Water solubility and thickness of cassava flour, glycerol and castor bean cake composites from renewable fuel industry

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Abstract: This work describes the interaction of cassava flour (88% starch content) with different concentration of micronized castor cake, glycerol and water by extrusion. Based on the content of reinforce material and the extrusion parameters, water solubility was estimated varying from 25.30 to 27.38%. Shear rate and compression ratio of the screw resulted in varied starch conversion. The thickness did not influence the functional properties of extrudates but have directly correlation with bioplastic solubility. The experimental data showed that the extruded bio-plastics mixtures were most efficient in terms of solubility than those of non mixture.

Cassava flour, donated by Embrapa Genetic Resources and Biotechnology (Brazil), was used as starchy source. The castor bean cake was donated by Embrapa Agroenergy (Brazil). Castor bean cake materials was finely ground in a planetary ball mill Fritsch (Idar-Oberstein, Germany) for 60 min in order to produce a micronized powder of average particle size of 20 μm. Mixtures of assava flour with different concentration of micronized castor cake powder (0, 0.5, 1, 2, 2.5, 5 and 10%) were equilibrated at 28% of moisture content and 8% of glycerol. The samples were homogenized manually, and then stored in plastic bags for for 24 h at 18°C. Only after this conditioning period, each batch (500g) was submitted to the extrusion process in a single screw extruder Brabender DSE 20 (Duisburg, Germany) keeping constant the following parameters: temperatures of the three heating zones from the feeding and die zones: 50, 80 and 100°C, and screw speed of 180 rpm. The extrudates (strips like) thickness was measured using a Fowler, IP54 micrometer (USA) taken using of five random measurements taken at different parts of the strips. The solubility of the bioplastics in water was determined according to the method proposed by Gontard et al. [1].

An increase of castor cake content in the bioplastic strips also caused a decrease in the studied parameters. In water solubility this decrease was 8.82% with varied from 27.38 to 25.42 (Figure 1).

Increasing the amount of castor cake in the composite resulted in a decrease in their thickness, values varied from 1.66 mm to 1.27 mm (Figura 2) when more castor bean cake was added. The addition of micronized castor bean addition decreased the hydrophilic behavior typical of starch molecules in the matrix as hydrophobicity and the thickness has a large influence in their properties of water vapour permeability. Visually an increase in micronized castor cake bean powder concentration caused an increase in darkness (Figure 3).

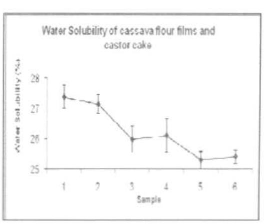

Figure 1: Water solubility of cassava flour bioplastics.

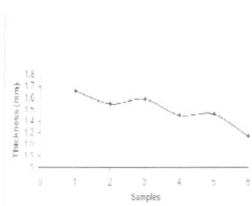

Figure 2: Thickness (mm) of cassava flour bioplastics.

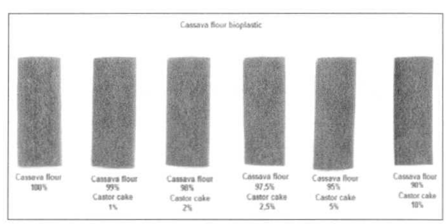

Figure 3: Bioplastics of cassava flour and castor cake

[1] N. Gontard, C. Duchez, J. L. Cuq, S. Guilbert: International Journal of Food Science and Technology (1994), 29, 39-50.