Thematic Section: Research into New Technologies. **Full Paper**
Subsection: High Molecular Weight Compounds. *The Reference Object Identifier* – ROI: jbc-01/20-63-8-11
The Digital Object Identifier – DOI: 10.37952/ROI-jbc-01/20-63-8-11
Submitted on August 30, 2020.

Sorbent based on chitosan and polyurethane foam for cleaning aqueous media from metal ions and dyes

© **Quyen Thi Quynh Anh**, **Lyubov A. Zenitova**,*+ and **Ngo Hong Nghia**
Department of Synthetic Rubber. Kazan National Research Technological University. K. Marx St., 68. Kazan, 420015. Republic of Tatarstan. Russia. E-mail: zenit@kstu.ru

*Supervising author; +Corresponding author

Keywords: sorbent, polyurethane foam, chitosan, oil, metal ions, dye.

Abstract

This article touches upon an urgent subject at present – the development of a sorbent for purifying water resources from metal ions and dyes. For these purposes, a sorbent based on polyurethane foam filled with 30% chitosan was developed to eliminate oil spills. It is well known that chitosan is an effective absorber of metal ions, it is recommended to use chitosan for metal ions extraction from waste waters of galvanic, mining, processing and textile industries. In this purpose, it is important to research which extent of the sorbent be developed, for oil spills treatment, and have metal ions absorbability. Unfilled polyurethane foam has been studied to use as a sorbent for metal ions previously, this research shown that they are not suitable sorbents for these purposes. In order to develop a versatile sorbent, a study to combine the ability to absorb oil and oil products of polyurethane foam and the ability to purify water from metal ions and dyes of chitosan has been carried out.

The best degree of purification by the sorbent is observed at a concentration of Cu^{2+} ions of 100 mg/l and Pb^{2+} ions of 200 mg/l. In addition, the sorbent is proved to be effective to a dyes of 500 mg/g concentration for their removal from aqueous solutions.

Sorption isotherms according to the Langmuir and Freundlich models have high confidence coefficients – $R^2 > 0.87$. Equilibrium parameters (R_L) for Langmuir isotherms are in the range of $0 < R_L < 1$. The process of sorbents adsorption for both Cu^{2+}, Pb^{2+} ions and dyes is satisfactorily described by both the Langmuir and Freundlich isotherms.

Low values of E and G indicate the occurrence of predominantly physical adsorption in all the cases studied.

It has been established that the developed sorbent, which is a specific sorbent for cleaning water surfaces from oil pollution, also allows to purify wastewater of chemical enterprises containing metal ions Cu^{2+} and Pb^{2+} up to 29% and dyes in wastewater of textile industries up to 97%, which proves its versatility.

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