

Preparation and application of a magnetic composite sorbent for collecting oil from a water surface

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Abstract

© 2006-2016 Asian Research Publishing Network (ARPN). All rights reserved. Oil products are among the most dangerous pollution of water objects. They have a deleterious effect on the physiological and biochemical processes in the body of biological objects. In recent years, more and more attention is paid using of industrial waste for water treatment from oil products. In this study, the composite magnetic sorption material was received by chemical sedimentation using of the waste of MDF production (wood fiber) and iron chloride (II) and (III). Fractional composition and physico-chemical characteristics (Tamped density, content of moisture, ash content, buoyancy, specific surface area) of the reagent was detected, the micrographs were obtained by scanning electron microscope. The elemental composition of materials was identified using the method of energy-dispersive X-ray spectroscopy. The remanent magnetism and the coercive force of the samples of modified wood fiber were calculated According of obtained hysteresis loops. IR spectra of the sorption materials were obtained and described using the method of FTIR spectroscopy in a frequency range of 400-4000 cm^{-1} . Oil sorption capacity and water uptake of waste wood fiber and magnetic composite sorbent were evaluated in static system. Increase of oil sorption capacity and decrease of water uptake after modification of waste wood fiber was observed. Experiments to remove oil pollution from the water surface were carried out. The effectiveness of the proposed sorption material was discussed.

Keywords

Magnetite, Oil, Sorption material, Waste, Wood fibers

References

- [1] Stepanova SV, Domozhirev VV, Shaikhiev IG. 2014. The investigation of sulfuric acid treatment influence on oil and water sorption capacity of oat processing wastes. Herald of Technological University. 8: 228-231
- [2] Shaikhiev IG, Hasanshina EM, Stepanova SV, Abdullin IS. 2010. Waste processing flax as a mineral oil sorbents. 3. Effect of high-temperature plasma on neftepgloschenie and hydrophobicity. Bulletin of Bashkir University. 3(15): 610-614.
- [3] Alekseeva AA, Fazullin DD, Kharlyamov DA, Mavrin GV, Stepanova SV, Shaikhiev IG, Shaimardanova AS. 2016. The use of leaves of different tree species as a sorption material for extraction of heavy metal ions from aqueous media (Review). International Journal of Pharmacy and Technology. 8(2): 14375-14391.
- [4] Kharlyamov DA, Mavrin GV, Danilova EA, Zinnatov RR, Prytkova EV, Dvoryak SV. 2016. Application of a magnetic composite sorbent on the basis of woodworking waste for sewage treatment from heavy metals. Research Journal of Pharmaceutical, Biological and Chemical Sciences. 7(3): 1667-1670

- [5] Denisova TR, Shaikhiev IG, Mavrin GV, Sippel IY, Kuznetsova NP. 2016. The influence of ash tree sawdust acid treatment on the removal of crude oil from water surfaces. *Research Journal of Pharmaceutical, Biological and Chemical Sciences*. 7(5): 1742-1750.
- [6] Veprikova EV, Tereshchenko EA, Chesnokov NV, Kuznetsov BN. 2011. Wood - Polystyrol Fiber Sorbents for Elimination of Oil Pollutions. *Journal of Siberian Federal University. Chemistry*. 4(1): 27-37.
- [7] Kuznetsov BN, Chesnokov NV, Ivanov IP, Veprikova EV, Ivanchenko NM. 2015. Methods of Porous Materials Obtaining from Lignin and Wood Bark. *Journal of Siberian Federal University. Chemistry*. 8(2): 232-255.
- [8] Kamenschikov FA, Bogomolny EI. 2005. Oil sorbents. *SIC Regular and Chaotic Dynamics*. Izhevsk.
- [9] Kreslin VU, Naiden EP. 2002. Automated system for studying the characteristics of hard magnetic materials. *Instruments and Experimental Techniques*. 1: 63-67.
- [10] Katasonov PA, Martemyanov DS. 2015. Features of the magnetic properties of iron powder produced by plasma electrolytic dispersing of the iron-carbon alloys. *Letters on materials*. 5(1): 30-34.
- [11] Smith AL. 1979. *Applied Infrared Spectroscopy*. New York
- [12] Alekseeva AA, Stepanova SV. 2015. The study of physicochemical bases of sorption process of oil layer from the water surface by mixed leaf litter. *Water: chemistry and ecology*. 4: 87-90
- [13] Vadetsky UV. 2002. *Petroleum encyclopedia*. Moscow.
- [14] Lubentsova KI, Pastukhov AV, Davankov VA, Kitaeva DK, Karandi IV, Ilyin MM. 2015. Sorption of toxic organic and inorganic compounds by composite materials with nanodispersed iron oxides in polystyrene matrixes. *Sorption and chromatographic processes*. 15(3): 333-344.
- [15] Zhou Q, Li Z, Shuang C, Li A, Zhang M, Wang M. 2012. Efficient removal of tetracycline by reusable magnetic microspheres with a high surface area. *Chemical Engineering Journal*. 210: 350-356.
- [16] Zhou Q, Zhang MC, Shuang CD, Li ZQ, Li AM. 2012. Preparation of a novel magnetic powder resin for the rapid removal of tetracycline in the aquatic environment. *Chinese Chemical Letters*. 23: 745-748.
- [17] Yurishcheva AA, Dzhardimalieva GI, Kasymova EJ, Pomogailo SI, Kydralieva KA, Li SP. 2014. The structure of nanocomposites based on magnetite and humic acids produced by chemical coprecipitation and mechanochemical synthesis. *International Journal of Nanomechanics Science and Technology*. 5(4): 323-336.
- [18] Veprikova EV, Tereshchenko EA, Chesnokov NV, Shchipko ML, Kuznetsov BN. 2010. Peculiarity of Water Purifying from Oil Products with Make Use of Oil Sorbents, Filtering Materials and Active Coals. *Journal of Siberian Federal University. Chemistry*. 3(3): 285-304.
- [19] Kharlyamov DA, Nasyrov IA, Zinnatov RR, Mavrin GV, Sokolov MP. 2015. Sorption concentration of ions of copper (II) and lead (II) by magnetic sorbent. *Research Journal of Pharmaceutical, Biological and Chemical Sciences*. 6(5): 1623-1628.
- [20] Silva-Silva MJ, Mijangos-Ricardez OF, Vazquez-Hipolito V, Martinez-Vargas S, Lopez-Luna J. 2016. Single and mixed adsorption of Cd(II) and Cr(VI) onto citrate-coated magnetite nanoparticles. *Desalination and Water Treatment*. 57(9): 4008-4017.
- [21] Tolmacheva VV, Apyari VV, Kochuk EV, Dmitrienko SG. 2016. Magnetic nanoparticles sorbents based on iron oxides for separation and concentration of organic compounds. *Journal of Analytical Chemistry*. 71(4): 339-356.
- [22] Pastukhov AV, Davankov VA, Lubentsova KI, Kosandrovich EG, Soldatov VS. 2013. Structure and properties of magnetic composite sorbents based on hypercrosslinked polystyrenes. *Russian Journal of Physical Chemistry*. 87(10): 1721-1727.