Production of magnetic adsorbent using nickel and activated carbon

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Research on magnetic adsorbents materials have been increasingly more exciting as it can be applied in many wastewater treatment, mainly because it's easy to be removed. To be a good adsorbent the material must have a good surface area, in addition to presenting surface polarity similar to the analyte desired to remove. Thus, there is a large possibility of using both natural and synthetic adsorbents such as clays, fibers, zeolites, activated carbon, among others. Activated carbons generally have a high surface area and a good porous structure which is essential for adsorption of some small molecules. Moreover, coal can be magnetized by the insertion of particles of magnetite, cobalt or nickel. So the aim of this work is to produce an activated carbon impregnated with nickel magnetic particles. Activated carbon was produced by physical activation with water steam from the endocarp of babassu (*Orbignya martiana)*. Since the metallic nickel particles were synthesized with nickel content ranging from 10, 20 and 30% by the precipitation of nickel ions with sodium hydroxide (pH 12) in the presence of activated carbon, subsequently being heat treated to give up the metal particles. These materials were characterized by textural analysis (TA), thermal gravimetric analysis (TGA), transmission electron microscopy (TEM), magnetic properties and X-ray diffraction (XRD). TA showed that the coal produced is a microporous material with a surface area of 825 m^2/g and materials having nickel contents of 10, 20 and 30% resulted in a decrease in area due to occlusion of the pores by metal particles. Furthermore, TGA showed that the synthesized material has a good thermal stability, ~ 450 ° C, and that this stability improves with increasing nickel content in the samples. Also, TEM images showed that the particles have a spherical shape and size that vary on the surface of the activated carbon, but also has particles in nanometric scale (~ 100 nm) that were trapped in the coal pores. The magnetic analysis showed that the material has ferromagnetic characteristics and the magnetization increases with the nickel content in the samples. The XRD have well defined and intense peaks in the region of 44.5° and 51.9° and a lower intensity peak at 76.5° featuring nickel metal phase in a cubic face-centered system, but there are also remaining phases of nickel oxide which is characteristic by peaks at 37.3°, 43.3° and 62.9°. There is also a maximum extended by 23° characteristic of the reflection (002) of coal turbostrátic structure and a diffraction peak at 21.8 ° which is characteristic of silica from babassu. *Kovummal, G.R.; Pattayil, A. J.; J. Environ. Chem. Eng.* ***2015,*** 2068–2075.

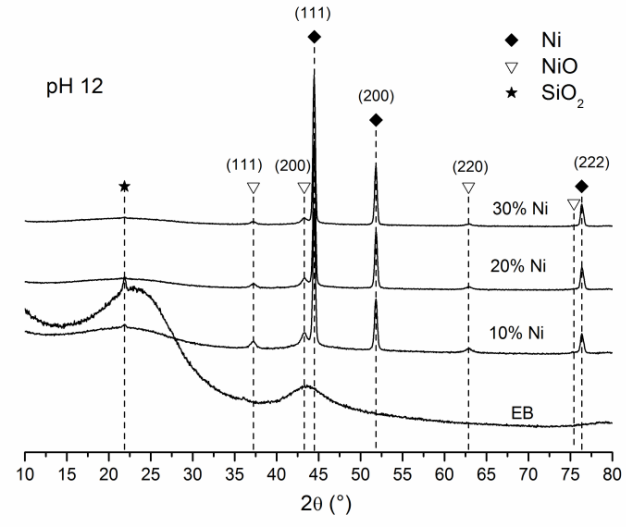

Fig. 1. XRD of activated carbon (EB) and nickel contents of 10, 20 and 30% loaded on de activated carbon.