Nanocomposites and nanomaterials

Development of new effective sorbents based on nanomagnetite

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Due to heavy metal environmental persistence and intense utilization in several applications, development of cost-effective removal strategies is required for treating metal containing waters and wastewaters. A variety of well-known treatment methods exist for metal removal including precipitation, coagulation and co-precipitation as metal hydroxides, electrochemical treatment, ion exchange and membrane separation [1]. However, high capital costs for the above mentioned processes have led researchers to explore more cost-effective options including the use of sorption media developed from natural materials such as biosorbents. Many low cost adsorbents such as chitosan, clay, saw dust, lignin, pectin, seaweed, zeolite, bark materials, iron oxide-coated sand have been previously investigated for metal ions removal. Lignin, the by-product of paper industry and emerging cellulose ethanol industry is a potential metal sorbent.

The main aim of this study was to compare the relative ability of kraft and modified lignins to sorb Cu(II), Zn(II), Cd(II) and Pb(II) ions from aqueous solution. Modification of lignin by iron nanooxides was provided in order enhance its sorption properties. Iron oxides have relatively high surface area and effective adsorption groups on their surface. Various forms of iron oxides e.g. magnetite Fe_3O_4, hematite α-Fe_2O_3 and maghemite γ-Fe_2O_3 can be used [2]. Batch experiments were carried out in the pH range from 2-6, sorbent dose 0,01-0,5 g and the initial metal concentration 50–200 mg M(II)/L. A secondary aim was to find the correlation between the sorption mechanisms and such important parameters as the surface properties (i.e., particle size, surface area, functional group composition/content) of selected lignin biosorbents.

1. *Guo, X., Zhang S., Sang X.Q,* Adsorption of metal ions on lignin // J Hazard Mater. -2008, **-151**, -P 134-142.

2. *Deliyanni E.A., Peleka E.N., Matis, K.A.* Modeling the sorption of metal ions from aqueous solution by iron-based adsorbents // J Hazard Mater. -2009. **-172**, -P. 550-558.