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**FACULTY OF  
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# WV INTERNATIONAL CONGRESS

## V ENGINEERING, ENVIRONMENT AND MATERIALS IN PROCESS INDUSTRY EEM2023

### BOOK OF ABSTRACTS



JAHORINA  
MARCH 20-23, 2023

REPUBLIC OF SRPSKA  
BOSNIA AND HERZEGOVINA

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# **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**

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

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### 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 exhausted 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. Additionally, 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, additionally 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

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