

Effects of laccase, xylanase and their combination on the rheological properties of wheat doughs

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ABSTRACT

The effects of *Aspergillus oryzae* and *Bacillus subtilis* xylanases and *Trametes hirsuta* laccase on the rheological properties of wheat flour dough and gluten dough were examined with Kieffer dough and gluten extensibility rig, determining the dough extensibility (E_x) and the resistance to stretching (R_{max}). Laccase increased the R_{max} of dough and decreased the E_x at R_{max} as a function of dosage (5-50 nkat/g flour) whereas xylanases decreased the R_{max} of dough and increased the E_x at R_{max} in flour and gluten doughs. Hardening by laccases and softening by xylanases were weaker in gluten doughs, which were, as the enzymes were believed to use arabinoxylan (AX) as their primary substrate, presumably due to the lower AX content in gluten. As a function of dough resting time (15, 30 and 45 min), the laccase treated doughs were observed to soften. The softening effect occurred especially at higher dosages (> 50 nkat/g flour) and was strengthened as a function of laccase activity. The softening phenomenon was presumably related to the laccase-mediated depolymerization of

crosslinked AX network. In combined laccase and xylanase treatments, the effect of laccase seemed to be predominant, especially at low xylanase dosage (50 nkat/g flour), but when xylanase was added to flour dough at high concentration (500 nkat/g flour), the hardening effect of laccase on dough was decreased. Presumably, when the AX fraction was hydrolyzed effectively by xylanase, laccase was not able to create a strong AX network. Similar decrease in laccase-mediated hardening in doughs was not seen, when performing the combined laccase and xylanase test with gluten, which was most probably due to low AX content of gluten. The results indicated the critical role of feruloylated arabinoxylan fraction in laccase-catalyzed structure formation both in flour and gluten, although in gluten doughs, protein fraction might have also been affected.