

Alternative Baking of Cereal Dry products considering microwaves and infrared to reduce the baking energy and to enhance the final quality of biscuits

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Traditionally, biscuits baking is done at high temperature resulting in high-energy demand. Such baking condition also yields higher risk of acrylamide formation, which can be magnified by the use of ammonium bicarbonate (leavening agent) due to the presence of ammonium. This presentation addresses new challenges with the objective of developing alternative low-energy processes for baking of biscuits combining microwave (MW) and infrared (IR) heating while enhancing the final nutritional quality, including reduction of acrylamide formation and glycemic index (GI), and sensorial properties of biscuits.

A laminated biscuit has been considered as a model system. The dough was prepared using a combination of ammonium bicarbonate and sodium bicarbonate with sodium acid pyrophosphate as leavening agents. MW-baking at 2.45 GHz was done in a modified domestic microwave cavity equipped with airflow to evacuate moisture and connected to a 200 W solid-state microwave source (SAIREM-France). The proposed process was compared to conventional baking. First results (lab-scale) showed that it was possible to reduce the baking energy by 30% for MW biscuit while obtaining a pale crust colour. The water content of the MW biscuit, which was kept below 5% (wb), was adjusted by controlling the MW power and the baking duration. The texture of the MW biscuit was measured through the 3-point bending test and was comparable to the control biscuit. An investigation on the optimization of the ratio of ammonium bicarbonate to the sum of sodium bicarbonate and sodium acid pyrophosphate has been carried out showing the final volume of the biscuit was impacted by this ratio. The ratio of these leavening agents yielded also an impact on the presence of sodium in the final product, which can negatively affect the taste of biscuits for consumers. Further tests are envisaged to combine MW with IR heating to develop a coloured crust in order to enhance the organoleptic properties of the newly developed biscuit and thus reach consumers' expectations in terms of colour and flavour. Complementary nutritional analyses (glycemic index, acrylamide, sodium content) associated with process optimization in terms of global energy consumption with larger batch of biscuits are also planned.