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Production of microbial exopolysaccharides in the sourdough and its effects on the rheological properties of dough

Ali Ketabi, Sabihe Soleimanian-Zad, Mahdi Kadivar, Mahmoud Sheikh-Zeinoddin *

Department of Food Science and Technology, College of Agriculture, Isfahan University of Technology, P.O. Box 84156, Isfahan, Iran

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ABSTRACT

Exopolysaccharides (EPS) are exogenous microbial metabolites which are secreted mainly by bacteria and microalgae during growth. In addition to natural polysaccharides present in cereal grains flour and dough, microbial flora is usually involved in production of polysaccharide on sourdough fermentation. Total polysaccharides (microbial and flour) were extracted from sourdough and dough samples dehydrated and were added at the rate of 0%, 0.25%, 0.5%, 1%, 1.5%, 2% and 2.5% (w/w flour based) on the dough to investigate its effects on the rheological properties of the dough. Addition of polysaccharides to the dough increased the water absorption and decreased the dough softening after 20 min. Resistance to extension after 45, 90 and 135 min resting time was decreased by increasing the percentage of the added polysaccharides. Longer fermentation time for each level of polysaccharides led to greater stability. No significant differences were observed in the extensibility of dough. The overall effects of different levels of added polysaccharides resulted in a decrease in resistance to extension ratio of the samples. Energy input decreased in all cases. It seems therefore that addition of polysaccharides may be useful when bread is to be made with stronger flour and longer fermentation time is needed.

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1. Introduction

Exopolysaccharides (EPS) are exogenous microbial metabolites which are mainly produced by bacteria and microalgae during their growth. EPS may be assembled as capsular forms that are tightly associated with the cell surface, or secreted into the extracellular environment as slime materials (Sutherland, 1972). Lactic acid bacteria (LAB) are widely used food grade organisms, which are generally recognized as safe and known to produce different metabolites including EPS (Stiles & Holzapfel, 1997). EPS play different roles such as protection of cell against water absorption, phagocytosis and phage invasion (Cerning, 1990 and Cerning, 1995). Plant based polysaccharides and their modified forms as well as microbial polysaccharides are important additives which are commonly used in the food industry (Armero & Collar, 1996; Belitz & Grosch, 1999; Butt, Anjum, Samad, Kausar, & Tauseef Mukhtar, 2001). These polysaccharides improve texture and increase quality and durability of bread (Armero & Collar, 1996 and Armero & Collar, 1998). Plant based polymeric compounds (polysaccharides) can be replaced by microbial polysaccharides produced by LAB during the dough fermentation (De Vuyst & Degeest, 1999). Mentioned microbial polysaccharides can also be considered as prebiotics (Gibson & Roberfroid, 1995; Korakli, Pavlovic, Gaenzle, & Vogel, 2003).

Cereal products are the most important food sources in the world. Cereal grains are predominantly composed of starch. Non-starch polysaccharides, which are classified as minor parts of flour, are naturally present in dough too (Belitz & Grosch, 1999). In addition to natural polysaccharides from cereal grains, microbial flora of dough are usually involved in sourdough fermentation produce different kinds of polysaccharides (Korakli, Rossmann, Gaenzle, & Vogel, 2001). Increasing the amount of polysaccharides to the dough causes many changes in the dough system, which affects the rheological behavior of dough and finally improves technological quality of dough and bread. Addition of hydrocolloids to the dough also affects reterogradation of starch and delays the staling of bread (Collar, Martinez, & Armero, 1999). While application of EPS produced by lactic culture bacteria is very common in dairy industry, the research on the production of EPS in the dough and the impact of those polysaccharides on the quality of bread is very limited. Emphasizing on the native Iranian species of microorganisms, this study examines the application of polysaccharides in bread dough.

* Corresponding author.
E-mail address: Zeinodin@cc.iut.ac.ir (M. Sheikh-Zeinoddin).

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