185

Manufacturing and Potential of High Protein Plant-Based Ingredients from African Crops

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Abstract

There is a huge need to improve protein self-sufficiency worldwide and switch from animal to plant-based proteins. Cowpea, Bambara groundnut and amaranth are very important African grains with high protein content and good balance in amino acid profile. The aim of this work was to develop protein-rich ingredients from cowpea, Bambara groundnut and amaranth by dry fractionation and evaluate their techno-functional properties as well as their suitability for high moisture extrusion. Cowpea, Bambara groundnut and amaranth were milled with a fine impact mill, defatted (only Bambara) and air classified into fine and coarse fractions. The fine fractions (i.e., protein-rich ingredients) were characterized by their chemical composition (protein, dietary fibre, starch and ash), mass yield, protein separation efficiency and techno-functional properties (protein solubility and water holding capacity). Fine fractions were also used to produce meat analogues by using high-moisture extrusion. Air classification resulted in fine fractions with double amount of protein content compared to initial raw materials (56, 53 and 31 % of protein in fine fractions of cowpea, Bambara groundnut and amaranth, respectively). The mass yield of those protein-rich ingredients reached 23, 34 and 36%, from cowpea, Bambara groundnut and amaranth, respectively. The protein-rich ingredients were more soluble at all tested pH-values when compared with their raw materials. The water holding capacity was also improved in the protein-rich ingredients of Bambara (2-fold) and amaranth (1.4-fold). High moisture extrudates obtained from fine fractions of cowpea and Bambara groundnut failed to form fibrous structure resembling meat. However, supplementation of protein-rich fractions by 25% gluten (w/w) enabled better fibrous structure based on visual observation. The fine fraction of Bambara groundnut was texturizing better than cowpea one. The extrudates with Bambara groundnut were harder and required more compression force (180 N) compared to extrudates with cowpea (136 N). Protein-rich ingredients produced by dry fractionation had good techno-functional properties, but their use in wet-extrusion were limited probably due to their high solubility of proteins and other factors that should be further investigated.

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