10 Role of sucrose in retention of aroma and enhancing the flavor of foods

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10.1 Introduction

Sucrose interacts with food ingredients and in processed foods in many different ways. The major flavor function of sucrose is, certainly, to sweeten food, but sucrose also influences the flavor quality of foods in diverse other ways.

Anecdotal and hearsay claims are made about the interaction of sucrose with the flavor of foods, many of these in advertising copy for competing ingredients. An example of this is the following statement that appeared in the October 1993 issue of Food Engineering (Dillon, 1993) touting another sweetener: ‘. . . sucrose often overshadows fruit and spicy flavors’. Is this true or untrue, and how do we find out? As we will find, later in this chapter, that statement is not true.

The home cook has known for generations that a small amount of sucrose will enhance the flavor of vegetables, meats and other foods that are not normally sweet. These cooks have found that sucrose added in a subthreshold concentration (below the sweet detection level) will improve the overall flavor.

Commercial food processors have recognized the same phenomenon, and add sucrose (and sometimes other sweeteners) in small quantities to enhance and improve the flavor of many canned and processed meats, condiments and vegetables.

10.2 Sucrose and the other basic tastes

Four basic taste sensations are recognized in sensory studies – sweet, sour, salty and bitter. A fifth sensation, known as ‘umami’ is recognized by Japanese workers, but it is not yet well enough defined in the literature to be considered a basic taste. Tastes differ from flavors or aromas in that a ‘taste’ is sensed on the tongue and can still be identified when the nose is closed off. Aromatics or volatiles are sensed with the olfactory apparatus and are very numerous, encompassing literally hundreds of sensations. ‘Flavor’ is the term that encompasses the entire sensory experience of a
food, and includes such elements as individual aromas and basic tastes as well as other sensations, such as texture and chemical stimulation.

In general, bitter, acid and salty tastes are suppressed in the presence of sucrose, but the sweet taste of sucrose is not suppressed as much except at high concentrations of the other tastants. The ability of sucrose to suppress the other basic tastes, especially bitter and sour tastes, is responsible for much of sugar’s ability to ‘round out’ or ‘smooth’ the flavor of foods. All taste–taste interactions are concentration dependent.

10.2.1 Interactions with salty taste

A low concentration of sodium chloride enhances the sweetness of sucrose, and a high salt concentration depresses sweet taste. Sucrose, on the other hand, depresses saltiness at all concentrations of sucrose (Kroeze, 1978; Gillette, 1985; DeGraff and Fritjers, 1989). Other salts, i.e. alkaline acetates and butyrates, also enhance the sweetness of disaccharides (Unilever NV, 1980). Moskowitz (1972) suggests that mixtures of sweet and salt develop an unblended or ‘clashing’ taste when the taste intensities are in a similar range because the two taste modalities are attempting to dominate the taste perception.

10.2.2 Interaction with bitter taste

Some current theories on sweetness receptors postulate that a close relationship exists between sweet and bitter taste receptors. Structure–function studies have shown that some carbohydrates possess both bitter and sweet molecular regions, and may, therefore, be able to span both types of receptors. As a consequence, the interactions between sucrose and bitter substances are complex and interesting.

Many bitter foods (chocolate, coffee, tea, alcohol) are traditionally sweetened. Sucrose imparts ‘balance’ to bitter foods (Busch-Stockfisch and Domke, 1991). Sucrose moderates (suppresses) the bitterness of caffeine and coffee, but these do not suppress the sweetness of sucrose as much (Calvino et al., 1990).

10.2.3 Interaction with acid–sour taste

Sucrose effectively decreases the acidity of sour compounds. Hoppe showed that the sourness of citric acid undergoes an exponential decrease with increased sucrose concentration (Hoppe, 1981). An optimum sugar–acid blend of 8% sucrose and 1.11% citric acid was recommended for maximizing beverage flavors (McBride and Johnson, 1987). These researchers noted a compression pattern in that increasing concentrations