

Nanocomposites and nanomaterials

Application of nanobiochar for removal of rare earth elements

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Owing to continuous technological innovations and growth in the number and diversity of electronic devices around the world battery exploitation them increases. Processing of spent batteries is very important not only in connection with the treatment of hazardous wastes but also with recovery of valuable rare earth elements. The elements present in the batteries are heavy metals such as Ni(II), Cd(II), Fe(III) and rare earth elements La(III), Ce(III), Pr(III) and Nd(III), as well as others. Due to the fact that lanthanides are widely applied for production of special glasses, semiconductors and catalysts, their recovery has a very important economic significance. Various methods are used for recovery of rare earth elements such as co-precipitation, ion exchange, solvent extraction and leaching. However, these methods have disadvantages associated with large consumption of reagents which generates a large amount of secondary wastes.

An alternative to these processes is adsorption. The adsorption process on biochar was used as an efficient and economical method for removal of lanthanides from wastes. Interest of biochar stems from the fact that it is obtained from solid wastes. Biochar is characterized by a highly developed specific surface area, porous structure, and the presence of functional groups. These characteristics are decisive for the fact that it is used as a sorbent for the capture of organic and inorganic contaminants [1,2].

The paper will present the results of La(III), Ce(III), Pr(III) and Nd(III) ions sorption on magnetic biochars. These nanocomposites were obtained using sodium borohydride and iron sulfate to modify biochar.

1. *Fernandes A., Afonso J.C., Dutra A.J.B.* Separation of nickel(II), cobalt(II) and lanthanides from spent Ni-MH batteries by hydrochloric acid leaching, solvent extraction and precipitation // *Hydrometallurgy*.-2013.-**133**.-P. 37-43.
2. *Wang Y.Y., Lu H.H., Liu Y.X., Yang S.M.* Ammonium citrate-modified biochar: An adsorbent for La(III) ions from aqueous solution // *Colloids Surf. A Physicochem. Eng. Asp.*-2016.-**509**.-P. 550-563.