EFFECT OF SUGAR BEET SHREDS PARTICLE SIZE ON BIOSORPTION OF Cu(II) IONS FROM AQEOUS SOLUTIONS IN A FIXED-BED COLUMN

Nevena Blagojev, Dragana Kukić, Vesna Vasić, Marina Šćiban, Jelena Prodanović, Oskar Bera

Faculty of Technology, University of Novi Sad, Bul. Cara Lazara 1, Novi Sad, Serbia
+381638687534, nevenan@uns.ac.rs

Biosorption process is one of the most widely used methods for the removal of heavy metals from water with advantage of low operating costs, high treatment efficiency and no contaminative by-product released into treated water. This technological process is influenced by various process parameters, such as pH, temperature, initial metal ion concentration, sorbent dosage, etc [1]. Furthermore, the biosorbent properties, such as composition, surface structure and particle size, may also affect the biosorption performances [2]. This study investigates the influence of biosorbent particle size, namely sugar beet shreds, on the uptake of Cu(II) ions from aqueous solutions, in a fixed-bed column. Concentration (C_0) and the pH of the inlet solution were 100 $mg \cdot L^{-1}$ and 4.5, respectively, and 10 g of the adsorbent were used. Sugar beet shreds were milled and sieved through the set of sieves, and three fractions were used for the adsorption experiments: 224-400, 400-600 and 600-800 μm. Results obtained for the concentration of the copper ions in consecutive effluent aliquots (C) were fitted with the parallel sigmoidal (PS) model [3], since this model fits the experimental data more accurately than any other commonly used model. Namely, coefficient of determination, R^2, for the samples with ascending particle sizes were 0.9991, 0.9998 and 0.9982, respectively, and sum of squared errors, *SSer*, for the same samples were $2.27 \cdot 10^{-3}$, $0.8 \cdot 10^{-3}$ and $0.5 \cdot 10^{-3}$, respectively. Two-stage nature of the biosorption process has been confirmed by the low values of the one phenomenon moiety in the overall adsorption process, p (0.31, 0.40 and 0.35, respectively). However, there is no significant differences between samples with different particle sizes, regarding this parameter. The efficiency of the adsorption process is calculated as the ratio of the amount of metal ion adsorbed and the amount of metal ion fed into the column, using PS mathematical model equation. The most efficient was the process applying the smallest biosorbent particles, 224-400 μm, achieving the efficiency of 60.67%. This could be attributed to the fact that smaller particles provided a larger and easily accessible surface area for the same amount of biomass, making more binding sites available for the metal uptake [4]. The sample with particle sizes 400-600 μm achieved 44.24% adsorption efficiency, while the sample with the largest particles achieved efficiency of 52.25%. The higher efficiency of the largest fraction could be attributed to the fact that the smaller total surface area of this sample has been compensated with contribution of some additional adsorption mechanisms, unlikely to occur in the sample with smaller particles.

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