Bioprocessing of Climate-Smart Crops for Improved Technological Functionality

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Abstract

Introduction: Sorghum and cowpea are compatible for intercropping in arid environments, and thus, have potential to improve food security in regions affected by climate change. In addition to compatibility from an agricultural perspective, they are also complementary nutritionally. However, they are currently used in limited capacity in industrial food manufacturing, due to lacking technological functionality and sensory properties compared to e.g. wheat. Improving these characteristics could improve food system sustainability, food security and contribute to local economies.

Methodology: This research aimed to investigate the potential of bioprocessing by various enzyme treatments (cell-wall degrading, proteases, and phytases) and lactic acid bacteria to tailor the techno-functional properties of wholemeal sorghum and cowpea flours in different applications, such as gluten free baking. The methods were chosen based on previous work, as well as work on other cereals and legumes. The bioprocessed sorghum and cowpea flours were characterized by sugar analysis, pasting properties, water binding capacity, soluble protein at pH 3 and 6.3, RVA, DSC and swelling capacity.

Results: Bioprocessing of sorghum released limited amounts of free sugars in monomer form (1.2-3.0%), mostly as glucose, while there was limited release of longer water-soluble polysaccharides. The highest amount of protein solubilisation was achieved by treatment with Alcalase at pH 8 (43% at both pH 6.3 and 3). Pasting properties of both crops were affected by fermentation, although in opposite directions, peak viscosity was increased for cowpea (282 to 519cP), while it was reduced for sorghum (532 to 351 cP). Swelling capacity and DSC profiles of sorghum were not much affected by the treatments, while for cowpea swelling was reduced by all treatments, while protein melting temperature was increased especially for fermented cowpea samples (85°C to 93 °C).

Discussion: Techno-functional properties of sorghum and cowpea could be modified by bioprocessing pre-treatments. Sorghum was more resistant to modifications compared to cowpea, e.g., when it comes to protein or dietary fibre solubilisation. However, with protease treatment at mildly alkaline conditions, high solubilisation of sorghum proteins was achieved. In conclusion, this study gives an insight into how bioprocessing can be used to tailor the functionality of cowpea and sorghum.

Biography: Natalia Rosa-Sibakov

Dr Natalia Rosa-Sibakov (PhD) is a Senior Scientist at VTT Food Solutions team. Her research interests focus on the technological and nutritional properties of plant-based ingredients. She has a solid knowledge on the structure of cereal dietary fibre (notably arabinoxylan and β-glucan) as well as modification methods (i.e., mechanical, and enzymatic) to tailor their functional properties. She has been also working with in vitro digestion models. In addition, she has experience on the application of plant-based ingredients in diverse food products, such as pasta, beverages, and yogurt.