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Sorghum Polyphenols Encapsulated by Spray Drying, Using Modified Starches as Wall Materials

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Abstract : Different studies have recently been focused on the use of antioxidants such as polyphenols because of to its anticarcinogenic capacity. However, these compounds are highly sensible to environmental factors such as light and heat, so lose its long-term stability, besides possess an astringent and bitter taste. Nevertheless, the polyphenols can be protected by microcapsule formulation. In this sense, a rich source of polyphenols is sorghum, besides presenting a high starch content. Due to the above, the aim of this work was to obtain modified starches from sorghum by extrusion to encapsulate polyphenols the sorghum by spray drying. Polyphenols were extracted by ethanol solution from sorghum (Pajarero/red) and determined by the method of Folin-Ciocalteu, obtaining GAE at 30 mg/g. Moreover, was extracted starch of sorghum (Sinaloense/white) through wet milling (yield 32 %). The hydrolyzed starch was modified with three treatments: acetic anhydride (2.5g/100g), sodium tripolyphosphate (4g/100g), and sodium tripolyphosphate/ acetic anhydride (2g/1.25g by each 100 g) by extrusion. Processing conditions of extrusion were as follows: barrel temperatures were of 60, 130 and 170 °C at the feeding, transition, and high-pressure extrusion zones, respectively. Analysis of Fourier Transform Infrared spectroscopy (FTIR), showed bands exhibited of acetyl groups (1735 cm-1) and phosphates (1170 cm-1, 910 cm-1 and 525 cm-1), indicating the respective modification of starch. Besides, all modified starches not developed viscosity, which is a characteristic required for use in the encapsulation of polyphenols using the spray drying technique. As result of the modification starch, was obtained a water solubility index (WSI) from 33.8 to 44.8 %, and crystallinity from 8 to 11 %, indicating the destruction of the starch granule. Afterwards, microencapsulation of polyphenols was developed by spray drying, with a blend of 10 g of modified starch, 60 ml polyphenol extract and 30 ml of distilled water. Drying conditions were as follows: inlet air temperature 150 °C ± 1, outlet air temperature 80°C ± 5. As result of the microencapsulation: were obtained yields of 56.8 to 77.4 % and an efficiency of encapsulation from 84.6 to 91.4 %. The FTIR analysis showed evidence of microcapsules loaded with polyphenols in bands 1042 cm-1, 1038 cm-1 and 1148 cm-1. Analysis Differential scanning calorimetry (DSC) showed transition temperatures from 144.1 to 173.9 °C. For the order hand, analysis of Scanning Electron Microscopy (SEM), were observed rounded surfaces with concavities, typical feature of microcapsules produced by spray drying, how result of rapid evaporation of water. Finally, the modified starches were obtained by extrusion with good characteristics for use as cover materials by spray drying, where the phosphorylated starch was the best treatment in this work, according to the encapsulation yield, efficiency, and transition temperature.

Keywords : encapsulation, extrusion, modified starch, polyphenols, spray drying
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