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Effect of the Joule heat-based WG-12 active carbon modification process on the sorption of Cr(III)

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ABSTRACT

The activated carbons used in water technology are most frequently used to remove organic compounds. They can also be used in the adsorption of mineral pollution, among others for heavy metals. The adsorption capacities of activated carbons in relation to these pollutants are slight and their concentrations in water are also low. Heavy metal removal efficiency can be increased by modifying activated carbons. In the article the results of activated carbon modification with the usage of Joule heat are presented. The modification was carried out in the reactor with the height h = 25 cm and diameter d = 5.5 cm filled with activated carbon. At two sides of the reactor electrodes were placed which were joined with a direct current generator. The flow of the current through the deposit was accompanied by incensement of activated carbon temperature. The modification took place during the flow of carbon dioxide while heating and/or cooling down of this deposit. The effects of modification were evaluated on the basis of Cr(III) adsorption isotherms each time on three parts of activated carbon taken from different heights of the deposit. In the case of deposit modification as the result of heating up to 400°C and cooling down by means of flowing CO_2 with the intensity of 40 dm^3/h much higher adsorption capacities in relation to Cr(III) were obtained if carbon was taken from the bottom and the middle part of the deposit. The carbon from the high part of the deposit decreased its abilities of cation Cr(II) adsorption. Carrying out of the modification process of activated carbon in two cycles of heating up and cooling down is not advisable. The obtained Cr(III) adsorption results are higher than in the case of non-modified carbon, however, they are lower than on carbons modified in one cycle. It is also not advisable to pass carbon dioxide through the deposit during the heating up process. Increasing the speed of carbon dioxide flow during the cooling down of the deposit from 40 to 80 dm^3/h has also been analyzed. The results obtained for Cr(III) adsorption prove that the change of carbon dioxide in the examined range did not have a great influence on the obtained sorbent.

Keywords: Activated carbon; Chromium(III); Sorption

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