrup to massecuite (crystal / molasses mixture) and by controlling the temperature.When the massecuite is discharged from the pans it is retained in stirred tanks called crystallisers, where the sugar crystals continue to grow through cooling rather than boiling.

- **Separation of crystals from molasses**

Massecuite leaving the crystallisers has now to be separated into crystals and molasses. The more efficient this separation, the more sucrose will be recovered as sugar and the less sucrose will be lost in molasses. A centrifugal is a machine that separates crystals from molasses. Centrifugation involves spinning massecuite in a perforated basket; centrifugal force acts on the molasses, forcing it through the perforations while the sugar remains on the basket wall. Water and steam may then be sprayed onto the crystals to wash off the remaining molasses.

- **Sugar drying**

Sugar leaving the centrifugals has excess moisture which has an extremely detrimental effect on the keeping quality of the raw sugar and drying is therefore important. In a drier, the moisture is driven off from the surface of the liquor layer covering the crystal by passing heated air around the sugar crystals.

The product from the process described so far is a raw sugar (Brown sugar) that can be used as is, or sent to a refinery to be converted to a white (refined) sugar.

- **Sugar refining**

The purpose of the refinery is to remove impurities from sugar crystals. The refinery accepts raw sugar as its feed material. The sugar is dissolved (melted) and the colour is removed by various clarification processes.

Re-crystallisation (from a higher purity mother liquor) is alone responsible for a considerable amount of colour removal but other techniques must be employed to obtain the low colour levels of white sugar. Tongaat Hulett uses two colour removal processes before the crystallisation and these are carbonatation and ion exchange.

In carbonatation lime and CO^2 (carbon dioxide) gas are added to the melt to form a calcium carbonate precipitate. This precipitate absorbs colour, is removed by filtration. Further colour is then removed by ion exchange. Resin beads are held in tanks through which the liquor is allowed to percolate under pressure.

The purified melt is evaporated and up to 4 crops of crystals are boiled from this. These crystals are combined to form the refined sugar product.

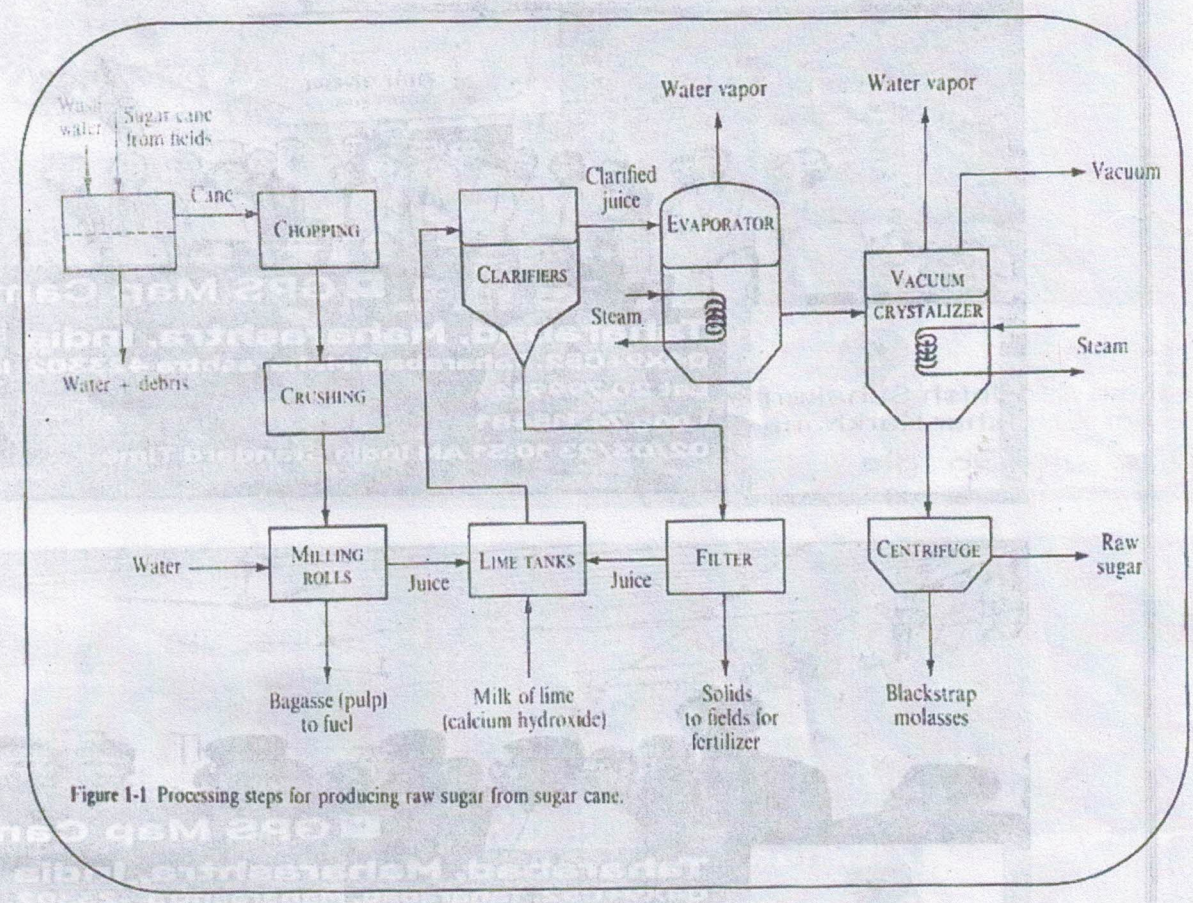
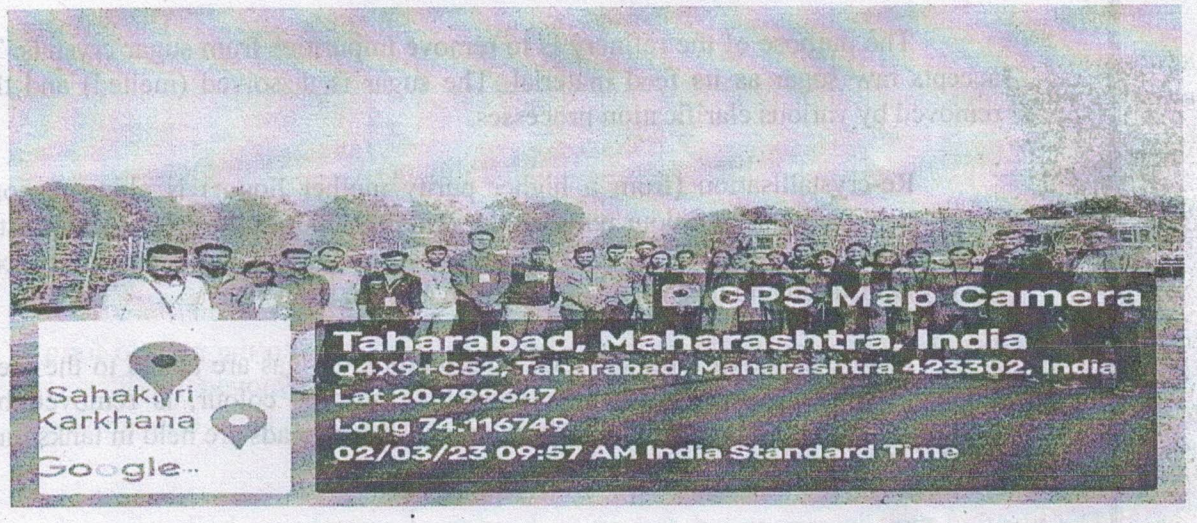


Figure 1-1 Processing steps for producing raw sugar from sugar cane.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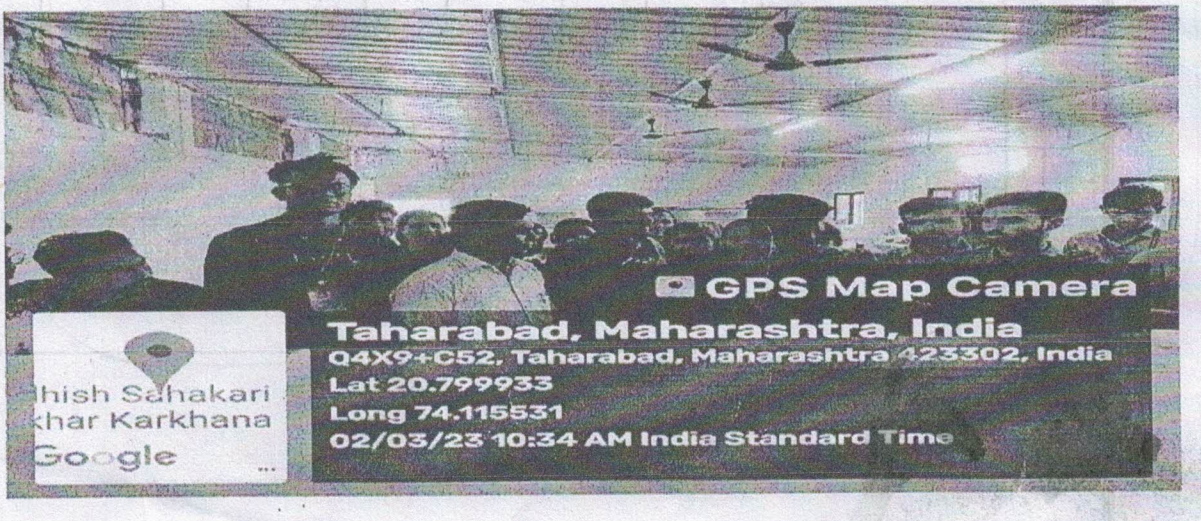
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