

Optimization of Blending Ratios of Flours from Marula Seedcake, Mopane or Mealworm for the Production of a Protein-Enriched Bread

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Abstract

The faster-growing demand for protein with a reduced environmental impact is currently one of the biggest challenges for the food industry. According to the United Nations report, the population of 8 billion is expected to reach 8.6 billion by 2030, increasing the pressure on land use, greenhouse gas emissions, energy consumption and ultimately food security. Besides its biodiversity Africa is known for its indigenous knowledge, especially of wild plants and even insects. Human consumption of insects (entomophagy) is now regarded as one of the most promising answers to the increasing need for protein related to the increase in world population as they are part of the traditional diet of many communities. In this study, the composition, safety and functional properties of flour prepared from marula seedcake, mopane worm (*Imbrasia belina*) and mealworm (*Tenebrio molitor*) flours were determined and their potential for breadmaking was evaluated. The microbiological safety of different flours was assessed by performing total viable plate counts (ISO 4833-2:2013) and screening for selected pathogens. Yeast and mould counts were determined using the ISO 21527-1:2008 method. Wheat bread flour supplemented with different percentages (2.5, 5, 10, 15 and 20%) of alternative flours were prepared and the effects of the replacement on the rheological properties of doughs were determined by Mixolab analysis. Baking trials were performed under semi-commercial conditions and the baking performance (crust and crumb colour, texture, height) was determined using the relevant standard AACC methods. The crumb structure of baked products was measured by C-Cell analysis (AACC 74-09.01). The microbial analysis confirmed that the marula seedcake, mopane worm and mealworm flours were suitable for human consumption. As expected, the reduction of gluten in the dough, due to the increasing percentage of alternative flour resulted in a decrease in the viscoelasticity and volume of the bread with an increase in density. A replacement at 15% by marula seedcake or mopane worm flour was found to be the most suitable product with a protein content of 11% and 13% respectively and a competitive pricing of R15 to R 38 per loaf.

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Charles is a post graduate student and senior technologist at the Department of Biotechnology and Food Technology at the Tshwane University of Technology. He is strongly involved mentoring the new generation food technologist by guiding them to understand how sciences and the industry combine to improve the quality of products. His research focus is to in-rich basic products with protein using insects and underutilized nuts that are locally consumed by the rural communities in Southern Africa.