Mini Review

BIOMEDICAL Journal of Scientific & Technical Research

ISSN: 2574 -1241

DOI: 10.26717/BJSTR.2019.21.003608

The Importance of Trehalose Sugar

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ARTICLE INFO

Received: September 16, 2019

Published: September 20, 2019

Citation: Kahraman H, Budak Zk. The Importance of Trehalose Sugar. Biomed J Sci & Tech Res 21(3)-2019. BJSTR. MS.ID.003608.

ABSTRACT

Keywords: Trehalose; Effect; Microorganisms

Introduction

Trehaloz was first discovered in 1832 by Wiggers in the "ergoda bit plant. In 1859, Berhelot was able to isolate trehalose from trehala, a substance produced by wheat plants. The enzyme responsible for the hydrolysis of trehalose was first detected in yeast. Trehalose is a sugar molecule consisting of the binding two glucose by the α-1-1 bond. Trehalose is non-reducing because it is formed by the coupling of two reducing groups. This bond also ensures that trehalose is not affected by acid hydrolysis. Therefore, it can maintain its stability even in acidic environments and high temperatures. Because of this bond; aldehydes and ketones do not bind to protein ends such as arginine and lysine. Until recently, only a few plants species - drought tolerant plants - were thought to synthesize trehalose. However, it was later found that trehalose was found in animals, plants and microorganisms (including *Arechaea*) in nature. Plants and animals are able to produce trehalose when they are in dry conditions and in dry conditions for a long time. Moisture retention is very high. Therefore, it is widely used in cosmetics and food industry.

When the cell is dehydrated, the sugar in the cell forms the gel phase. As a result, intracellular organelles are protected from adverse conditions. Stoplasmic membranes have a protective role against drying, freezing and heat stress. During the rehydration, the cells can return again without disturbing their normal activity that constitutes the dehydration/rehydration cycle. At this stage, trehalose may also serve as an antioxidant [1-10]. Trehalose can accumulate in the cell at high concentrations without disrupting the biological functions of proteins, lipids and DNA. Such a compatible solute is trehalose; dehydration, osmotic shock, extreme temperature, oxidative damage and even radioactive damage. Trehalose also exerts its effects on living organisms by preventing protein denaturation. In addition, trehalose protects DNA and prevents stress breakage of membranes [8]. Trehalose may be used as a "non-toxic cryoprotective agent with long-term biocompatibility and bioavailability" [11]. It has a taste characteristic corresponding to 45% of sucrose. It has much less dissolution property than sucrose at temperatures below 80^0C.

In addition, the anhydrate trehalose form has the property of retaining moisture by forming dihydrate. Isolation of trehalose: both complex and expensive. Today however, it can easily be isolated from starch by the extraction method. It also acts as an energy storage component. Trehalose is the most important energy source for flying insects. Trehalose is a major constituent of the circulatory fluid, especially of shrimp and insects. This is because when trehalose is broken down by trehalase, it converts to two glucose molecules and provides the high amounts of energy required. When the tadrigates are left in an anhydrous environment, the glucose molecule turns into trehalose in the cryptobiosis stage (a stage in which it appears lifeless). Trehalose enzyme; it is also found in the human body, although not in high amounts. Enzymes in the stomach break down trehalose into two glucose molecules [12]. Trehalose is recognized as a new food additive in the US and

EU. Therefore, it has a broader use than other sugars. Trehalose is known as an energy source as well as being an anti-stress molecule. Trehalose accumulation increased in stress conditions of plants.

Trehalose is also used as a carbon and energy source many plants, animals, fungi and bacteria. Trehalose, which is found in 1-17% dry rate in the fungal family, is therefore also known as fungal sugar. Trehalose is also a storage carbohydrate in yeasts. Bread yeast has a very important role in determining the shelf life. When synthesized by organisms, trehalose is mainly capable of stabilizing the membranes, as well as protecting against stress conditions such as drying and dehydration. The high rate of trehalose in the cell causes prolonged shelf life. Trehalose, which is used in frozen foods, ready meals and some beverages, increases the resistance of foods against dryness and frost as well as its protective properties; high melting temperature and moisture retention pave the way for different usage areas [1,13]. This compound is also a component of cell wall glycolipids in actinomyclics containing many microorganisms' micolic acids. It can also function as a signaling or regulatory molecule that affects metabolism in yeast and plants. Trehalose accumulates in many bacteria as a compatible soluble substance at high osmolarities and is synthesized in a number of biosynthetic ways [6]. Water retention is known to be high.

This characteristic feature are used; food, cosmetics and pharmaceutical industry. Trehalose; fermentation plays an important role in acid resistance, ethanol resistance and cold resistance in different microorganisms [14]. It plays an important role in stress conditions as a protective agent and as a structural component of the cell wall. The best-known example is trehalose dimicolate, which is important in the virulence process of *Mycobacterium tubereulosis*. Trehalose has many applications in the pharmaceutical, food and cosmetic industries due to its special properties [4]. In some cases, particularly in yeasts and plants, it also functions as a molecule that induces or suppresses certain metabolic pathways. Trehalose is also frequently found in cell walls as a component of various glycopids [5]. Trehalose not only protects biomolecules in vivo but also has the same protective effects in vitro, which has opened a new field for application in the food industry and pharmaceutical manufacturing processes. Three metabolic pathways for biosynthesis have been reported in microorganisms. The first route is trehalose-6-phosphate, wherein trehalose is synthesized by binding from a UDP-glucose to glucose-6-phosphate to glucose-6-phosphate to form trehalaphosphate and trehalase-6-phosphate, The second way involves rearranging the internal glycosidic linkages between molecules of polymers such as malto-oligosaccharides which are capable of transforming the α-(1-4) linkage of the malto-terminal residue produced from hydrolysis of starch with α-amylase. As a result, the oligosaccharides turn into an α-(1-1) linkage. The third way comprises the internal arrangement of the glycosidic linkage between molecules. Trehalosentase (TreS); catalyzes the recycling of maltose and trehalose [3-4].

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Kahraman H. Biomed J Sci & Tech Res