Mini Review

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Chitooligosaccharides in Food Industry

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ABSTRACT

In the recent decade, there has been an increasing interest in development of functional food ingredients and dietary supplements based on chitooligosaccharide (COS) which is the major degradation product of chitosan. This review summarizes some of the recent applications of COS in food industry.

INTRODUCTION

Chitooligosaccharide (COS) is homo- or heterooligomers of N-acetyl-D- glucosamine (GlcNAc) and D-glucosamine (GlcN) linked by β-1,4-O-glycoside bond and usually prepared from partial hydrolysis of unstable glycosidic bonds of chitosan [1]. Hetero-COS with low, medium and high molecular weight (M_w) oligosaccharides is often used in food industries, pharmaceutical industries, and agriculture [2]. The different M_w is attributed to the different production methods and degree of deacetylation (DD) of starting material. COS typically possesses an average M_w <10,000 Da and degree of polymerization (DP) < 50–55 [3]. Compared to chitosan, COS is almost 100% absorbable along gastrointestinal tract (GIT) and another mucosal membrane, has lower viscosity and readily dissolves in water over a wide range of pH due to its shorter chain lengths [1]. Furthermore, COS rapidly undergoes clearance by the liver and kidney and then is excreted in the urine or absorbed in skeletal muscle and articular cartilage [4]. COS is nontoxic, biocompatible, biodegradable and has excellent biological properties such as, antibacterial, antitumor, antioxidant activity making it superior to chitosan in food industry to enhance food safety, quality, and shelf-life [5]; Figure 1.

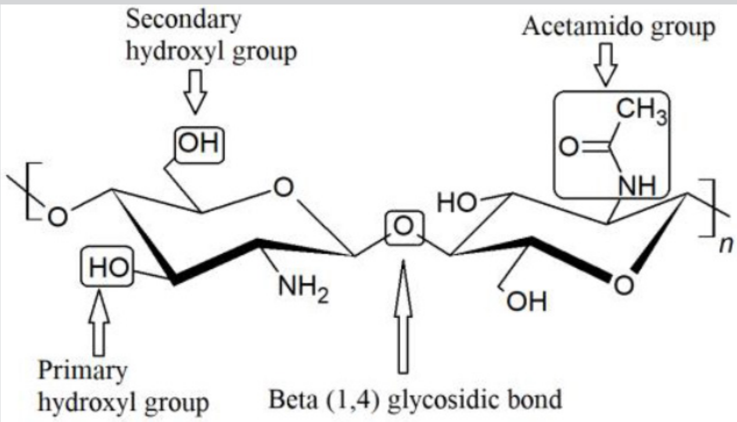

Figure 1: Chemical structure of COS.

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FOOD APPLICATIONS

COS can be used in the food industry as packaging material and food preservative due to its antioxidant activity as well as antimicrobial activity against different microbes which allows the protection of foods from microbial deterioration. The amalgamation of COS in chitosan films has shown to improve the antimicrobial activity of film against *E coli, B cereus, S aureus, Serratia liquefaciens, Lactobacillus plantarum* while maintaining the water vapour permeability of the films [6]. COS was able to successfully inhibit beer spoiling bacteria (*Lactobacillus brevis*) in the brewing while not affecting the fermentation process of brewer's yeast [7]. Moreover, an extended shelf life of minced meat up-to 15 days was observed when it was kept with COS and lysozyme mixture at low temperature [8]. Furthermore, COS has the potential as a prebiotic source because it is non-digestible by intestinal enzymes, supports the growth of beneficial probiotic bacteria in the GIT such as *Bifidobacterium* and *Lactobacillus*, and inhibits intestinal pathogens [9]. In addition, COS has applied as a supplement in dietary therapy against obesity. It is reported that COS prevent weight gain by inhibiting adipocytes differentiation or altering adipose tissue gene expression in rodent models of obesity [10,11]. COS was effective in reducing serum levels of triglyceride and cholesterol and alleviating lipid accumulation in the liver [12,13].

CONCLUSION

COS is a promising material in food industry due to its high antimicrobial and antioxidant activities. These significant biological benefits of COS are directly related to its low MW and DD which make it water soluble and absorbable. However, the impurity of COS samples is the biggest challenge limiting their wide applications, recalling the necessity of further investigations for purification of COS samples.

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