



Gur and Khandsari

Raw Sugar Preparation

The total cane production in the state is 63.40 lakh tonnes, out of which about 30 per cent is crushed by sugar factories, 55 per cent is converted into ***gur*** and ***Khandsari*** and remaining 15 per cent is used as seed and for chewing. Sugar cane is an important agro-industrial crop in the state of Punjab and is grown on an area of 1,04,000 hectares. The

important cane growing districts are Gurdaspur and Ropar.

Crushing of the cane sticks is the first step in the manufacturing of ***gur***. Various types of bullock and electric driven crushers are used for this purpose. Some of these crushers are not very efficient and give a low extraction of juice but in spite of this cane growers have tendency to select a crusher of local make probably due to easy availability, though it sometimes results in a low juice extraction and can sequentially reduce recovery of ***gur***. Selected crusher has a reasonably high crushing speed together with the power of optimum juice extraction.

For juice extraction, cane is cut in the field, trashes are removed and upper portion are then washed with water. Cane is crushed with crushers. The juice is

stored in barrel in tin bucket. The juice is boiled in pan on furnaces for further processing.

Sajji (crude sodium carbonate), soda, ash, sodium hydrosulphate, sodium carbonate and super phosphate etc. are few clarificants used in *gur* making process. They are generally dissolved in a small quantity of water and added in the cooling pan just before final stringing of the mass. These clarificants are sometimes added twice. After clarification with some vegetable clarificant, the process is repeated again in the cooling pan. As regards lime, it is always used before the boiling has started and never in the cooling pan.

Gur making

For the manufacture of **gur**, single pan furnace is generally used in Punjab, though double or multiple pan furnaces are not an uncommon sight. The main



difficulty with most of common furnaces is their excessive fuel consumption and low rate of boiling. Boiling of juice to the proper consistency requires great skill on the part of the boiler as slight over-boiling results in caramelization and consequent damage to the colour and flavour of the **gur**.

On other hand **gur** does not solidify in case the juice is under boiled. The exact point at which boiling is regarded as complete and the boiling mass is fit to be taken out of the pan for cooling is called the striking point.

Juice is first strained through a piece of cloth for removing the particles of bagasse and any other material suspended into it. The strained juice is taken into the pan and firing of the furnace is started. The scum that rises to the surface is ladled out and filtered through a cotton or woollen cloth. The filtrate is again mixed in the juice. The extract of "**Sukhali**" is then added to it in the boiling pan. This results in

coagulation of all the colouring matter and other impurities in the juice, which rise to the surface in the form of thick scum. This scum is again skimmed off by means of a perforated ladle and the filtrate returned back to the pan.

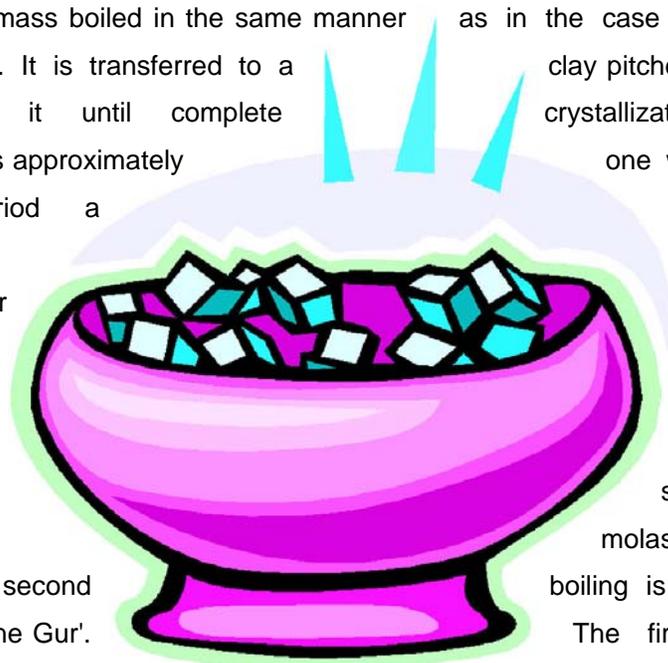
When the boiling has sufficiently advanced, the mass is stirred frequently by means of a wooden stirrer in order to avoid caramelization due to excessive local heating. At the final stages mustard oil is used to keep down the froth. An experienced juice boiler can judge accurately when the mass has to be stuck out of the boiling pan. This striking point is reached when the boiling mass attains a temperature between 115°C to 120°C. But this striking point is always judged by eye-estimation and never by thermometer.

In order to judge the striking point correctly, any one of the following methods can be tried.

- When striking point is reached, the mass is poured into a cooling pan and allowed to cool.
- When the temperature is just bearable, small portion is removed by a wooden handle and made into the desired shape.

Khandsari Sugar

The mass boiled in the same manner as in the case of ordinary ***gur*** manufacture. It is transferred to a clay pitcher and allowed to remain in it until complete crystallization takes place. This requires approximately one week. After this curing period a centrifugal machine producing the first sugar and molasses purges the masseciute. The molasses is reboiled to obtain the second sugar. The exhausted molasses, resulting from this second boiling is boiled to make the 'Melasgine Gur'. The first and second sugar thus obtained is sent to refineries for making



white sugar. The polarization of this sugar is 96-97% and the moisture content is less than 0.5%.

For raw sugar production cane cut in the field and reached in factories with trucks, bullock carts and wagons etc. Then extraction of juice with three rollers arranged in triangular form is the standard milling unit of the industry. From three to seven sets of such three roller units, described respectively as a nine-roller to twenty one roller mill, are in use, although nine-roller mills are seen today only in the older and smaller factories. Each mill unit is commonly driven by separate motor power, either steam engine, electric motor.

In addition, one crusher or shredder or both, cane knives and intermediate carriers are used. Sometimes a 'Kicker' is recommended in addition to be installed as an auxiliary device to level the layer of whole cane into uniform thickness to feed the cutter knives in order to eliminate their choking and promote smooth performance. A shredder is also considered a good adjunct to improve the cane preparation, higher rate of crushing and mill extraction.

Milling

After milling, the cane juice as it comes from the mills contains many soluble and insoluble impurities. It is turbid and viscous in nature, and is not fit to be worked for white sugar manufacture without suitable chemical treatment. It is necessary to remove the maximum quantity of impurities from the expressed juice at the earliest to obtain pure crystallized sugar.

Clarification

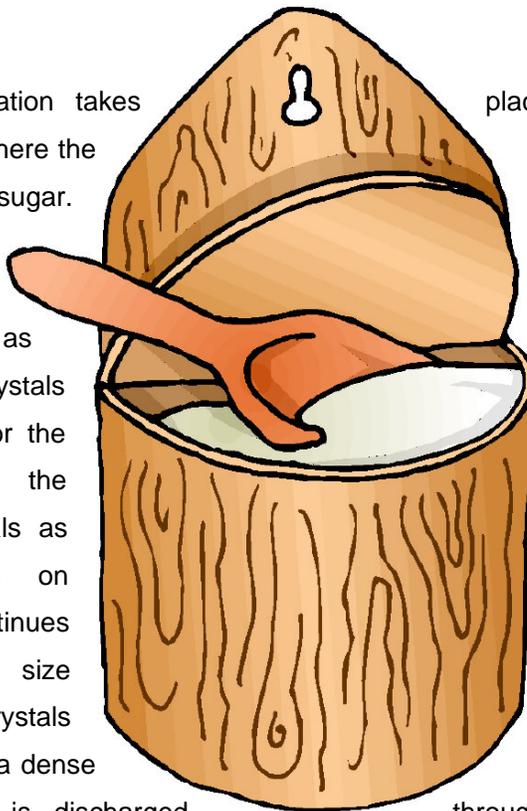
For clarification chemical agents used i.e. milk of lime, about 1 litres CaO per ton of cane, neutralizes the natural acidity of the juice, forming insoluble lime salts, mostly calcium phosphate. Heating the lime juice to boiling or slightly above coagulates the albumin and some of the fats, waxes and gums and the precipitate thus formed entraps suspended solids as well as finer particles. The mud is separated from the clear juice by sedimentation. The muds are filtered on rotary-drum vacuum filters, or in pressure leaf filters. The filter-pressed juice returns to process or goes directly to clarified juice, and the press cake is discarded to the field

for fertilizer. The clear dark-brown clarified juice goes to evaporator without further treatment.

The clarified juice, having much the same composition as the raw extracted juice except for the precipitated impurities removed by the lime treatment, which contains about 85% of water. Two third of this water is evaporated in vacuum multiple effects consisting of succession of vacuum boiling cell arranged in series at lower temperature. Each succeeding body has higher vacuum therefore the juice boils at 100 degree centigrade or less, the vapor from one body can thus boil the juice in the next one. In this system the steam introduced to unit, the first goes to a condenser. So the vapor fro the final body goes to a condenser. A gradual effect in which 1 lb of steam evaporated 4 lb of water to syrup leaves the last body continuously with 65% solids and 35% water.

Crystallization

Crystallization takes place in vacuum pans, where the syrup is evaporated unit saturated with sugar. At this point, seed grain is added to serve and mules for the sugar until crystals, and more syrup is added as the water evaporates. The original crystals formed by the skill of the pan boiler or the instrument control grow without the formation of additional crystals as sugar from the boiling mass deposits on them. The crystal continues until they are of predetermined size when the pan is full. The mixture of crystals and syrup is concentrated to a dense mass, "massecuite", and the strike is discharged through a foot valve into a mixer or crystallizer. The boiling of massecuite and the re boiling of the molasses are carefully controlled and carried out by boiling system.



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The massecuite from mixer or crystallizer is drawn into revolving machines called centrifugal. The cylindrical basket suspended on a spindle has perforated

sides lined with wire cloth, inside of which are metal sheets. The belt-driven machine revolves at speed. The perforated lining retains the sugar crystals, which may be washed with water if desired. The mother liquid, molasses, passes through the lining because of the centrifugal force exerted and when the sugar is purged. It is cut down leaving the centrifugal ready for another charge of massecuite.

In three boiling systems, the first boiling of pure syrup yields raw sugar and a molasses, which is returned to the vacuum pan to be re boiled on a footing of first grade massecuite to a second massecuite 'B' that in turn yields a second crop of crystals. B sugar is mixed with the A sugar to form the commercial output of the factory. The second or B malasses is of much lower purity and in turn is re boiled on a footing of syrup crystals to form low-grade or C massecuite. These low-grade massecuite remain in crystallizers for several days where they cool while being kept in motion with stirrings arms. The 'C' sugar is mixed with syrup and used for A and B massecuite seed. The final molasses or blackstrap of heavy viscous material containing approximately one-third sucrose, one third reducing sugars, the remainder ash, organic non sugars, and water, serve as a base for cattle feed, the manufacture of industries alcohol and yeast production.

Latest focus: Modernization of sugar mills

In a bid to encourage sugarcane growers, the Government had decided to give back Rs. 60 collected as purchase tax on every tonne to the growers especially in Andhra Pradesh. It has been reported that Union Government has announced financial assistance for modernization and expansion of ten cooperative sugar factories in Andhra Pradesh in tune of 358 crore as working package.

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