EC NUTRITION
Mini Review

Xanthan Gum as a Unique Microbial Polysaccharide

Hussein Azzaz Murad* and Asmaa Abuel Khair

Dairy Research Department, National Research Center, Dokii, Cairo, Egypt

***Corresponding Author:** Hussein Azzaz Murad, Dairy Research Department, National Research Center, Dokii, Cairo, Egypt.

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Natural polysaccharides are essential materials for vital *in vivo* functions such as providing an energy source and as a structural material [1]. In view of the fact that polysaccharides are naturally recycled carbon resources and looked at to be eco-friendly because of their biodegradability, it is estimated that the efficient use of polysaccharides will show the way to the production of environmentally benign materials [2]. In addition, many polysaccharides like cellulose, starch, chitin and those produced from plants, bacteria, and seaweeds have been considered [3]. For example, some polysaccharides are used as hydrocolloids for a stabilizer, a viscous agent, and a structure provider in food industries [4].

Xanthan gum is an extracellular hetero polysaccharide produced by *Xanthomonas campestris*. Because of its unique rheological behavior, xanthan gum is one of the major microbial polysaccharide actually employed in many industrial processes. The polysaccharide is used as suspending, stabilizing, thickening and emulsifying agent, for food and non-food industrial applications [5]. Xanthan is non-toxic and does not inhibit growth. It is non-sensitizing and does not cause skin or eye irritation. On this basis, xanthan has been approved by the United States Food and Drug Administration (FDA) for use as food additive without any specific quantity limitations [6]. Xanthan molecular structure is often reported to be heavily affected by the composition of the production medium. In this respect, several studies have so far focused on a variety of nutrients, particularly the nitrogen and carbon sources [7,8]. To produce xanthan gum, *X. campestris* needs several nutrients, including micronutrients (e.g. potassium, iron, and calcium salts) and macronutrients such as carbon and nitrogen. Glucose and sucrose are the most frequently used carbon sources. The concentration of carbon source affects the xanthan yield [9-11]. Higher concentrations of these substrates inhibit growth. Nitrogen, an essential nutrient, can be provided either as an organic compound [12-15] or as an inorganic molecule [9,10,16-19]. The C/N ratio usually used in production media is less than that used during growth [9,10,13,17,19,20]. Generally, lower concentrations of both nitrogen and carbon are conducive to produce the xanthan polymer. Most commercial production method for xanthan gum uses glucose or invert sugars, and most industries prefer batch processes than continuous processes [21]. Development of xanthan production includes the determination of media nutrients in order to reach high production yield at low cost. Xanthan has been produced in a wide range of both complex and well-defined media. Initial cultures is complex media involved growth in cabbage extract [22] and further scale-up studies aiming at industrial production used lactose rum, soybean liquor, cereal hydrolysate and other agricultural waste production as growth media [23-26]. Other substrates have also been tested, such as hydrolyzed rice, barley, corn flour, acid whey, sugar cane molasses, coconut juice, sugar cane, etc., but glucose is still the best in terms of product yield, supply, and product quality [27]. The choice of substrate is dependent not only on cost but also on the end use of the product and nitrogen content [28]. One of the greatest factors limiting the use of xanthan in large-scale fermentation processes is the cost of production when compared to similar polymers from algae or plants. Some attempts have been made to use cheaper substrates such as citrus waste [29], whey [30,31] and [32], corn steep liquor [33], molasses and glucose syrup [10,19,34,35] and olive oil waste waters [36].

It has been found that the production and the properties of xanthan gum are influenced by bacterial strain [37,38], culture medium [21,39,40], temperature [41], pH [42], time of fermentation [43], and agitation rate [4,39].

The utilization and functionality of stabilizers in food products is not new; they have been used for more than half a century. However, it is only in more recent years that a wide range of new dairy products that rely, to a large extent, on the functionality of stabilizers has been introduced [44]. One of the major objectives of dairy manufacturers is to produce dairy products that have desirable quality attributes (appearance, texture and flavor) over a sufficient shelf life. In order to achieve this objective, dairy manufacturers have been utilizing ingredients such as stabilizers to improve the kinetic stability of food emulsions [45,46]. Blends of xanthan gum, carrageenan, guar, Locust bean gum and galactomannans are excellent stabilizer for ice cream, ice milk, sherbet, milk shakes and water ices. Xanthan, guar and LBG blend is vital to slice ability, firm body and flavor release of cream cheese. Also, xanthan thickens cottage cheese dressings by providing good drainage control [47-51].

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