Value Addition to Local Biomass: Synthesis of Activated Carbon from Babassu Mesocarp and Its Environmental Applications

Anupama Ghosh[1], Paloma Nayra da Silva Lima[2], Claudia do Amaral Razzino[3], Rubens Costa Silva[2], Kazunori Fujisawa[4], Odair P. Ferreira[5], Anderson O. Lobo[2], Mauricio Terrones[4], Bartolomeu Cruz Viana[1,*]

1. Departamentof Physics, Federal University of Piaui, Teresina, Piauí, Brazil
2. Department of Chemistry, Federal University of Piaui, Teresina, Piauí, Brazil
3. Instituto de Pesquisa e Desenvolvimento (IP&D), Vale do Paraíba University (UNIVAP), São José dos Campos, São Paulo, Brazil
4. Department of Physics, Pennsylvania State University, University Park, PA,USA
5. Departament of Physics, Federal University of Ceara, Fortaleza, Ceará, Brasil

Keywords: Activated carbon, Babassu coconut, dye adsorption, suparcapacitor.

Abstract: Activated carbon with high surface area and porosity was synthesized from mesocarp of babassu coconut, fruit of a locally abandunt palm tree using a KOH-activation route. The method and the temperature of the pre-treatment and pyrolysis, as well as the KOH-starting material ratio were varied in order to better the physical and chemical properties as well as the yield. The samples were characterized well: infrared spectroscopy showed presence of surface funcional groups like hydroxyl and carbonyl; Raman spectroscopy indicated the distinct grafitic D (1350 cm^{-1}), G (1580 cm^{-1}), somewhat merged 2D (2700 cm^{-1}) and D+G (2950 cm^{-1}) bands; the thin-walled porous structure was visible under scanning electron microscope; the few-layer corrugated graphitic nature of the walls were observed under transmission electron microscope. Nitrogen adsorption isotherms revealed the samples to be mostly mesopourous with a high surface area ranging from 600-1100 m^2/g, depending on the method of the preparation. Point of zero charge tests with varying pH showed the surface of the samples to be negatively charged, probably owing to the OH surface groups. The adsorption studies of a cationic dye, methylene blue, found in large quantities in the effluents of textile industry, responsible for contaminating the water bodies, were carried out, which showed a very huge and efficient adsorption (up to 400mg dye/1g of activated carbon in 10 min.).