ANSI (ST) 3RD YEAR NOTES

Open – Pan Sulphitation Sugar Process

by

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The technology is based on an upgrade of Khandsari production in India, using a mix of traditional and scaled – down version of modern sugar technologies. The production process can be divided into six stages:

Extraction of juice from the cane

Clarification of the juice

Boiling of the juice

Crystallization

Centrifuging

Dry and Packaging

Extraction:

Juice is extracted from the cane by a crushing unit consisting of two or three power roller mills of three rollers each. These crushers are similar to those found in large-scale factories. Improved extraction can be achieved by hydraulically loading the pressure roller and slicing the cane along its length before crushing.

Clarification:

Chemical clarification based on modern cold lime Sulphitation is carried out to remove impurities which inhibit the formation of the crystals and can discolor the final product. Lime also reduces the natural acidity of the cane juice.

Batches of juice are treated simultaneously with lime and sulphur dioxide after which the juice is transferred to an open boiling pan and quickly heated to 90°C or above.

The lime and heat treatment form a heavy precipitation the flocculation carrying with it most of the suspended impurities in the juice. The juice is then filtered and allowed to settler the clear juice is decanted and transferred to the boiling furnaces.

Boiling:

The boiling operation is required to evaporate water and reduce the juice to a concentrated form usually called massecuite.

The equipment used is based on traditional Indian Technology for the production of Khandsari and jaggery. A series of four or five open pans, each boiling a successive concentration of juice at progressively higher temperatures, is located above a furnace.

The massecuite is removed from the final boiling pan at above 84°Bx at a temperature around 112°C.

The heat required for boiling is provided by bagasse and depending on the design of furnace, is often supplemented by other fuels. The hot flue gases pass directly under the pans, heating the juice, before being exhausted to the atmosphere.

The transfer of juice from one pan to the next is controlled by valves through overflow pipes, or the juice can be ladled manually. The massecuite from the final pan is usually too viscous to flow easily. So it is ladled in to buckets and transferred to the crystallizers.

Crystallization:

The massecuite is placed in U-shaped vessels where it is slowly rotated and allowed to cool for up to 48 hours. This technique is often referred to as crystallization in motion. Rotation promotes even cooling of the massecuite which helps to achieve uniform crystal growth. Seeding can also be carried out that is granulated massecuite from a crystallizer in which grains have already been developed are place in to the crystallizer before it is filled with fresh massecuite. This helps to promote uniform crystal growth.

The massecuite, now consisting of crystals suspended in molasses, is transferred to the centrifuge.

Centrifuging:

The centrifuge, a scaled down version of those used in large-scale factories. Consist of a perforated inner drum located inside a larger drum. The perforated drum is rotated rapidly forcing the molasses to separate from the crystals. Water is sprayed in to the spinning drum to assist in the removal of the molasses.

The crystals of sugar and then removed from the centrifuge and transferred for drying. The molasses is collected and can be reboiled, crystallized and re – centrifuged to produce a second, lower quality, crystal sugar known as B-sugar.

Drying & Packaging:

The crystals can be dried in a number ways by placing them in the sun, by using simple solar driers, or by using rotary or hopper driers which require fuel to provide drying heal. The dried product can be then be packed in to suitable containers or bags,

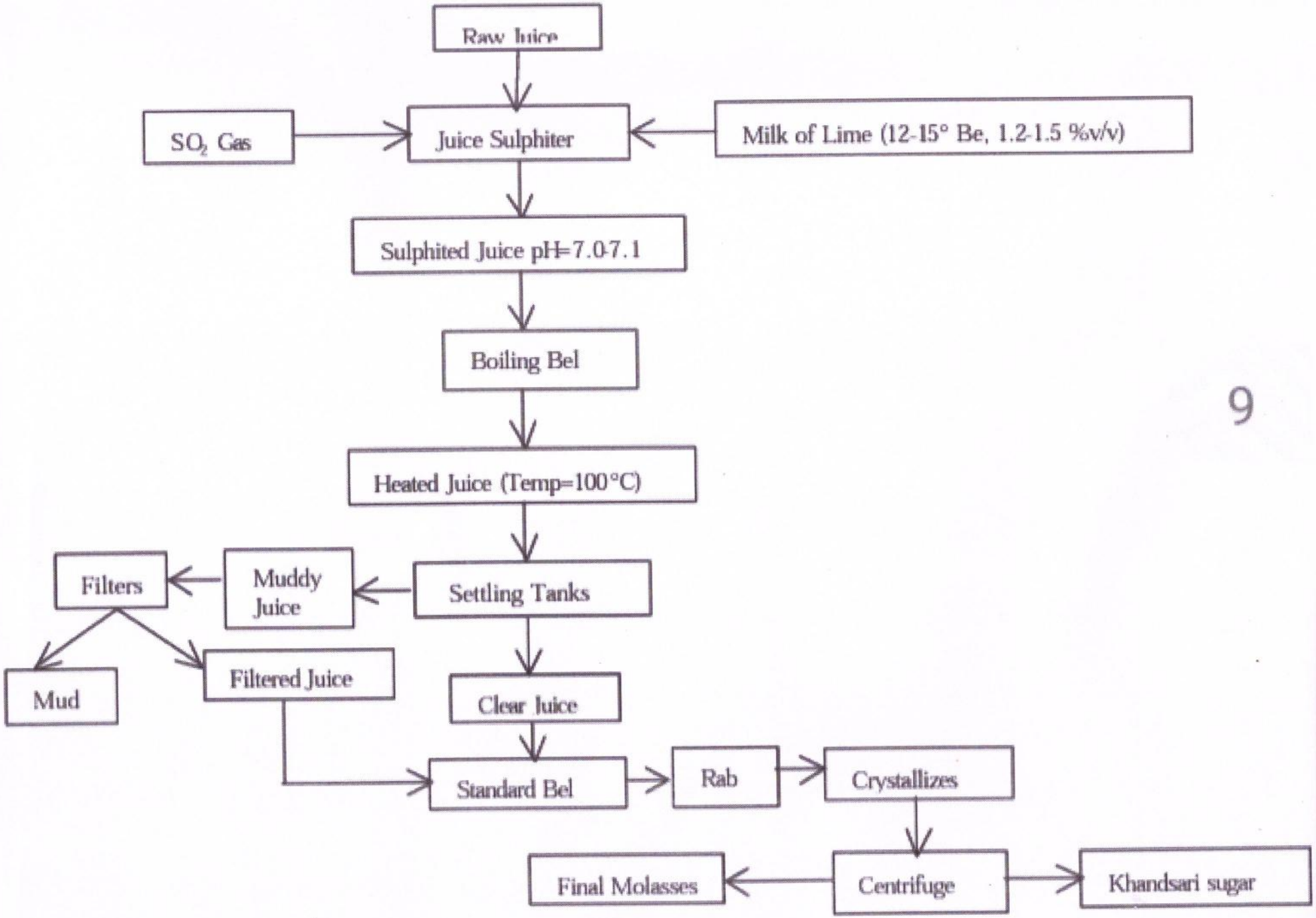

Figure 9: Manufacture of Khandsari Sugar by Improved open pan Boiling System [5]

Table 1 Requirements for *Khandsari*

(*Clause* 4.5)

Characteristics	Requirements			Method of T
	Khandsari Desi	*Khandsari* Sulphur		Annex of this Standard
		Grade 1	Grade 2	
(2)	(3)	(4)	(5)	(6)
Moisture, percent by mass, *Max*	0.5	0.3	0.5	—
Pol percent, *Min*	96.0	97.5	96.5	—
Sulphur dioxide, (on dry basis), mg/kg, *Max*	Nil	70	70	—
Acid insoluble ash (on dry basis), percent by mass, *Max*	0.7	0.3	0.5	A
Calcium oxide (CaO), mg/100 g, *Max*	100	100	100	—
Specific conductivity (mhos/$cm^2 \times 10^6$), in 5 percent solution at 30°C, *Max*	100	—	300	—