

Development and Structural Characterization of a Snack Food with Added Type 4 Extruded Resistant Starch

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Abstract : Snack foods are usually classified as 'junk food' because have little nutritional value. However, due to the increase on the demand and third generation (3G) snacks market, low price and easy to prepare, can be considered as carriers of compounds with certain nutritional value. Resistant starch (RS) is classified as a prebiotic fiber it helps to control metabolic problems and has anti-cancer colon properties. The active compound can be developed by chemical cross-linking of starch with phosphate salts to obtain a type 4 resistant starch (RS4). The chemical reaction can be achieved by extrusion, a process widely used to produce snack foods, since it's versatile and a low-cost procedure. Starch is the major ingredient for snacks 3G manufacture, and the seeds of sorghum contain high levels of starch (70%), the most drought-tolerant gluten-free cereal. Due to this, the aim of this research was to develop a snack (3G), with RS4 in optimal conditions extrusion (previously determined) from sorghum starch, and carry on a sensory, chemically and structural characterization. A sample (200 g) of sorghum starch was conditioned with 4% sodium trimetaphosphate/ sodium tripolyphosphate (99:1) and set to 28.5% of moisture content. Then, the sample was processed in a single screw extruder equipped with rectangular die. The inlet, transport and output temperatures were 60°C, 134°C and 70°C, respectively. The resulting pellets were expanded in a microwave oven. The expansion index (EI), penetration force (PF) and sensory analysis were evaluated in the expanded pellets. The pellets were milled to obtain flour and RS content, degree of substitution (DS), and percentage of phosphorus (% P) were measured. Spectroscopy [Fourier Transform Infrared (FTIR)], X-ray diffraction, differential scanning calorimetry (DSC) and scanning electron microscopy (SEM) analysis were performed in order to determine structural changes after the process. The results in 3G were as follows: RS, $17.14 \pm 0.29\%$; EI, 5.66 ± 0.35 and PF, 5.73 ± 0.15 (N). Groups of phosphate were identified in the starch molecule by FTIR: DS, 0.024 ± 0.003 and %P, 0.35 ± 0.15 [values permitted as food additives (<4 %P)]. In this work an increase of the gelatinization temperature after the crosslinking of starch was detected; the loss of granular and vapor bubbles after expansion were observed by SEM; By using X-ray diffraction, loss of crystallinity was observed after extrusion process. Finally, a snack (3G) was obtained with RS4 developed by extrusion technology. The sorghum starch was efficient for snack 3G production.

Keywords : extrusion, resistant starch, snack (3G), Sorghum

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