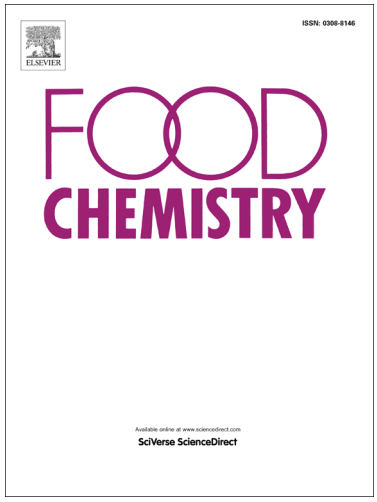

Mechanical wheat flour modification and its effect on protein network structure and dough rheology

Stefanie Hackenberg, Mario Jekle, Thomas Becker

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Mechanical wheat flour modification and its effect on protein network structure and dough rheology

Author: Stefanie Hackenberg[a], Mario Jekle[a,] *, Thomas Becker[a]

[a]Technical University of Munich, Institute of Brewing and Beverage Technology, Research Group Cereal Technology and Process Engineering, Weihenstephaner Steig 20, 85354 Freising, Germany

*Corresponding author
E-mail address: mjekle@tum.de (Mario Jekle)
Phone number: +49 8161 71 3669

Abstract

Mechanical flour modification is frequently associated with a reduced bread volume due to changed structural and functional properties of protein and starch. To clarify the effect of mechanical flour treatment on the protein network formation at the optimum kneading time ($Peak_{time}$), dough was produced with various mechanical starch modification (MSM) levels and visualized by confocal laser scanning microscope before being characterized by protein network analysis (PNA). Dough produced with high MSM showed a reduced branching rate (-14%), a high end-point rate (+25%) and an increased lacunarity (+139%), indicating a poor network connectivity with network interruptions. Alterations of the protein microstructure were closely related to the dough rheological dough properties. In this regard, reduced extensibility and resistance to extension of dough produced with high MSM levels were responsible for decreased dough height (Hm) during fermentation and thus might be the cause for lower baking volume of bread produced with high MSM.

Keywords: Damaged starch; dough extensibility; resistance to extension; protein network analysis; CLSM; swelling; bread quality

1. Introduction

Mechanical flour treatment has an influence on the biopolymers of flour and thus on its structural and functional properties. The level of mechanical flour modification is commonly characterized by the value of starch damage. Starch damage is a collective term, describing a variety of effects on different structural levels of the polysaccharide (Li, Dhital & Hasjim, 2014). In the study at hand, the term “mechanical starch modification” (MSM) was used instead of “starch damage” according to Hackenberg, Verheyen, Jekle & Becker (2017). In general, the evaluation of the flour modification level is only in consideration of starch but fails to recognize the protein component, which may be also affected by grinding. However, the MSM level is currently the most appropriate method for