2021

Adsorptive properties of ZnCuAl LDH based materials dependig on adsorbent thermal pre-treatmen

Hadnađev-Kostić Milica, Vulić Tatjana, Karanović Đurđica, Jokić Aleksandar

Leskovac: University of Niš, Faculty of Technology

UNIVERSITY OF NIŠ
Faculty of Technology, Leskovac

BOOK OF ABSTRACTS

14th SYMPOSIUM

" Novel Technologies and Economic Development "

Leskovac, October, 22 - 23, 2021

UNIVERSITY OF NIŠ
Faculty of Technology, Leskovac

BOOK OF ABSTRACTS

14th SYMPOSIUM „NOVEL TECHNOLOGIES AND ECONOMIC DEVELOPMENT“

Leskovac, October, 22-23, 2021.

Faculty of Technology, Leskovac

Publisher: Faculty of Technology, Leskovac

For the Publisher: Prof. Dragiša Savić

Editor: Prof. Miodrag Lazić

CIP – Каталогизација у публикацији
Народна библиотека Србије

6(048)

SYMPOSIUM with international participation "Novel Technologies and Economic Development" (14 ; 2021 ; Leskovac)
Book of abstacts / 14 th Symposium [with international participation] "Novel Technologies and Economic Development" Leskovac, October, 22-23, 2021. ; [organized by] Faculty of Technology, Leskovac [and] Serbian Academy of Sciences and Arts (SANU), Branch in Niš] ; [editor Miodrag Lazić]. - Leskovac : Faculty of Technology, 2021 (Leskovac : Makos print). – 162 str. ; 25 cm

Na vrhu nasl. str.: University of Niš. - Tiraž 130. - Registar.

ISBN 978-86-89429-44-2

а) Технологија -- Апстракти б) Технолошки прогрес -- Привредни развој -- Апстракти

COBISS.SR-ID 48095241

Print: MAKOS-PRINT, Leskovac; 2021.
Printing: 130

Proofreader: Biljana Mitić Stanković
Paging and graphical design: Vesna Marinković

ISBN 978-86-89429-44-2

Support from The Ministry of Education, Science and Technological Development of the Republic of Serbia for the investigation (Contract No. 451-03-9/2021-14/200134) is highly acknowledged.

ADSORPTIVE PROPERTIES OF ZnCuAl LDH BASED MATERIALS DEPENDING ON ADSORBENT THERMAL PRE-TREATMENT

Milica Hadnađev-Kostić, Tatjana Vulić, Đurđica Karanović, Aleksandar Jokić
University of Novi Sad, Faculty of Technology Novi Sad, Novi Sad, Serbia

Water contamination by various organic dye pollutants has become a major concern because of their negative impact on the environment and public health. Considering their complex aromatic structures, dyes are chemically inert when discharged into the aquatic systems and have the ability to resist degradation, even when exposed to the light. One of the most commonly produced dye in the industry is Methyl Orange (MO), a well-known water-soluble organic anionic dye with pronounced mutagenic and toxic character. Recently, in terms of initial cost, ease of operation and satisfactory adsorption capacity, layered double hydroxide (LDH)-based materials have lately been considered as one of the most appropriate adsorbents. LDHs are a versatile class of two-dimensional ionic laminar compounds, layers containing different M^{2+} and M^{3+} metals, where M^{2+} ions are partially exchanged with M^{3+} ions and the resulting positive charge is compensated with different interlayer anions. The motivation for this study was to investigate the influence of thermal pre-treatment on adsorptive properties of synthesized and thermally activated LDHs for the MO removal. ZnCuAl-LDHs were synthesized by the coprecipitation method and thermally treated (500°C/5h). The influence of the thermal pre-treatment on structural (X-ray diffraction analysis - XRD), textural (low temperature nitrogen adsorption) and adsorption properties was investigated. Adsorption behaviour of ZnCuAl LDH based metals, as well as the adsorption mechanisms were investigated with the aim to elucidate the adsorbent-dye interactions, enabling optimization of the experimental design. X-ray diffraction measurements revealed that ZnCuAl-LDH had layered hydrotalcite-type anionic clay structure and phase composition that was consistent with the hexagonal structure having rhombohedral symmetry. XRD analysis of thermally treated LDHs showed that the layered structure of the original LDH phase collapsed triggering the elimination of most interlayer carbonate ions and water molecules, leading to the formation of multi-metal mixed oxides. Textural characterization of both, LDHs and derived mixed oxides, revealed hierarchical pore structure favourable for the mass transfer enabling diffusion and fast transport of adsorbates in the interconnected pore structure systems, as well as high surface area (32.5 and 90.3 $m^2 g^{-1}$) suggesting the presence of higher amount of active adsorption sites, thus enhancing the adsorption capacity. In adsorption experiments initial C_{MO}=20mg L^{-1} and 50mg of adsorbent were used. The results showed high removal efficiency rate for both, LDHs (75% after only 60 min of contact) and derived mixed oxide (100% after only 30min of contact) adsorbents, suggesting two possible adsorption mechanisms that were in correlation with the structural and textural properties, as well as with the "memory effect" reconstruction phenomenon. These results present a solid base for further investigation and design of LDH-based adsorbents as potential adsorbent for the MO removal, considering their favourable structural and textural properties and excellent adsorption capacities.