SugarText-EN-INT 4 [C]

After harvesting, the beets are hauled to the factory. Delivery in the UK is by hauler or, for local farmers, by tractor and trailer. Railways and boats were once used in the UK, but no longer. Some beets were carried by rail in the Republic of Ireland, until the 2006 shutdown of sugar beet production in the country due to the end of subsidies. Each load entering is weighed and sampled before tipping onto the reception area, typically a "flat pad" of concrete, where it is moved into large heaps. The beet sample is checked for[:] soil tare - the amount of non beet delivered[;] crown tare - the amount of low sugar beet delivered[;] sugar content ("pol") - amount of sucrose in the crop[;] nitrogen content - for recommending future fertilizer use to the farmer. From these elements, the actual sugar content of the load is calculated and the grower's payment determined. The beet is moved from the heaps into a central channel or gulley where it is washed towards the processing plant. […] After reception at the processing plant, the beet roots are washed, mechanically sliced into thin strips called cossettes, and passed to a machine called a diffuser to extract the sugar content into a water solution. Diffusers are long vessels of many metres in which the beet slices go in one direction while hot water goes in the opposite direction. The movement may either be by a rotating screw or the whole unit rotates, and the water and cossettes move through internal chambers. There are three common designs of diffuser: the horizontal rotating 'RT' (Raffinerie Tirlemontoise, manufacturer), inclined screw 'DDS' (De Danske Sukkerfabrikker), or vertical screw "Tower". A less common design uses a moving belt of cossettes, with water pumped onto the top of the belt and poured through. In all cases the flow rates of cossettes and water are in the ratio one to two. Typically cossettes take about 90 minutes to pass through the diffuser, the water only 45 minutes. These are all countercurrent exchange methods that extract more sugar from the cossettes using less water than if they merely sat in a hot water tank. The liquid exiting the diffuser is called raw juice. The colour of raw juice varies from black to a dark red depending on the amount of oxidation, which is itself dependent on diffuser design. The used cossettes, or pulp, exits the diffuser at about 95% moisture but low sucrose content. Using screw presses, the wet pulp is then pressed down to 75% moisture. This recovers additional sucrose in the liquid pressed out of the pulp, and reduces the energy needed to dry the pulp. The pressed pulp is dried and sold as animal feed, while the liquid pressed out of the pulp is combined with the raw juice, or more often introduced into the diffuser at the appropriate point in the countercurrent process. During diffusion, there is a degree of breakdown of the sucrose into invert sugars. These can undergo further breakdown into acids. These breakdown products are not only losses of sucrose but also have knock-on effects reducing the final output of processed sugar from the factory. To limit (thermophilic) bacterial action, the feed water may be dosed with formaldehyde and control of the feed water pH is also practised. There have been attempts at operating diffusion under alkaline conditions, but the process has proven problematic. The improved sucrose extraction in the diffuser is offset by processing problems in the next stages. […] The raw juice contains many impurities which must be removed before crystallization. This is accomplished via carbonatation. First, the juice is mixed with hot milk of lime (a suspension of calcium hydroxide in water). This treatment precipitates a number of impurities, including multivalent anions such as sulfate, phosphate, citrate and oxalate, which precipitate as their calcium salts and large organic molecules such as proteins, saponins and pectins, which aggregate in the presence of multivalent cations. In addition, the alkaline conditions convert the simple sugars, glucose and fructose, along with the amino acid glutamine, to chemically stable carboxylic acids. Left untreated, these sugars and amines would eventually frustrate crystallization of the sucrose. Next, carbon dioxide is bubbled through the alkaline sugar solution, precipitating the lime as calcium carbonate (chalk). The chalk particles entrap some impurities and absorb others. A recycling process builds up the size of chalk particles and a natural flocculation occurs where the heavy particles settle out in tanks (clarifiers). A final addition of more carbon dioxide precipitates more calcium from solution; this is filtered off, leaving a cleaner, golden light-

brown sugar solution called thin juice. Before entering the next stage, the thin juice may receive soda ash to modify the pH and sulphitation with a sulfur-based compound to reduce colour formation due to decomposition of monosaccharides under heat. […] The thin juice is concentrated via multiple-effect evaporation to make a thick juice, roughly 60% sucrose by weight and similar in appearance to pancake syrup. Thick juice can be stored in tanks for later processing, reducing load on the crystallization plant. […] The thick juice is fed to the crystallizers; recycled sugar is dissolved into it and the resulting syrup is called "mother liquor". This is concentrated further by boiling under vacuum in large vessels and seeded with fine sugar crystals. These crystals grow, as sugar from the mother liquor forms around them. The resulting sugar crystal and syrup mix is called a massecuite (from French "cooked mass"). The massecuite is passed to a centrifuge where the liquid is removed from the sugar crystals. Remaining syrup is rinsed off with water and the crystals dried in a granulator using warm air. The remaining syrup is fed to another crystallizer from which a second batch of sugar is produced. This sugar ("raw") is of lower quality with a lot of colour and impurities and is the main source of the sugar that is re-dissolved into the mother liquor. The syrup from the raw is also sent to a crystalliser. From this a very low-quality sugar crystal is produced (known in some systems as "AP sugar") that is also redissolved. The syrup separated is molasses; still containing sugar but with too much impurity to be economically processed further. There are variations on the above system, with different recycling and crystallisation paths.

Processing. Wikipedia [This page was last modified on 6 January 2009, at 18:06.]
http://en.wikipedia.org/wiki/Sugar_beet#Processing [aktivt link 2009-20-01]