

Sugar Industry

The sugar market worldwide

Sugar is one of the most important raw materials traded on the worldwide markets. In the 18th century only few countries were producing sugar. In the 21st century, over 100 nations process different base materials into sucrose. India, China, Brazil & the European Union alone deliver 50% of the global demand.

Raw materials & processing

In temperate regions such as West, Central & Eastern Europe, the United States, China and Japan raw sugar is produced from sugar beets. However in the tropics and subtropics sugar is extracted from sugar cane.

Sugar Facts

- Worldwide production of raw sugar reached 175 million tons in 2014
- Sugar is produced in 120 countries, Brazil alone produces 25% of world production.
- Brazil, India, China & EU are the 4 largest producers of raw sugar. The United States produces about 7 million tons per year.
- With an annual consumption of more than 24 million tons India, is the world's largest market for raw sugar.



Processing

The processing of those two raw materials only differs in the first few steps. The main goal is to extract the juice, where sugar is contained, from the beet or sugar cane as efficiently as possible.

Extracting the sugar

Sugar cane is cut into small pieces during the harvest before it runs through an industrial press to squeeze out the sweet sap. Sugar beet has to be processed in extraction towers, where the plants release their sugar during a hot water treatment at 70°C.

Evaporation

After filtering the juice, the water is extracted by passing through different stages of evaporators until only thick syrup is left consisting of around 70% sugar.

Crystallization

The syrup is then boiled until sugar crystals are formed. These crystals are then cleaned through centrifugation. To reach an even

higher purity this process will be repeated twice.

Cooling & drying

Now the sugar has to be dried. One option is to use large scale drum dryers at a temperature of 60°C. After drying, the sugar is cooled down on fluidized-bed coolers before going to the warehouse for packaging and shipping. Sugar

continued

COUNTRY	2011/12	20013/14
Brazil	35,750	36,800
India	28,300	27,900
European Union	16,740	16,300
China	11,840	13,700
Thiland	10,170	11,000
United States	7,153	7,706
Mexico	5,650	6,890
Russia	4,800	4,400
Pakistan	4,220	4,860
Australia	4,150	4,400
Other	39,474	46,033
Total	168,247	176,560

World sugar production (1.000 metric tons)

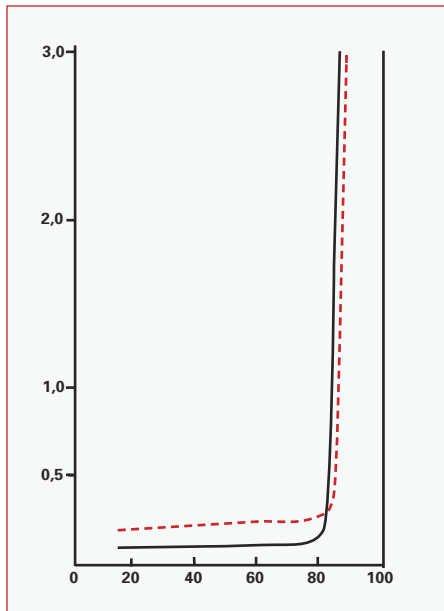
Raw materials & processing

Cooling & drying

(continued)

belongs to the group of hygroscopic goods with extremely low water content (below 1.5%). Sugar is a robust material but vulnerable to high humidity and temperature changes. Generally it is recommended to store and transport sugar at a temperature of 20-25°C and 25-60% relative humidity.

As shown in the adsorption curve (see figure below) for sugar, it is clear that the quality of sugar is not affected by relative humidity up to 75%. Beyond 75%, sugar starts to clump together. Beyond 80%, sugar begins to dissolve.



Adsorption curve of sugar at 10 & 20°C
X: Relative humidity Y: Water content

Storage

Right after the production, the refined sugar is stocked unpacked



Clockwise from left: sugar beet and sugar cane . . . sugar production process . . . sugar storage.

in humidity controlled sugar terminals or ventilated silos connected to dehumidifiers.

Logistics

Large quantities are transported in silo trucks or train wagons. When sent by ship, sugar is packed in double-walled bags made of natural fiber and plastic. If sealed in this manner, temperature is the crucial parameter which affects the quality of the sugar. Due to big differences in temperature, water vapor left inside the bags may cause clumping and even liquefaction. The finer the sugar the higher is the risk of clumping.

Why the need to measure humidity?

As seen above, temperature and humidity are crucial parameters in the sugar industry. Due to the hygroscopic behavior of sugar, small changes in humidity and slight temperature variations are not a major problem. As soon as relative humidity rises above 80% or temperature changes significantly, the product can be destroyed as it clumps or even turns into liquid. During the process of evaporation, crystallization, drying and cooling, temperature and humidity play a huge role.