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SOIL AMENDMENT AND SLOW RELEASE FERTILIZER PREPARATION FROM CASTOR MEAL

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This work seeks to determine the best methods of production of partly carbonized waste of biodiesel industry - castor (*Ricinus communis*) meal - aimed at obtaining material comparable to organic matter of soils *Terras Pretas de Indios* to be used as a soil amendment and as a matrix material to prepare slow release fertilizers. Analyzes by R-ray fluorescence (XRF), indicates the presence of elements that play important role in the soil biomass nutrients. The comparison between the raw and the carbonized materials shows (Table 1) that the concentration of the plant nutrient elements, P, Si, K, Ca and Fe increase their concentrations in the bulk carbonized material, as compared with the raw material, while the concentration of sulfur and magnesium, decreases.

By DRUV-Vis spectroscopy (Figure 1) the raw material presents two mainly absorption bands at 220 and 280 nm, typical of electronic transitions into the organic materials (π → π*), and the carbonized material presents continuous absorption from 250 to 850 nm, typical of humic materials with high degree of conjugation. The electron paramagnetic resonance spectroscopy (EPR) study (Figure 2) shows that the concentration of free radicals increase from the raw material (number of spin $g^{-1} = 5.38 \times 10^{16}$) to the carbonized material (1.45×10^{19}). Thought this technique, the carbonized material shows performance of a humic-like material in correlation with the results of the DRUV-Vis study. The material was also used to prepare a potassium slow release fertilizer by mixing potassium sulfate with appropriate quantity of the raw material and promoting the carbonization. By tests of leaching with water, aqueous citric ($C_6H_8O_7$) and HCl acids, 0.1 mol L^{-1}, the obtained product shows a capacity of K retention of 87.6 % (Figure 3). The retained K will slowly be released to the soil in more satisfactory way with the necessity of the plants. The carbonized material and the potassium slow release fertilizer are been characterized now by the technique of ^{13}C Nuclear Magnetic Resonance (^{13}C-NMR).

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Table 1. Element oxides percentage obtained by XRF for the castor meal samples.

Raw castor meal.								
P_2O_5	SO_3	SiO_2	K_2O	CaO	MgO	Al_2O_3	Fe_2O_3	Cl
1.8	1.3	1.3	1.2	0.9	0.8	0.3	0.1	0.1
Carbonized (500 ºC, 2 h) castor meal.								
P_2O_5	SO_3	SiO_2	K_2O	CaO	MgO	Al_2O_3	Fe_2O_3	Cl
4.1	0.2	2.4	4.8	4.8	0.3	0.3	0.6	0.3

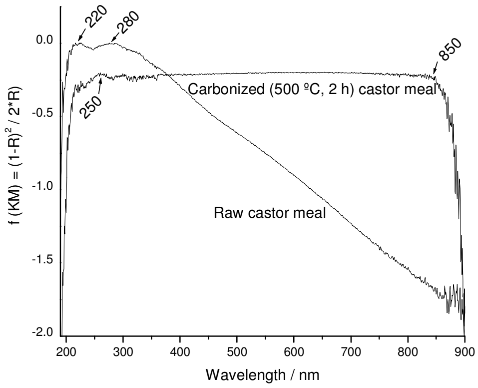

Figure 1. DRUV-Vis spectroscopy

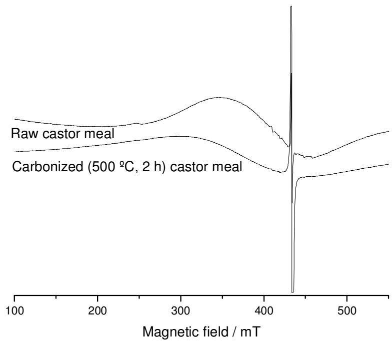

Figure 2. Electron paramagnetic resonance spectroscopy

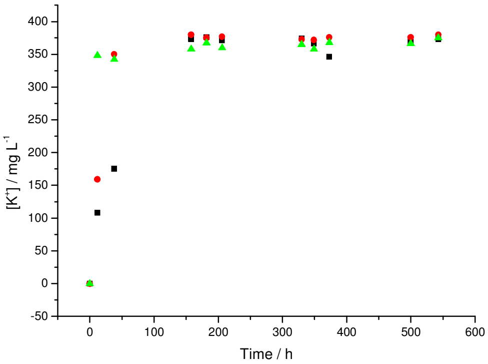

Figure 3. By tests of leaching with water (■), aqueous citric acids $C_6H_8O_{7(aq)}$ 0.1 mol L^{-1} (▲) and $HCl_{(aq)}$ 0.1 mol L^{-1} (●), 0.1 mol L^{-1}