Magnetic hydrochar prepared from sugarcane bagasse

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Magnetic hydrochar is known for its technological applications such as environmental remediation, biosensors, adsorption, drug delivery and catalysis [1]. However, magnetic iron oxide can be easily oxidized, causing reduction of magnetic properties. Because of these limitations, such materials could be improved for greater stability. Hydrothermal carbonization at moderate temperatures (150-350°C) has been recognized as a auspicious and efficient methodology for preparing carbonaceous material from biomass residues [2, 3]. In this work, we performed the preparation and characterization of magnetic hydrochar via one-pot hydrothermal carbonization of biomass. The samples were prepared by treating hydrothermally sugarcane bagasse in presence of iron nitrate (III). Reaction parameters such as temperature, time and mass proportion of iron nitrate to bagasse were studied. Structural characterization revealed a mixture of iron oxide phases: hematite and maghemite. SEM and TEM images showed spherical particles with mean diameter between 1-5 µm and irregular clusters of nanostructures with diameters ranging from 5-11 nm, respectively. On the surface were detected oxygen groups (hidroxila, fenólica, carbonila ou carboxílica). The specific surface area was measured to be 71.54-162.63 m^2/g and it's saturation magnetization 13.1-34.3 emu/g. The results suggest that the samples were composed of carbon microparticles and iron oxide nanoparticles. The carbon layers were observed to be encapsulating the iron oxide nanoparticles, in which the magnetite phase is responsible for the magnetic response.

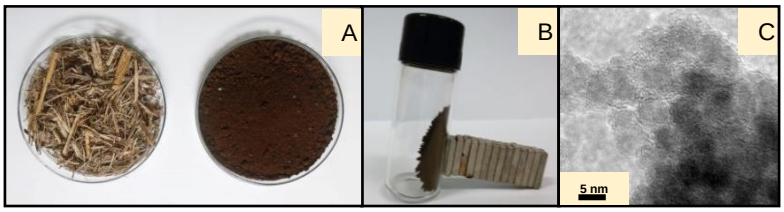

Figure 1: (A) sugarcane bagasse before and after hydrothermal carbonization; (B) magnetic hydrochar and (C) TEM images of the magnetic hydrochar.

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References

[1] Tang *et al*., Chemical Engineering Journal, **322**, 102-114 (2017)
[2] Reza *et al*., Biorsource Technology, **186**, 34-35 (2015)
[3] Zhu *et al*., International Journal of Environmental Science&Tecnology, **9**, 463-472 (2012)