Our experience of Sulphur free Sugar at Shri Sai Priya

Adikrao Pawar – Unit Head – Shri Sai Priya Sugars Ltd. Jamkhandi, Dist:Bagalkot

Abstract:
At SSPSL we have installed plant capacity of 16000 TCD. Till 2022 we have produced plantation white sugar. In 2023 we have decided to adopt the process of manufacturing sulphur free sugar equivalent to 8000 TCD cane crushing and balance syrup equivalent to 8000 TCD cane crushing is diverted to distillery.

In this paper process description and advantages of sulphur free sugar are briefed.

Keywords:
Sulphur-dioxide, Sugar colour, Turbidity, Sediment, Raw sugar, Sulphur free sugar

Methods:
Following internationally accepted ICUMSA methods are used for analysis of all intermediate products and final product, sugar.

a) Sulphur Dioxide - ICUMSA GS 2–33 : 2022
b) Colour - ICUMSA GS 9/1/2/3-8 (2011)
c) Turbidity - ICUMSA GS 2/3-18 (2013)
d) Sediment content of sugar - ICUMSA GS 2/3/9–19 (2007)

Introduction:

Most of the sugar factories in India have adopted double sulphitation process for production of white sugar. The sulphur content in sugar varies in between 20 to 50 ppm. Due to this higher sulphur content, this sugar is not acceptable as per international norms.

In the case of sulphitation process, the equipment and piping in operation get corroded resulting in the requirement of repair, maintenance and replacement cost.

For human health and environmental benefits it is recommended to stop use of Sulphur Dioxide.

Considering above we have decided to switch to the production of sulphur free sugar.

Shri Sai Priya Sugars Ltd, Hippargi–Mygur,Tal:Jamkhandi,Dist:Bagalkot (Karnataka)
Email: Mobile:-

Equipment used and Process followed:

A) Production of raw sugar

We have produced raw sugar having following specifications

Colour	: 350 to 500 IU
Turbidity	: Less than 200 IU
Sulphur-dioxide	: Less than 10 ppm
Sediment	: Below 100 mg/kg
Polarization	: 96 to 97 %

For production of raw sugar, we have added one no 100 T/h capacity continuous pan, 2 nos. 100-ton capacity air cooled crystallizers and 3 nos. 1750 kg/charge centrifugal machines for A massecuite curing.

B) Production of Sulphur free sugar

Below A centrifugals, we have installed 2 nos. magma minglers and 4 nos. magma pumps. Magma brix is kept around 90° using hot water. Magma is then pumped to three compartment melter. Each compartment is provided with stirrer. First body vapours are provided for heating raw melt upto 65 to 70°C. temperature of melt is maintained by using vapour control valve. Melt brix is maintained around 60 to 65°. Flow meter and control valve is provided in hot water piping and brix transmitter at melt pump delivery.

Raw melt is pumped to a fully closed rotary screen. Auto wash system is provided for intermediate washing with hot water.

Screened melt is collected in buffer tank and colour precipitant is added in the tank. Screened melt is pumped to direct contact heater. At DCH we maintain temperature of melt upto 80°C. Heated melt is fed to reaction vessel. The reaction vessel is provided with stirrer shaft fitted with axial flow impeller. Milk of lime and phosphoric acid is added in the inlet piping. At outlet of reaction vessel pH sensor with transmitter is provided. pH of treated melt is kept around 7.

Treated melt then delivered to aerator. The aerator is equipped with aeration disc for micronized air mixing with the treated melt. Flotation polymer is added after aerator.

From aerator the floc enriched melt flows in the flotation clarifier through a center pipe. Scum is removed from the top surface of the clarifier. Clear melt collection coil and telescopic valve arrangement is provided to take out clear melt from clarifier and flows to clear melt tank by gravity.

Scum resulted from melt clarification is collected in scum tank and then fed to mud tank of decanter system.

Following chemicals are used for MCS:

1. Colour precipitant : 100 to 250 ppm on melt solids
2. Phosphoric acid : 250 to 350 ppm on melt solids
3. Lime sucrate or MOL : to maintain desired pH of treated melt
4. Flotation polymer : 10 to 12 ppm on melt solids

Chemical dosing is in auto mode.

Clear melt is then pumped to multibed filter system. We have 3 nos. multibed filters out of which 2 nos. are working and 1 under back wash. Multibed filter is having 6 layered filter media consist of various sized gravels, sand and anthracite.

The entire operation of multibed filters is in auto mode.

Filtered melt is collected in back wash tank. Back wash tank is always in filled condition and filtered melt overflows in filtered melt tank. Melt is then pumped and pass through 50 micron opening bag type filters. From bag filters melt is fed to melt concentrators. We have used Robert type melt concentrators to concentrate melt upto 70° brix. Concentrated melt is then collected in concentrated melt tank and pumped to pan supply tank.

We have used existing set up to produce R1, R2 and R3 sugar. We are following R1, R2 and R3 pan boiling scheme. Runoff from R1 centrifugal is taken to produce R2 sugar. Runoff from R2 centrifugal is taken to produce R3 sugar. Runoff from R3 centrifugal is taken to A pan for raw sugar production.

We are bagging R1 sugar separately and R2 + R3 sugar separately.

Sulphur free sugar specifications

Colour R1 sugar	: Below 30 IU
Colour R2+R3 sugar	: Below 50 IU
Sulphur-dioxide	: Less than 5 ppm
Sediment	: Below 20 mg/kg
Polarization	: Above 99.5 %
Beverage floc	: Negative

Advantages of Sulphur free sugar:

- Sulphur free sugar is suitable for international market.
- 100% saving in sulphur cost
- Around 30% saving in lime cost.
- Improved keeping quality
- Lower insoluble matter in sugar.
- Lesser risk of inversion loss.
- Rise in recovery.

Conclusion:
As use of sulphur is totally eliminated the sulphur free sugar produced is beneficial for human consumption, better atmospheric conditions and increased life of equipment. Sulphur free sugar gives higher premium. Existing double sulphitaion plant can be converted to sulphur free sugar plant easily.

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