



Technical Paper

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THE ROLES OF SUGARS IN THE MANUFACTURE OF BAKED PRODUCTS

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Sugars are a sub-group of compounds within the family of carbohydrates. The latter is an all-embracing term for food materials that are based on the presence of three types of atoms, carbon, hydrogen and oxygen. As a generic group they are a main source of energy in most diets around the world. There are many raw materials and food ingredients which fall into the category of carbohydrates including simple sugars, starches and fibres. The basic building blocks of carbohydrates are the monosaccharides, with the single molecules of simple sugars being linked in a variety of complex ways. It is these complex linkages which determine if and where in the human digestive system carbohydrates are broken down to provide the glucose molecules which are essential for the proper functioning of the brain, nerve cells and developing red blood cells. Sugars arrive in the human diet from many sources, though by far the largest proportions are naturally associated with fruits and plants.

All sugars are sweet tasting and they have become a common part of sweetened bakery products, such as cakes, biscuits, cookies, pastries, buns and the fillings and toppings that may be used with them. While the sweetness contribution is the most readily recognised role for sugars, they have other important technological roles in the manufacture of bakery products which include supporting fermentation, creating structures in different ways, and contributing to the extension of the sensory life of products (e.g., anti-staling).

One technological role of sugars that is often overlooked is their potential contribution to extending product microbial shelf-life (i.e., limiting spoilage). When sugar solids go into solution they lower the Equilibrium Relative Humidity (ERH – also known as Water Activity, a_w) which limits the availability of water for microbial growth. Different types of sugar have differing impacts on product ERH and therefore microbial shelf-life.

Types of Sugars and Their Characteristics

Sucrose

The term 'sugar' is most commonly applied to sucrose which is a disaccharide (2-sugars) comprising one molecule of glucose and one of fructose. Sucrose is typically obtained by processing and refining extracts from sugar cane or sugar beet. It is available in a range of forms, the most common of which is white, with varying particle sizes. The largest particle size is often referred to as 'granulated' (about 0.5 mm in size), with the other common forms in order of decreasing particle size being caster, pulverised and icing.

The different types or grades of sucrose have the same chemical composition and degree of sweetness, but their physical forms affect their technological impact in the manufacture of bakery products. When added to water alone, sucrose is highly soluble, and its solubility increases with temperature. In broad terms 1g of sugar will hold approximately 2g of water which has important implications for its behaviour in bakery products. The larger the size of the sucrose particles, the slower they are to dissolve; thus, it takes longer for the granulated form to completely dissolve than the caster.

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Sucrose exists as crystals and while they readily dissolve in water, when that water is removed (e.g., by baking) the crystals can reform. This process also has significant implications for baked product qualities.

The sweetness of other types of sugar are commonly compared with that of sucrose, as shown in the table below.

Sugar Type	Sweetness Impact Compared with Sucrose (=100) on a Weight for Weight Basis
Brown sugars	85-90
Molasses	70-70
Invert sugar (solids)	110-140
Fructose (solids)	170
High fructose corn syrups	100-160 depending on type
Glucose solids (dextrose)	approximately 75
Glucose syrups (depends on DE)	40-80 with increasing DE
Maltose	40
Lactose	20
Honey	95-100

Brown Sugars

Brown forms of sucrose are available which are based on white sugar forms combined with varying amounts of molasses. Chemically they are almost identical to the white forms of sugar. They are used to add colour and flavour in bakery products. They are slightly less sweet than sucrose.

Molasses and Treacle

Molasses or black treacle is a viscous product obtained during the refining of sugar cane or beet. It is a mixture of sugars. The dominant sugar is sucrose with different levels of glucose, fructose and raffinose (a trisaccharide) being present. Molasses is dark in colour and less sweet than sucrose. It also tends to have bitter flavour notes which limits the levels of addition in many bakery products. Molasses, treacle and golden syrups (see below) may be used to colour some speciality bakery products (e.g., Christmas puddings and heavily fruited cakes), biscuits and cookies.