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Influence of Magnetic Field on the Adsorption Process on Vermiculite and Halloysite for the Selected Metals

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Abstract

Aim of presented study was to investigate a novel method of the heavy metal removal process, where static magnetic field, generated by permanent magnets, was used as a modification agent with effective induction value equal 0.518 T. Adsorption process was conducted in bath reactors, using vermiculite and halloysite as adsorbents. Two different metals, copper and nickel were analyzed as a representative of heavy metals with different magnetic susceptibility. Beside the magnetic field influence other aspects of copper and nickel adsorption were also analyzed, such as adsorption isotherms, pH influence, etc. The previous study showed, that the magnetic field can be used for increasing heavy metals adsorption properties on ferromagnetic activated carbon. That is why presented studies were conducted to check if a similar situation will occur if mentioned minerals will be used as adsorbents. The result showed a clear influence of the magnetic field, by decreasing the final efficiency of the adsorption process on vermiculite for 20.5% and 5.2% for nickel and copper respectively. For the halloysite, similar results were obtained showing 11.8% decrease of copper removal efficiency. Final results were completely opposite to that, obtained for activated carbon, in other studies, however it can be related with a specific magnetic structure of the applied minerals. Nevertheless, using this modification could be an interesting novel method of modification, especially for solutions that contain both metals and other, non-metallic compound, such as organic pollutants, cause with decrease of metals removal, and more active sites will stay available for other, non-metallic compounds.

Keywords: adsorption modifications; copper removal; magnetic field; nickel removal; wastewater treatment.