III. FAQ

1. **Explain principle behind sugar confectionary?**

Ans: Confectionery also called sweets or candy, is a sweet food. Sugar confectionery includes sweets, candied nuts, chocolates, chewing gum and bubble gum, sweetmeats, pastillage, and other confections made primarily of sugar.The term confectionery varies in different countries.

Sucrose is produced in vast quantities throughout the world and it is the basic ingredient for classical sugar confectionery. Indeed, the whole confectionery industry has been built around the physico-chemical properties of sucrose and their modification by other traditional sweeteners. Sugar occurs widely in the vegetable world, in the roots and stems of grasses and root vegetables and in the sap of many trees. It also appears in the juices of many fruits. Commercially, however, it is extracted from sugar cane, which is grown in tropical areas, and from sugar beet, which is grown in temperate climates. World sugar production is upwards of ninety million tons a year, out of which roughly 60% is from cane and 40% from beet.The principal sugar constituents are mentioned in **Table 1**

2. **What are the commercial type of sugar?**

Ans: **1.** Granulated: They are available in several grades as explained below.

a) Granulated: This is white sugar, sold industrially and domestically. It constitutes to highest proportion of total production of granulated sugar.

b) Industrial granulated: This sugar has a slight off-white colour and is used where white sugar is not required for e.g. in the manufacture of toffee, fudge and chocolate.

c) Cubes: These are usually produced by moistening granulated sugar with one percent water, pressing into cubes and drying.

d) Nibs: These are agglomerates of granulated sugar crystals, made by dampening the sugar and dried into thick mass. The product is sieved to various sizes.

2. Caster sugar**:** White sugar with small crystal size, for domestic and industrial use.

It is produced either by boiling in vacuum pans or milled from granulated sugar.

3. Icing sugar: Produced by double milling granulated sugar to fine crystals. Usually, an insoluble anticaking agent is added. Used mainly for bakery.

4. Liquid sugars**:** Granulated sugar dissolved in distilled water to produce the highest quality liquid sugars. In the confectionery industry, the decolorized liquor from the refining process is used, instead of evaporating to produce granulated sugar. Lower grade syrups are used to provide colour and flavour. The total solids ranges between 66 to 84%.

5. Brown sugars: A typical composition of a raw demerara sugar and three types of refinery brown sugars are shown in **Table 2**. The non-sugars from the original cane are responsible for the flavour. Prolonged storage in a low relative humidity leads to slow evaporation of the water and resulting in the hard sugar.

6. Molasses:A one million tones a year cane refinery produce 600-800 tonns of molasses per week, from which no more sugar can be extracted. Some part is used for human consumption, but the bulk goes to cattle food and to the fermentation industries, e.g. alcohol and citric acid. Treacle is clarified molasses and can be mixed with higher purity syrups to mellow the taste.

7. Microcrystalline sugars: For this form, sugar syrup is evaporated to around 95% solids and then subjected to intense shear. The sugar crystallizes instantly as very fine crystals (5-20 um), then dried, milled and sieved to final products.

3. Mention the effect of composition on sugar types?

Ans: **1.** White sugars**:** Refined white sugar is probably the purest food known, containing over 99. 95% sucrose, on a dry basis. The composition varies a little between refiners, (**Table 3).** Colour is measured in international Units (IU).

2. Brown sugars**:** It is either an unrefined or partially refined soft sugar consisting of sugar

crystals with some residual molasses content (natural brown sugar), or it is produced by the addition of molasses to refined white sugar (commercial brown sugar)

3. Liquid sugars**:** The range of liquid sugars available is extensive. These are decolorized liquor from the refinery before evaporation in the vacuum pans. It is pure enough to be used for most confectionery purposes. Other liquid sugars are less pure and would be suitable where colour, etc is not of prime importance. There are wide range of blended syrups available which, can be tailor-made to a confectioner's requirements. In addition, refinery syrups of varying flavour levels can be added, imparting a natural flavour to the end product.

4. Treacle and molasses**:** Beet molasses is rarely used in confectionery, due to its unpleasant flavour. The flavour of cane molasses is very strong and is often mellowed by adding higher grade refinery syrups. When this is done, the products are usually called 'treacle' (**Table 4)**.

4. What is caramelisation in sugar confectionary?

Ans: Caramelisation: Cane or beet sugar (sucrose) deteriorates in heated conditions to form coloured breakdown products in the process known as caramelisation. This also takes place when minor traces of acidic impurities are present with traces of fructose (laevulose). The resultant product is 5-hydroxyl methyl furfural which develops browning in a sugar syrup.

5. Importance of inversion in sugar confectionary?

Ans: Inversion: The second important reaction is the breakdown of sucrose into two simpler sugars. This process is known as inversion. This reaction is induced deliberately to get desirable characteristics in a sweetmeat. Invert sugar is a mixture of two simpler sugars dextrose and fructose. One hundred grams of sucrose will yield 105g of invert sugar when treated in the presence of water, and the resultant mixture contains equal proportion of glucose and fructose.

6. Role of crystallisation in production of sugar confectionary?

Ans: The main effect which involves a change of state during the production of sugar confectionery is transformation of ingredients held in a highly saturated syrup to the crystalline form. Pure sucrose crystals classification and are probably present in sphenoidal symmetry [12]. The type of sucrose crystal present in a confection is not in the pure shape of a spherulitic crystal but is slightly malformed. This is because other ingredients present, such as other sugars and gelling agents, cause distortion in the crystalline from of sucrose.

Sucrose can be dissolved in water and will reach saturation level at a concentration of 66.6%. However it is possible to continue the process, dissolving more sucrose in water to create a supersaturated solution. These solutions of the sugar in water, which are of higher concentration than can be achieved at their stable saturation point, will grain or crystallize under appropriate circumstances. A supersaturated solution of sucrose formed at a raised temperature may or may not deposit sucrose crystals on cooling. The syrup passes through a series of zones classified by Oswald [13] as labile, false grain, metastable and stable. The values for each of these zones are calculated by relating the weight of material present in 100g of water at a fixed temperature against the values found under the same conditions at saturation. Crystallization does not occur in the stable zone no matter how the solution is treated. This zone represents the saturation concentration of 66.6% for sucrose in water at 20 °C with an S value of 1.0. Crystallisation does not occur naturally in the metastable zone unless influenced by an outside effect- vibration, stirring, presence of seed crystals. This effect occurs particularly in the false grain zone. Crystallization invariably occurs in the labile zone.

7. Importance of starch gelatinization for sugar confectionary?

Ans: The starch molecule is composed of amylase and amylopectin fraction. In the process of starch gelatinization, the starch swell in water during heating. The temperature at which this process takes place is usually referred as the gelatinization point. The presence of sugars inhibits the process of gelatinization. Prolonged heating will also destroy the gel by causing disruption of the structure, resulting in leaching from the swollen granules into the liquid

fraction, affecting the gel-forming capability.

8. List down the raw ingredients for sugar confectionary?

Ans: Carbohydrates (sugar)

- Fats
- Thickeners
- Stabilizers and
- Proteins

9. Explain techniques required for lollipops manufacture?

Ans: **Lollipops** ---Basically three types of lollipops based on preparation techniques.

They are as explained hereby (**Fig 2)**

a) Depositing process by using special moulds.

b) Moulding/ stamping techniques including the following steps: cutting or a well-tempered sugar rope, free fall of the cut pieces into a mould, and stamping the cut pieces in a rotating disc.

c) Moulding/ stamping process as shown in **Fig 3.**

10. Explain boiled sweets?

Ans: Boiled sweets**:** Technically the term 'boiled sweet' is applied to mixtures of sucrose and glucose syrup which are cooked to such a high temperature that the cooked mass becomes clearly marked by the following characteristics:

1) Non-crystalline, clear and glassy in appearance.

2) An extremely low amount of residual moisture (1-3%) with an equilibrium relative humidity (ERH) below 30%, which can result in a marked tendency to absorb humidity from the atmosphere.

3) After cooking, the two main components, sucrose and glucose syrup, are accompanied by a variable amount of invert sugar, the result of partial inversion of sucrose which takes place during the cooking process.

11.Difference between caramel and fudge?

Ans: Caramel toffee and fudge**:**Originally toffee did not contain milk and were high-boiled products containing brown sugar, glucose syrup or invert sugar and fats, usually butter. These products all have moisture levels below 5%. The introduction of milk into toffees led to the production of higher moisture products with up to 8 or 9% water content, and for some of these products the name caramel was used.

Toffees or caramels can be deliberately made to crystallise or grain and are then known as soft toffees or grained caramels. These products are very similar in eating texture to some fudges but are made by a different process. The name fudge is used for a wide range of products ranging from short crumbly textures to quite plastic masses for which names like Jersey Cream or Italian Creams are sometimes used. In all the these products the sugar crystal is developed during the manufacturing process and the structure has stabilised before the product is packed.

12.Role of hydrocolieds in sugar confectionary?

Ans: Technology and chemistry of the hydrocolloids:

i) Agar agar

ii) Bacterial gums

iii) Gelatin

iv) Pectin

v) Starch.

i) : Gum acacia, fruit pulps and extracts tenderize and shorten the texture.

Starches and gelatins may be incorporated to modify the eat. A degree of recipe experimentation is desirable because agar phase separation leading to precipitation or textural granularity may result under certain conditions.

ii) from Xanthomonas campestris and gellan gum from

the fermentation of Pseudomonas elodea (with deacetylation) are now finding application in this type of confection.

The extraordinary enzymatic resistance of xanthan is leading to its application in natural fruit jelly bars where its unique pseudoplastic fluid rheology enables almost total viscosity recovery following shear processes. Xanthan gum is synergistic with both locust bean gum and guar gum in respect of viscosity.

iiiThe thermoreversibility of gelatin gels (at around 40°C) gives its main

organoleptic feature of a smooth elastic texture which melts agreeably in the mouth. Sugar addition enhances gel rigidity. Reducing sugars can promote Maillard reactions, which may be desirable for caramel jellies or for intensifying the colour of gels made with natural colours. Gel strength is reduced by hydrolysis, which is promoted by temperature, acids, bases, enzymes (e.g. from fresh fruit, especially pineapple) and irradiation.

iv) *Pectin:* Pectins are mainly obtained from apple or citrus fruit.

Pectin gels have a delicate fruit- like short texture and mouthfeel with very good

Flavour release. Pectins are characterized by their degree of esterification or methoxylation (DE or DM) and their gel strength (SAG value), which is usually standardized by small additions of sucrose. They may also be buffered or unbuffered, the buffer giving control over gelation speed.

v) *Starch:* Corn or maize starch is the most common origin, although sago/tapioca, rice,

wheat and potato starches can be employed to modify textures. These types vary in amylase/

amylopectin ration. Amylase contributes little to viscosity at high temperatures but in dilute situations can associate with hydrogen bonding to cause a precipitate. Amylopectin resists retrogradation in cooled cooked solutions but greatly influences viscosity by tangling even at relatively high temperatures. Waxy maize starch has barely any gel strength. Tapioca and potato have a low amount of amylase, giving soft gels when cooked. Starches give greater optical clarity and higher sheen gels than most other hydrocolloids.

13.Explain sugar less gums?

Ans: Chewing gum is used for sustained release of actives. Sugarless formulations assist tooth and gum protection, re-enamelling and plaque reduction. Zinc salts in buccal cavity contact for cold protection and nicotine in smoking reduction therapy are patented. In gum, 'actives' incorporation and 'encapsulation' are restrictive.

Sugarless gums usually require much more careful handing, and the proportioning of crystallizing and anticrystallising phase ingredients is critical. These gums usually require a greater quantity of gun base and have different textual and elasticity properties during forming. The addition of actives is performed in a similar way to that used in regular sugared gums.

Teeth whitening, gum protection and plaque claims are made with patented usage of urea and other compounds. The latest technology uses anhydrous gum formulations in which plasticity and softness are assured for much longer shelf-life periods than was previously possible.

14.Brief note on medicated sugar confectionary?

Ans: Medicated sugar confectionery encompasses formulations mainly for symptomatic relief of minor throat irritations, coughs, colds, respiratory tract congestions and allergies. Some stronger actives have other specific uses, and herbal extracts, vitamins, food supplements and antacids are also incorporated.

Medicated sugar confectionery has evolved from the original tableting and panning techniques.

The most common forms of medicated sugar confectionery are manufactured in the high

boiled sugar format followed by the vegetable gums, lozenges and sugarless product varieties.

15.Functions of fat in sugar confectionary manufacture?

Ans: **Fats:** One of the commonest fats in use in the manufacture of sweets is hydrogenated palm kernel oil and is relatively simple in chemical structural terms. Most sugar confectionery fats are non-lauric in origin. Their brittleness, hardness and flavour are related to their types of fatty acids i.e saturated or unsaturated. Fats are used to improve texture and to lubricate the product to achieve better chewing characteristics.

16.Explain requirement of Alternate or low calorie sweeteners?

Ans: Apart from these sugars other sugars are also used in confectionery industries. They are

a) Polydextrose: Another new ingredient available to the confectioner is polydextrose, which has a low-calorie content. It is a polymer of dextrose with sorbitol and an acid. The ingredient is hygroscopic in character and has a viscosity which is greater than sucrose.

b) Sorbitol, xylitol and mannitol: These are commercially available for use in recipes for sweet products. These are not sugars in the conventional sense but polyhydric alcohols, more usually known as sugar alcohols. These materials are promoted for their role in inhibiting changes during storage or as a low-calorie replacement for sucrose or for their value in minimizing tooth decay when compared to conventional sugars.

c) Lactose hydrolysates: The careful choice of processing conditions for the selective hydrolysis of lactose, a sugar present in milk products and for this process obtained from whey, produces lactose hydrolysates. These hydrolysates are high in two simpler sugars, namely galactose and dextrose. A typical enzymes used to achieve hydrolysis is β-galactoside.

d) Intense sweeteners: The use of intense sweeteners such as saccharin, aspartame and acesulphame potassium (acesulphame K) has found little adoption in the sweet industry. This is because most confectionery products require a high-mass viscosity to assist in processing and to gain consumer acceptance for their texture.

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