

India is among the largest producers and consumers of sugar in the world. About 3% of India's cultivable land is under sugarcane and around 50 million farmers and their families are dependent on sugarcane cultivation. Sugar is also India's second largest agro-processing industry. The sugar industry is therefore vital to our country's economy.

From Cane
to

SUGAR

Sweet Solutions for the Sugar Industry
From Jon Exchange

Due to the poor monsoons of the last few years and resultant shortfall in sugar production, the Government of India decided to import and reprocess raw sugar to produce plantation white sugar. Another Government



decision was the blending of 5% ethanol with petrol; hence many sugar factories have also diversified into byproducts by establishing distilleries, ethanol plants, organic chemical plants and power cogeneration plants. Some sugar mills have also upgraded their plants to produce refined sugar of EC grade in order to better compete in the international market.

The Sugar Industry and Water

Sugar mills require huge volumes of water for their production processes. They typically consume 900–1000 litres of water and generate about 300–400 litres of waste water per tonne of cane crushed. The conventional water demand of a 2500 TCD (tonnes of sugarcane crushed per day) plant producing 200 to 300 tonnes sugar/day is 1–2.5 million litres/day. From 2005, the sugar and associated industries such as distilleries and ethanol plants will need to meet the regulation of zero discharge of liquid effluents into surface water.

Water Treatment for Boiler Feed: The manufacture of sugar

generates large quantities of biomass waste such as rice husk, bamboo dust, bagasse, coconut coir, jute and sticks. This waste is ideal for use as fuel to generate power and is one reason why most sugar mills have set up captive biomass cogeneration plants. The high-pressure boiler and the turbine form the heart of the cogen plant. The quality of water used for cogen boiler feed is critical to avoid scaling, corrosion and fouling in the boilers and the turbine blades, and consequent loss of energy.

As most plants are located near surface water sources, there is a need to address the problem of non-reactive silica or colloidal silica as well as Total Organic Carbon (TOC) present in most feed surface waters, especially during periods of high run-off. While

demineralisation (DM) and reverse osmosis (RO) effectively remove inorganic constituents from feed water, contaminants like colloidal silica and TOC are not removed and will slip through the ion exchange beds. When carried into the boiler, colloidal silica converts into reactive silica at high temperature and pressure, leading to formation of scales on the turbine and a subsequent drop in efficiency.

A solution to treat colloidal silica is to integrate DM and RO with ultra filtration (UF) as pre or post treatment to meet required boiler feed water quality. The UF based membrane process has proved the best technology for effective and consistent removal of colloidal particles and silica required values.

Additionally,

considering the level of organics and colloidal impurity in most sources of water, effective

Process Chemicals

IEL also offers the sugar industry a wide range of INDION speciality process chemicals for use in solid and liquid sugar production. These include:

- Mill Sanitation Chemicals (Biocides)
- Sugar Enhancer (Bagasse Pol Reducer)
- Flocculants for juice clarification
- Scale Inhibitors or Antiscalants for evaporators
- Viscosity Reducers in pan crystallisers, for massecuites
- Ion Exchangers and Adsorbents/Activated Carbon for sugar decolourisation and refining
- Colour Precipitant
- Flotation Aid
- Boiler Water Treatment Chemicals
- Bagasse/Fuel Additives
- Cooling Water Treatment Chemicals
- Water & Juice Analysis Kits

pretreatment to the RO plant will also require the use of hollow fibre UF membranes to block contaminants which would otherwise foul the RO membranes. Use of UF in the pretreatment to RO significantly reduces the size of RO plant, lowers the operating cost and at the same time enhances the performance and life of RO membranes.

Sugarcane Water Treatment: The sugar industry is also trying to conserve water by reusing cane water, generated in the form of vapour condensate. Cane comprises 70% water which, after passing through the milling and juice processes, is available as condensate (in a 2500 TCD plant the condensate available is around 1500 tonnes/day). This vapour condensate contains large amounts of organic impurities and therefore cannot be used directly as process water. However, with additional treatment such as condensate polishing to remove the high organics, the condensate water can be reused directly in the process of macerations, juice heating and as a substitute for DM water in boilers and cooling towers.

Waste Water Treatment & Recycle: The combined waste water generated from the various manufacturing processes has high COD, BOD, suspended and dissolved solids and acidic pH. Therefore its

treatment is a must prior to disposal. Increasing scarcity of water is also compelling a focus on water conservation. A well designed effluent

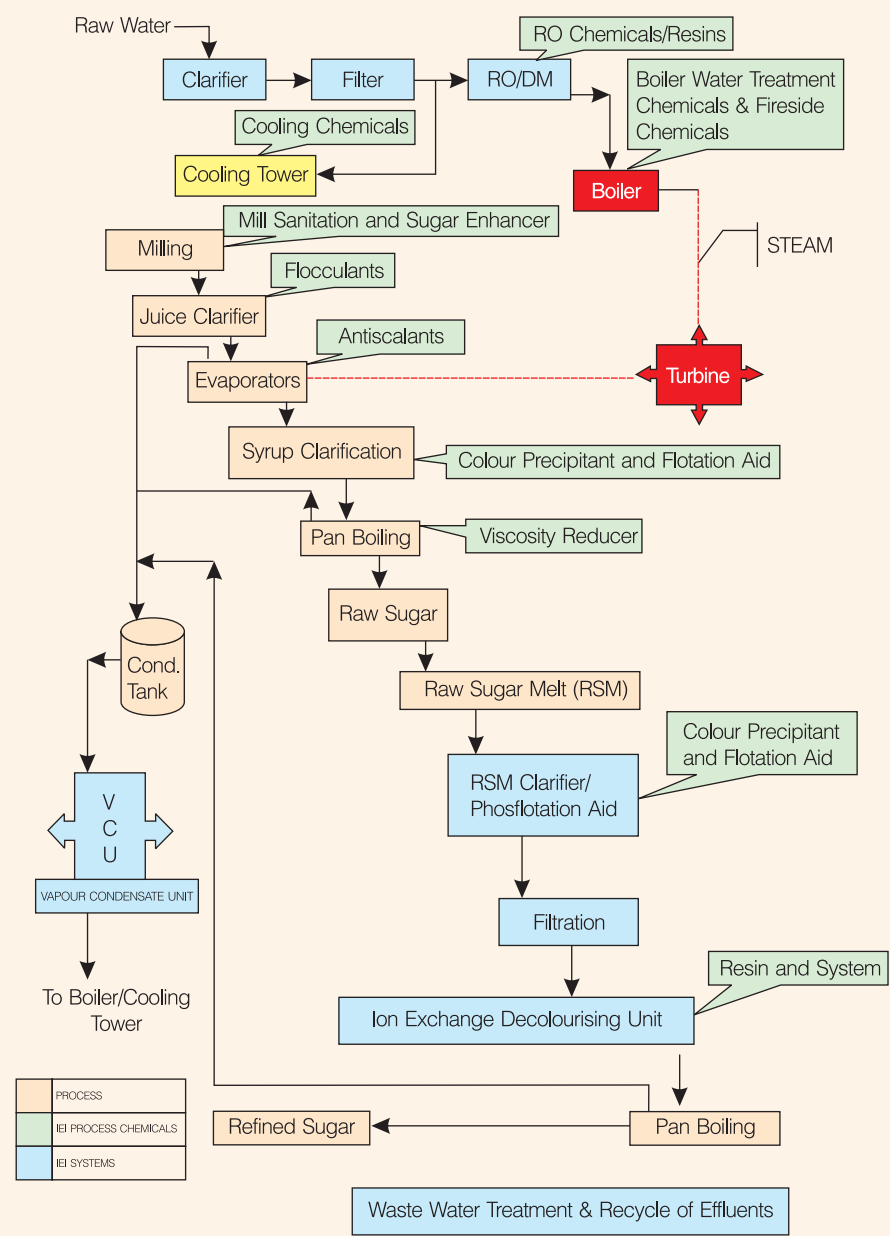
treatment plant comprising anaerobic and aerobic treatment, followed by membrane separation processes will help reduce 70 to 80% of

the effluent load and enable reuse of the water.



IEI in the Sugar Industry

Ion Exchange (India) Ltd. (IEI) offers sugar mills a wide range of products, processes and services, specially developed for diverse applications in sugar manufacture. An exclusive Sugar Division caters to the industry's need of water management, process engineering and speciality process chemicals; its synergistic approach provides total solutions to sugar mills and refineries enabling them to achieve significant competitive advantage.





INDION[®] Decolourisation of Cane Sugar Remelt using Ion Exchange Process

The sugar industry faces the dual problem of quality (colour) of sugar produced and of limited seasonal production. The INDION decolourisation solution using the ion exchange process has been developed by IEI to help sugar mills solve both these problems while increasing their profitability.

Colour of sugar is mainly due to the carryover of colour-causing complex bodies present in the sugarcane. Further colourants are formed during process stages, especially during juice concentration. The colour may be either from inclusion inside the crystal or even on the crystal surface, imparting a brownness on ageing.

The colour range acceptable to most countries is <50 ICUMSA. However, because of limited efficiency of clarification and decolourisation in conventional sulphitation, the colour of the final sugar is 150 to 300 ICUMSA. Even with the phosflotation process for clarification, colour levels of 100 to 150 ICUMSA are obtained. Thus, there is a need for decolourisation of melt subsequent to clarification to achieve the desired colour of sugar.

Realising the potential of refined sugar for the sugar industry, IEI undertook intensive R&D, working in close conjunction with a leading sugar mill in North India, to successfully develop and commercialise ion exchange resins Polystyrenic INDION 830S and Polyacrylic INDION 930A for decolourisation of cane sugar. We undertook conversion of the sugar mill's existing plantation white sugar plant based on double sulphitation process to a raw sugar-cum-refinery plant. The sugar produced by the refined sugar plant, after the addition of ion exchange columns supplied by us, qualified as EC Grade 2 sugar; it was exported to Europe against their quota for India and also sold in the Indian market at a premium. This ion exchange technology, which has a synergistic effect with phosflotation and carbonation, has replaced conventional colour removal methods with an economical operating cost. *On crystallisation, the final colour of the sugar is in the range of 20–40 ICUMSA units and is known as refined sugar.*

Currently very few mills manufacture refined sugar and IEI is the only company providing the technology to them.



Benefits to Industry and Nation

Using the INDION ion exchange decolourisation process, sugar mills in India are now able to produce EC1 and EC2 quality of sugar, with manifold benefits:

- The value-added product opens new avenues for exports of quality sugar by the sugar industry, thus also generating valuable foreign exchange for India.
- Sugar is a very important ingredient in traditional sweets and in the confectionery, beverage and pharmaceutical industries. Enhanced quality of sugar results in a general improvement in these products, gives a better shelf life, and enables optimum inventories without the risk of colour degradation. The decolourisation process reduces/eliminates their need to import high quality refined sugar, thereby also considerably reducing foreign exchange outgo.
- Sugar mills are dependent on the availability of cane, yield and quality of which in turn depend on agro-climatic conditions that are favourable only for a limited period during the year. Accordingly, the crushing duration is limited to 150 to 200 days, while the mill remains idle for the remaining period. This makes operations of most sugar mills unviable, especially in North India, where the season is the shortest in India. Sugar mills can now use their otherwise idle capacity to undertake sugar refining even during the off-season; this will create opportunities for employment as well for establishment of stand-alone refineries in coastal areas, which can reprocess imported raw sugar for manufacture of refined sugar for Indian and overseas markets. They can also utilise off-grade sugar which is otherwise wasted during the off-season or reprocessed only during the next season (which used to result in further deterioration of the sugar).

(See page 20 for more information)