## Biotechnology in the production of sugar substitutes Bilal Ali Kashan – Food Sciences Dep. – Agriculture College

Sucrose (table sugar) is one of the sugars used widely in many applications, especially in food and pharmaceutical industries as well as many other industries, Sucrose is a disaccharide, which consists of linking one unit of glucose and one of fructose by a glycoside bonds of type Alpha 1-2, which is easily degraded by the enzyme Invertase, this is what happens during digestion. Because of the increasing demand for this substance as it is one of the pillars of the food industry, its production has increased in recent decades and has steadily doubled.

Excessive consumption of dietary sugars as calories is still a major food problem in different regions of the world, reports indicate that the average American consumes 17 teaspoons of sucrose per day, which is approximately six double the daily intake for men and nine double the daily intake for women. This dietary behavior is associated with many adverse health effects such as obesity, increased rates of diabetes, high blood pressure and cardiovascular disease, for this reason, global efforts have emerged to reduce the consumption of sugars in this excessive form. which is why global efforts have emerged to reduce the consumption of sugars in this form. For instance, the World Health Organization (WHO) made a recommendation requiring that sugar consumption be reduced to less than 5% of the total calorie intake for adults and no more than 10% for children. For this reason, food producers began to search for alternatives that are less harmful to consumer health, until its value began to decline due to the general awareness of consumers during the past years. There is currently a global trend to reduce sugar consumption through the use of non-nutritive artificial sweeteners.

This article focuses on Thaumatin, which is a promising sweetener. It is a highly sweet protein isolated from the berries of the fruits of the katempe or "katemfe" plant, which West African countries such as Nigeria, Ghana and the Central African Republic are its original home. Thaumatin consists of a single-chain of 207 amino acids, has a relative molecular mass of 22 kDa. The distinctiveness of thaumatin lies in its sweetness index being up to 3500 times sweeter than sugar. According to the 2008 Guinness World Records, it is the sweetest natural substance known to mankind.

Thaumatin is one of the most promising alternatives to sugars and artificial sweeteners. Since the natural production of these proteins is often too expensive, attention has been drawn to the use of biological production methods, which are currently under investigation, through the use of DNA recombination technology to produce sweet proteins from a microorganism known as Pichia pastoris that contain a catalyst that allows good control of the production of this protein. Considerable efforts have been made to improve the yield and purity of toumatin, but more research and studies are still needed.

several studies involving the safety aspects of thaumatin indicate that the sweetener does not cause any allergenicity or toxicity, Numerous studies have been conducted to assess the toxicity of thaumatin. For instance, the Joint FAO/WHO Expert Committee on Food Additives, Food and Agriculture Organization of the United Nations & World Health Organization (1986) report claims that the protein is free from any toxic, genotoxic, or teratogenic effect. Numerous studies have provided strong evidence that toumatin is not an allergen to the oral mucosa, and research has indicated that garlicatin does not cause any serious effect when used as a flavor modifier or partial sweetener within a certain level of consumption.

Nowadays, the production of thaumatin has shifted from its extraction from the traditional plant to the stage of microbial production, where it was produced by many microorganisms, including bacteria and fungi, including yeasts, *Pichia pastoris* were the highest in producing this protein, as the final product has qualities that surpass plant production in many aspects, including not being

affected by heat or decomposition and stability when stored from crystallization and abundant production in larger quantities at a lower economic cost.

Artificial sweeteners can be described as non-caloric or low-calorie sweeteners because they provide very few calories when compared with sucrose due to lesser absorption by the digestive system. These low- or non-calorie sweeteners can be used to replace sucrose in sugar-based foods and beverages and thus constitute a solution for those who are prone to diabetes or obesity.

## Keywords: (sugar substitutes, sucrose, thaumatin, sweet proteins)

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