Characterization of raw and treated sugar beet shreds for copper ions adsorption

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ABSTRACT

Lignocellulosic materials have a great potential to be converted into different high value products including biofuels, value-added chemicals, and cheap energy sources for microbial fermentation and enzyme production. Their multifunctionality and ability to reuse contribute to their great importance in terms of environmental protection and sustainable development. Such materials are sugar beet shreds (SBS) which are usually used as animal feed but since they are produced in large amount in sugar industry, they can also be used as an adsorbent or for bioethanol production. Bioethanol production from SBS includes pretreatment processes in order to remove pectic substances and lignin, followed by enzymatic hydrolysis of cellulose in order to obtain the solution of fermented sugars. A novelty in this work is the investigation if solid residues from the pretreatment process of SBS for bioethanol production can be used as adsorbents, the same as raw SBS. Textural characteristics and capacities for copper ions adsorption of raw SBS, depectinated SBS, and SBS residues after enzymatic hydrolysis were investigated. The Brunauer–Emmett–Teller (BET) surface areas of investigated materials are 0.8, 0.6, and 0.9 m²/g, and copper adsorption capacities are 5.6, 4.0, and 4.7 mg/g, respectively. From the results of textural analysis performed by low-temperature nitrogen adsorption and mercury intrusion porosimetry methods, it can be concluded that studied samples are mainly macroporous materials without significant mutual differences. Although both treated SBS, which are generated as waste in bioethanol production process, have slightly lower efficiency of copper adsorption in comparison with raw SBS, they still can be successfully used as adsorbents.

Keywords: Adsorption; Sugar beet shreds; Copper

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