UNIVERSITY OF EAST SARAJEVO

FACULTY OF TECHNOLOGY ZVORNIK

VIII INTERNATIONAL CONGRESS VIII

ENGINEERING, ENVIRONMENT AND MATERIALS IN PROCESS INDUSTRY

EEM2023

BOOK OF ABSTRACTS

JAHORINA
MARCH 20-23, 2023

REPUBLIC OF SRPSKA
BOSNIA AND HERZEGOVINA

www.tfzv.ues.rs.ba
www.eem.tfzv.ues.rs.ba

CO-ORGANIZED BY

FACULTY OF TECHNOLOGY AND METALLURGY
Belgrade, Serbia

INSTITUTE OF PHYSICS
Belgrade, Serbia

UNION OF ENGINEERS AND TECHNICIANS OF SERBIA
Belgrade, Serbia

FACULTY OF TECHNOLOGY
Banja Luka, Bosnia and Herzegovina

FACULTY OF FOOD TECHNOLOGY
Osijek, Croatia

UNIVERSITY OF EAST SARAJEVO
FACULTY OF TECHNOLOGY ZVORNIK

BOOK OF ABSTRACTS

VIII INTERNATIONAL CONGRESS

ENGINEERING, ENVIRONMENT AND MATERIALS IN PROCESS INDUSTRY

EEM2023

UNDER THE AUSPICES OF

MINISTRY OF ECONOMY AND ENTREPRENEURSHIP OF THE REPUBLIC OF SRPSKA

AND

ACADEMY OF SCIENCES AND ARTS OF THE REPUBLIC OF SRPSKA

JAHORINA, MARCH 20-23, 2023
REPUBLIC OF SRPSKA
BOSNIA AND HERZEGOVINA

PUBLISHER
UNIVERSITY OF EAST SARAJEVO
FACULTY OF TECHNOLOGY
Karakaj 34a, 75 400 Zvornik
Republic of Srpska, B&H
Phone: +387 56 260 190
e-mail: sekretar@tfzv.ues.rs.ba
web: https://eem.tfzv.ues.rs.ba/

FOR PUBLISHER
Dragan Vujadinović, PhD, dean

DOMAIN
ENGINEERING, ENVIRONMENT AND MATERIALS IN PROCESS INDUSTRY

PUBLISHED: 2023

ISBN: 978-99955-81-44-2

TEXTURAL AND SURFACE CHARACTERIZATION OF SUGAR BEET PULP AS A BIOSORBENT FOR METAL IONS REMOVAL

Lidija Perović[1], Jelena Miljanić[1,*], Branislava Đermanović[1], Jovana Kojić[1], Branimir Bajac[2], Nikola Maravić[3], Zita Šereš[3]

[1] *Institute of Food Technology in Novi Sad, University of Novi Sad, Bulevar Cara Lazara 1, 21000 Novi Sad, Serbia fins@fins.uns.ac.rs**

[2] *BioSense Institute, University of Novi Sad, Dr Zorana Djindjica 1, 21000 Novi Sad, Serbia*

[3] *Faculty of Technology Novi Sad, University of Novi Sad, Bulevar Cara Lazara 1, 21000 Novi Sad, Serbia*

**jelena.krulj@fins.uns.ac.rs*

Abstract

Sugar beet pulp (SBP) as sugar-depleted by-product represents pectin-rich agroindustrial residue. From the prism of the sustainable development, reuse of the exhaused SBP contributed to closing material and energy flows. Finding a solution for the reuse of exhausted SBP transforms linear to circular bioeconomy on a micro level. Key role of the application of SBP as biosorbent for metal ions removal has surface of the biomaterial and their textural characteristics. Comprehensive analysis was conducted in this work regarding determining surface of the sugar beet pulp: Fourier transform infrared spectroscopy (FTIR), Scanning electron microscopy with energy dispersive X-ray spectrometry (SEM-EDX), thermogravimetric analysis (TGA), Boehm titrations, and detecting the point of zero charge (pH_{pzc}). The texture and surface of SBP were analyzed before and after the applied biosorption process of the removal of molassigenic metal ions (Na^+, K^+, Ca^{2+}) from the alkalized sugar juice. From the results obtained after the FTIR analysis could be concluded that main centers for the metal ions exchange are carboxyl, hydroxyl and phenyl functional groups. The graph obtained after thermogravimetric analysis confirms presence of the cellulose, hemicellulose and lignin in the structure of the sugar beet pulp which are mainly constructed of the carboxyl groups. Higher presence of the acidic groups on the surface of the sugar beet pulp (1.61mmol/g), than the base (0.25mmol/g), also confirms presence of the acid functional groups, possible proton donors for the exchange with molassigenic metal cations. Aditionally, acidic groups detected by the Boehm titration at the surface of sugar beet pulp after the applied biosorption process is smaller than before the process (1.10mmol/g). The pH working environment in which is conducted experiment (10.5) is convenient for the successful reduction of the present metal ions in alkalized juice, due to the negatively charged surface of the sugar beet pulp in the pH range higher than 10, whereas pH_{pzc} is 6.4. During this biosorption process morphological structure regarding the density of shrinks, cracks and surface smoothness is not changed at the significant level according to SEM micrographs. EDX used as detector, additionaly confirmed increase in the amount of Na^+, K^+, Ca^{2+} after the biosorption process at the surface of the sugar beet pulp. Therefore, SBP has appropriate surface structure suitable for the metal ions removal and at the same time process is not harmful to the environment and minimizes the depletion of this by-product from the sugar refinery.

Key words: *surface characterization, textural analysis, sugar beet pulp, metal ions removal*

Acknowledgement: *This study was funded by the Ministry of Education, Science and Technological Development of the Republic of Serbia (Contract Number 451-03-68/2022-14/200222). Additionally, authors would like to thank European Union's Horizon 2020 research and innovation programme under grant agreement NO. 739570 (ANTARES).*