Inactivation of Endogenous Rice Flour β-Glucanase by Microwave Radiation and Impact on Physico-chemical Properties of the Treated Flour

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Abstract The apparent reduction of β-glucan (BG) molecular weight in rice-based gluten-free (GF) breads fortified with cereal BG concentrates reveals the presence of β-glucanase activity in rice flour. Inactivation of endogenous β-glucanase in rice flour thus seems to be a necessary step when developing GF breads enriched with BG of high molecular weight. The aim of this work was to study the thermal inactivation of endogenous β-glucanase in rice flour by means of microwave (MW) processing; rice flours preconditioned at four different moisture levels (13, 16, 19, 25 %) were treated by MW radiation at 900 W and five MW treatment times (ranging from 40 s to 8 min, applied stepwise at 20-s intervals). The effects of microwaves on starch crystallinity, pasting, and thermal properties of MW-treated rice flours were also explored. The β-glucanase activity in rice flours was assessed by the rate of decrease in specific viscosity of a dilute solution of a purified β-glucanase preparation, upon addition of flour extracts. MW proved to be a useful alternative for thermal inactivation of endogenous β-glucanase in rice flours when applied to moistened samples. The inactivation process followed a first-order kinetic response and the apparent rate constant of thermal inactivation increased exponentially with the moisture content of the flour, M, according to the equation $0.0146 \exp (0.212 - M) \left( R^2 = 0.97 \right)$. The MW time required for complete β-glucanase inactivation was only 4 min when the initial flour moisture increased to 25 %. Following MW treatment, the starch crystallinity was unaffected ($p > 0.05$) and the side effects of the treatment on flour pasting and thermal properties were rather negligible.

Keywords β-glucanase inactivation · Microwave treatment · Pasting properties · Rice flour · Thermal properties · X-ray diffractometry