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## REMOVAL OF HEAVY METALS FROM WASTEWATER BY CHEMICALLY ACTIVATED SEWAGE SLUDGE

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### Abstract

Effective adsorbents were developed from sewage sludge by chemical activation with different activators (5M ZnCl<sub>2</sub>, 3M H<sub>2</sub>SO<sub>4</sub>, 3M H<sub>3</sub>PO<sub>4</sub>, 5M ZnCl<sub>2</sub>: 3M H<sub>2</sub>SO<sub>4</sub>, and 5M ZnCl<sub>2</sub>: 3M H<sub>3</sub>PO<sub>4</sub>). The developed adsorbents were used for the removal of the heavy metals Cd (II), Pb (II), Cu (II) and Mn (II) from wastewater. The effect of several parameters (pH, initial metal ion concentration, adsorbent dose, contact time and solution temperature) on the metal adsorption capacity were evaluated by batch experiments. Sewage sludge activated by 5M ZnCl<sub>2</sub>: 3M H<sub>3</sub>PO<sub>4</sub> (1:1) followed by pyrolysis at 650°C [ASSZ: P (1:1)] was an effective adsorbent for the removal of the studied metals. The adsorption of metals by ASSZ: P (1:1) increased with increasing pH and adsorbent dosage, while it decreased with increasing initial metal concentration. Maximum adsorption of the metals by ASSZ: P (1:1) adsorbent was obtained at 1 g mL<sup>-1</sup> adsorbent dosage, 2 hour contact time, 10 mg L<sup>-1</sup> initial metal concentration, 25°C and pH 5-9. The data obtained from sorption isotherms were fitted well to linear forms of Langmuir, Freundlich and Scatchard isotherm models.

*Key words:* adsorption, activated carbon, heavy metals, sewage sludge, treatment

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