Use of micronized sunflower cake as a reinforce material to produce cassava flour biodegradable composites

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Abstract – The massive use of synthetic plastic affects the environment. Eco-friendly alternatives has been considered to alleviate the pollution caused by non-easily biodegradable petroleum based plastics. The objective was to study the effect of different sunflower cake concentrations, on the moisture loss during extrusion, water solubility and die swelling (thickness) of the starch based biodegradable composites.

Cassava flour, donated by Embrapa Genetic Resources and Biotechnology (Brazil), was used as starch source. The micronized sunflower cake was donated by Embrapa Agroenergy (Brazil). Sunflower cake materials was finely ground in a planetary ball mill Fritsch (Idar-Oberstein, Germany) for 60 min in order to produce micronized powder of average particle size of 20 µm. The sample of cassava flour with different concentration of micronized sunflower cake powder (0, 0.5, 1, 2, 2.5, 5 and 10%) was equilibrated to 28% of moisture and 8% of glycerol. After adjusting moisture content, the samples were homogenized and then stored in plastic bags (24 h/ 18°C) prior to extrusion. After this conditioning period, each batch was submitted to the extrusion processing in a single screw extruder Brabender DSE 20 (Duisburg, Germany) at constant extrusion parameters: 50, 80 and 100ºC, and screw speed at 180 rpm. The film thickness was measured using micrometer IP54 (Fowler, USA). The final value represented the average of five random measurements taken at different parts of the strip like shape extrudates. The solubility of the composites in water was determined according to the method proposed by Gontard et al. [1].

The solubility in water and thickness decreased with an increase of micronized sunflower cake content. Water solubility varied from 27.3 to 25.5% (Table 1). This finding is interesting because usually starch based bioplastics materials have hydrophilic behavior, which is not desirable since it causes instability of the food package. Values for thickness varied from 1.62 mm to 1.50 mm (Table 1) when sunflower cake was added. Sobral [2] studied the functional properties of gelatin as a function of thickness, and concluded that the strength at break, water vapor permeability and color of the bioplastics obtained were linearly influenced by their increase in thickness. When sunflower cake was added difference in moisture loss during extrusion was observed (Table 1). It is possible to envisage the potential use of sunflower cake in the production of bioplastics that can be even used as edible package if all the food safety procedures would be taken.

Table 1: Effect of micronized sunflower cake powder on cassava flour composite properties.

Sample	Sunflower cake content (%)	Water Solubility (%)	Moisture loss extrusion (%)	Thickness (mm)
1	0,0	27,27±0,42	2,13±0,13	1,62±0,08
2	0,5	25,88±0,58	4,69±0,46	1,73±0,03
3	1,0	26,33±0,16	5,25±0,84	1,54±0,01
4	2,0	26,35±0,23	5,57±0,46	1,58±0,02
5	5,0	26,01±0,08	4,79±0,26	1,51±0,03
6	10,0	25,50±0,33	4,63±0,85	1,50±0,09

[1] N. Gontard, C. Duchez, J. L. Cuq, S. Guilbert: International Journal of Food Science and Technology (1994), 29, 39-50.
[2] P. L. J Sobral,Science and Engineering Journal (1999), 8, 60-67.