

Characterisation of Fractions Extracted from Sorghum Byproducts

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Abstract : Sorghum byproducts, namely bran, stalk, and panicle are examples of lignocellulosic biomass. These raw materials contain large amounts of polysaccharides, in particular hemicelluloses, celluloses, and lignins, which if efficiently extracted, can be utilised for the development of a range of added value products with potential applications in agriculture and food packaging sectors. The aim of this study was to characterise fractions extracted from sorghum bran and stalk with regards to their physicochemical properties that could determine their applicability as food-packaging materials. A sequential alkaline extraction was applied for the isolation of cellulosic, hemicellulosic and lignin fractions from sorghum stalk and bran. Lignin content, phenolic content and antioxidant capacity were also investigated in the case of the lignin fraction. Thermal analysis using differential scanning calorimetry (DSC) and X-Ray Diffraction (XRD) revealed that the glass transition temperature (T_g) of cellulose fraction of the stalk was ~ 78.33 °C at amorphous state ($\sim 65\%$) and water content of $\sim 5\%$. In terms of hemicellulose, the T_g value of stalk was slightly lower compared to bran at amorphous state ($\sim 54\%$) and had less water content ($\sim 2\%$). It is evident that hemicelluloses generally showed a lower thermal stability compared to cellulose, probably due to their lack of crystallinity. Additionally, bran had higher arabinose-to-xylose ratio (0.82) than the stalk, a fact that indicated its low crystallinity. Furthermore, lignin fraction had T_g value of ~ 93 °C at amorphous state ($\sim 11\%$). Stalk-derived lignin fraction contained more phenolic compounds (mainly consisting of *p*-coumaric and ferulic acid) and had higher lignin content and antioxidant capacity compared to bran-derived lignin fraction.

Keywords : alkaline extraction, bran, cellulose, hemicellulose, lignin, stalk

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