SUGARS

Introduction

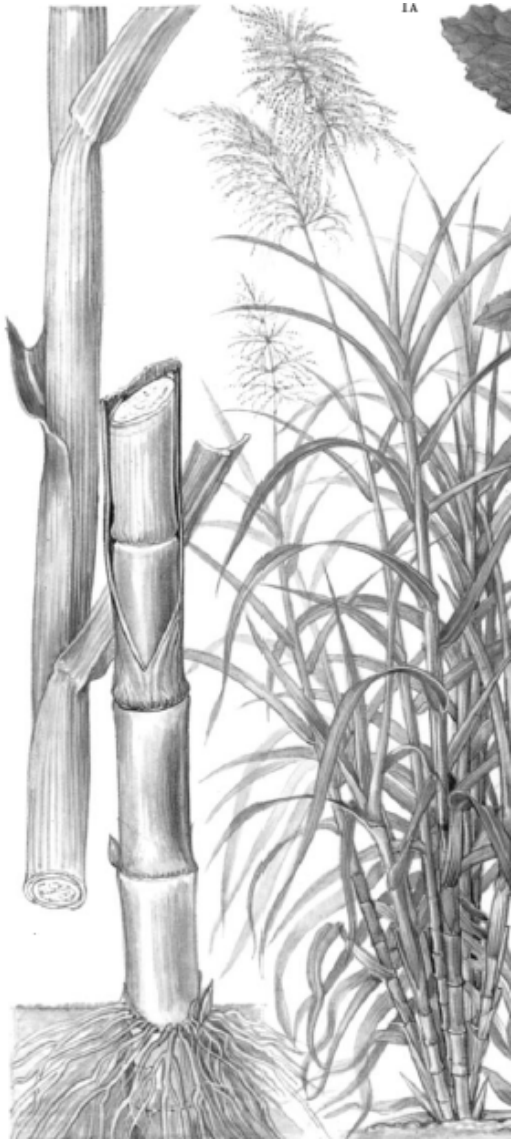
- Sugar is the world's predominant sweetener.
- It satisfies the human appetite for sweetness and contributes calories to our diet.
- Sugar is used in cooking, in the preparation of commercially processed foods, and as an additive to drinks; it is also a preservative and fermenting agent.
- It sweetens without changing the flavor of food and drink.

Introduction

- Sugar is the chemical sucrose that occurs naturally in plants.
- It is most richly concentrated in sugarcane and sugar beet, which are the sources of commercial sugar.
- Fully refined sugar, whether made from cane or beet, is pure sucrose, and the consumer cannot tell from which of the two plants it derives.

Sugar Cane

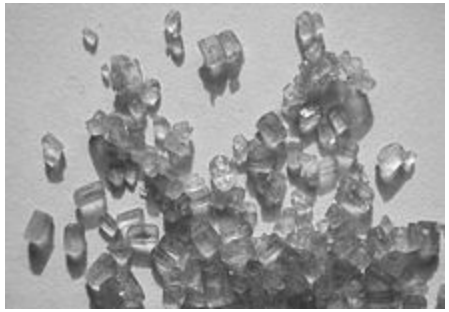
- SUGAR-CANE (*Saccharum officinarum)*.
- This is a large perennial grass cultivated in about 70 countries, mainly in the tropics but also the subtropics.
- Cane sugar was first produced in India, probably about 1000 BC, simply by evaporating the juice, squeezed from the cane, over an open fire to give a dark product, containing varying amounts of sucrose, which deteriorates rapidly.



Sugar Cane

- The method is still used in some parts of the world and the resulting sugar is given various names, for example *gur* in India, *jaggery* in Africa, and *panela* in Latin America.
- The vast majority of cane sugar produced is known as 'centrifugal'.
- In the country of origin, the harvested canes are taken to the factory where they are crushed, the sugar is extracted with water to give an impure solution which is purified, concentrated by evaporation, and the sugar crystallized.

Sugar Cane



- Sugar crystals are separated from the molasses, or brown syrup, by centrifugation.
- The sugar produced is raw (96 – 99% sucrose) and brown specialities are demerara and muscovado.
- The cane residue is known as ‘bagasse’ and is used in paper making, animal feed, and as a fuel.
- Molasses has a number of uses, including the manufacture of rum.

Sugar Cane

- Commercial sugars are classified according to their purity, which is measured in degrees of polarization with a polarimeter; purity ranges from 0° pol., signifying a total absence of sugar (as in distilled water, for example), to 100° pol., indicating pure sucrose.
- The basic centrifugal sugar of commerce is known as raw sugar, which, by international agreement, must have a polarization of at least 96°.
- Raw sugars are not quite pure sucrose and are intended for further processing, meaning that they are to be refined.

Sugar Cane

- Refining is the final stage in the manufacture of sugar.
- The result is pure sucrose, with a pol. of 100°.
- The process of refining involves melting the raws, removal of the last impurities, and recrystallization of the sucrose under very careful sanitary conditions.
- The raws lose a very minor percentage of their weight in the transformation to refined sugar, the amount depending on the pol. of the raws and the technical ability of the refinery

Sugar Cane

- The raw sugar may be exported to countries where it is refined to give the white crystalline substance, which is virtually 100% sucrose.

Sugar Beet

- SUGAR-BEET (*Beta vulgaris* cv).
- This is the most important source of sugar in temperate countries and is closely related to the various beet root and leafy vegetables.
- In the middle of the nineteenth century it was noted that the roots of the Silesian sweet fodder beet contained about 6% sucrose (modern cultivars contain up to 18% sucrose).

Sugar Beet

- The first factory for the extraction of beet sugar was erected in Silesia in 1801 and the industry spread throughout continental Europe.
- In the United Kingdom, cultivation of sugar beet started in earnest in the 1920s.
- Today, the crop is grown throughout Europe and in North America.

Sugar Beet

- The extraction of sugar from the root is carried out in essentially the same way as extraction of cane sugar, except that the process proceeds directly to white refined sugar.
- Both the root residue and molasses are used in animal feed. Molasses may also produce industrial alcohol.
- Filter cake, the residue left behind after the purification of the sugar beet juice, is used as a manure.

Palm Sugars

- Coconut palm sugar (*gula kelapa*)
- Palmyra palm sugar (*gula siwalan*)
- Arenga palm sugar (*gula aren*)

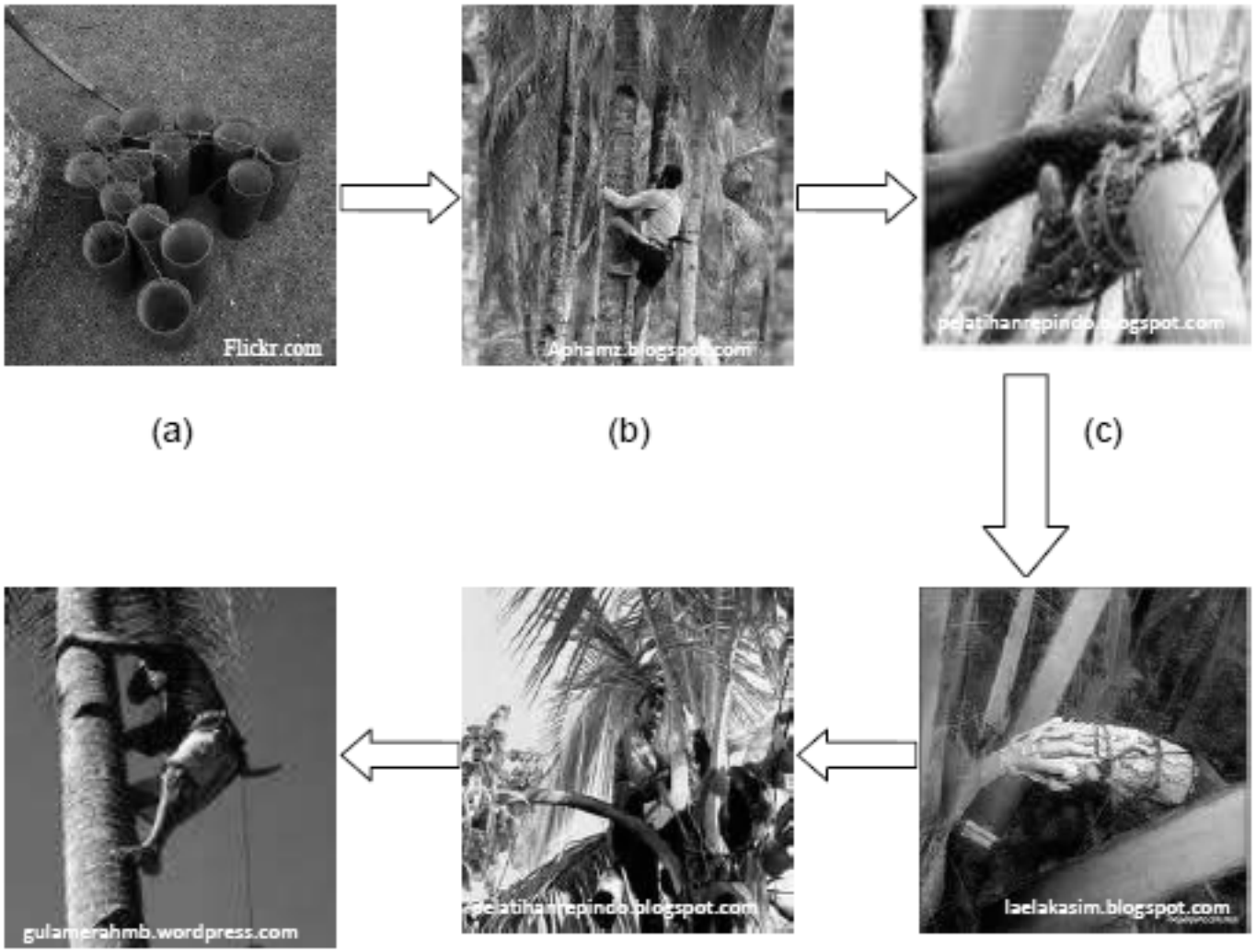
Palm Sugars

- There are three species of sugar palms that commonly used in palm sugars production in Indonesia, including *Cocos nucifera*, *Arenga pinnata* (syn. *A. saccharifera*), and *Borassus flabellifer*.
- These palms sometimes are cultivated, and commercial plantations have been established in Indonesia.
- Sugar or gomuti palm from *Arenga pinnata* (syn. *A. saccharifera*), which contains about 75% sucrose), is produced from the sap.

Palm Sugars

- The production of palm sugar is very interesting and needs specific skills to collect the sweet sap (*nira*).
- *Nira* is the liquid sapped from the coconut's young flowers.
- Skilled climbers use a rope passed around the tree trunk either as a belt or looped into stirrups for their feet.
- Inflorescences (*mayang*), flowering takes place when the plant is 7 – 10 years old.

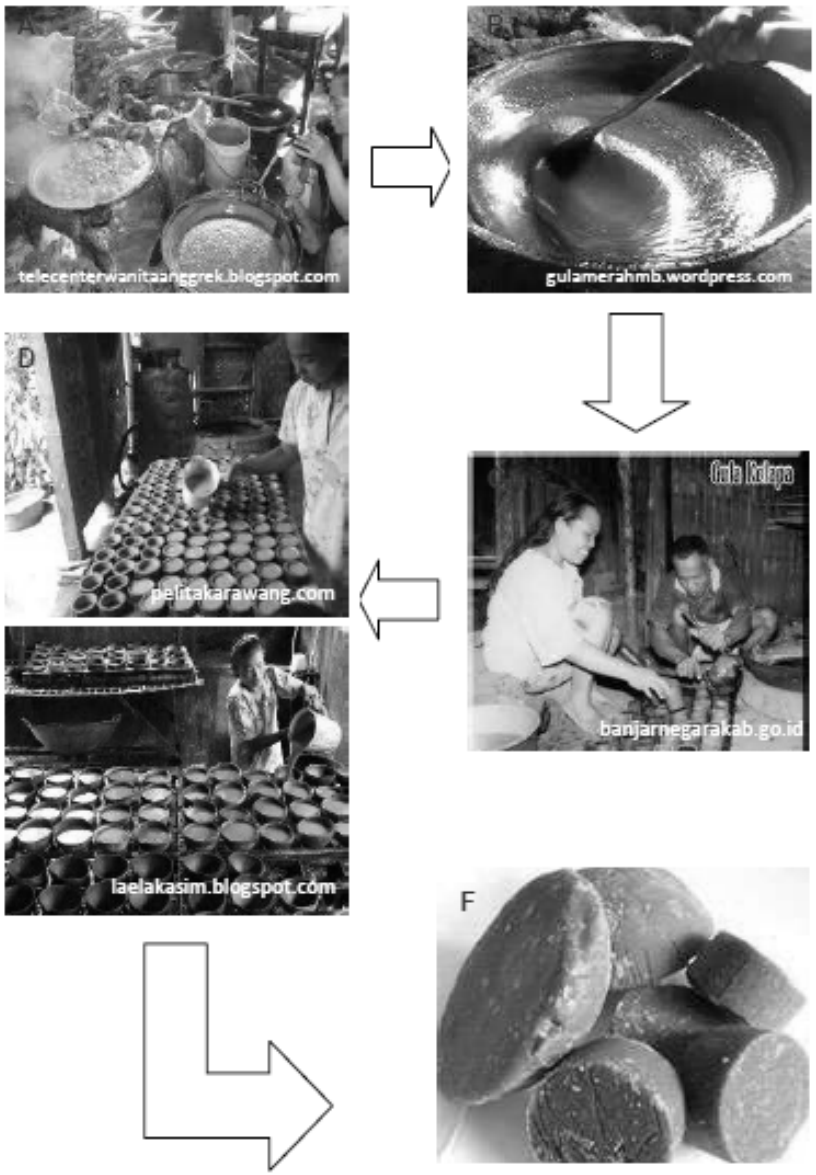
Palm Sugars



Note: (a) bamboo cane for bottling the sweet sap (*nira*), (b) collecting *nira* at the top of a coconut palm by climbing the tree, (c) sapping the *nira* from coconut's young flower, (d) placing the exudate of *nira* in the bamboo cane, (e) & (f) the collected *nira* then will be processed into coconut palm sugar

Figure 1. The stages of collecting sweet sap (*nira*) for producing coconut palm sugar

Palm Sugars



(A) *Nira* is boiled using traditional pans on traditional stoves, (B) The boiling *nira* is stirred continuously until forms the brown thick liquid, (C) Bamboo or coconut shells are prepared to mold the sugar, (D) Molding the sugar in the bamboo mold, (E) Molding the sugar in the coconut shell mold, (F) Coconut palm sugar products

Figure 2. Stages in the processing of coconut palm sugar

Other type of sugars

- **Rock sugar:**
  - It is not as sweet as regular *granulated sugar*, rock sugar comes in the form of large clear, white or amber-coloured crystals.
  - Clear and white crystals are made by slow crystallisation from a saturated sugar solution.
  - White rock sugar has small cracks which reflect the light, which results in a white colour.
  - Amber coloured crystals contain some *caramel*. It is less sweet, due to the presence of water in the crystals.

Other type of sugars

- **Castor sugar**
  - Castor or caster sugar is the name of a very fine granulated sugar in Britain, so named because the grains are small enough to fit though a sugar "caster" or sprinkler.
  - Because of its fineness, it dissolves more quickly than regular white sugar, and so is especially useful in meringues and cold liquids.
  - It is not as fine as *powder sugar*, which has been crushed mechanically (and generally mixed with a little starch to keep it from clumping).

Other type of sugars

- **Maple syrup**
  - A *syrup* obtained from the North American maple tree. It is a solution of 70% *saccharose* and *glucose* in water.
  - Main constituent is *saccharose* (sucrose).

The chemistry of sugars

- Chemically sugars and carbohydrates are synonyms, but normally sugars refer to sweet, small, soluble carbohydrates.
- The word *sugar* is generally used as a synonym for saccharose (sucrose).
- Sweetness in plants is mainly caused by three different sugars; saccharose, fructose and glucose. These sugars are either present alone or as mixtures.
- The only sugar of interest in animal products is lactose, the sugar in all animal milk.

Sugar	Sweetness as compared to saccharose
Saccharose (glucose + fructose)	100%
Glucose	74%
Fructose	173%
Maltose (glucose + glucose)	33%
Lactose	16%

Thank You…