



---

## ENHANCED HEAVY METAL ADSORPTION ON DYE-MODIFIED FLY ASH

Maria Visa<sup>1,2</sup>, Anca Duta<sup>1\*</sup>

<sup>1</sup>Transilvania University of Brasov, Eroilor 29, 500036, Brasov, Romania

<sup>2</sup>College for Natural Sciences, Armoniei 6, 500189, Brasov, Romania

---

### Abstract

The use of fly ash (FA) in wastewater treatment received a lot of attention for the immobilization of heavy metal cations, mainly  $\text{Cd}^{2+}$ ,  $\text{Pb}^{2+}$ ,  $\text{Ni}^{2+}$ ,  $\text{Zn}^{2+}$ ,  $\text{Cu}^{2+}$ . For an up-scalable wastewater treatment process, the substrate must have good adsorption efficiency and relatively constant behaviour. Modifying the fly ash surface can be a solution for reaching both goals. The use of FA for heavy metals removal, from wastewaters resulted in the dye finishing industry, faces a supplementary problem, related to the dyes affinity for oxide surfaces. Working with industrial wastewaters proved that there is a competitive adsorption process involving heavy metal cations and dyes. The paper presents the results obtained when modifying FA powders, with NaOH 1N and 2N solutions; the XRD experiments confirmed that dissolution/precipitation processes are responsible for the increase in the heavy metal immobilization. The AFM proved that the initial surface morphology plays an important role in these processes. The modified FA is loaded with methylene blue and the novel substrates are tested for cadmium, copper and nickel removal. The adsorption kinetic, the substrate capacities and the mechanisms are further discussed correlated with the surface structure and morphology. The results show that, FA with controlled surface properties allows the heavy metals removal resulting waters respecting the discharge regulations. Supplementary, the heavy metal maximal load allows the FA discharge without any further treatment.

*Key words:* adsorption, fly ash; surface modification, wastewater treatment

---

---

\* Author to whom all correspondence should be addressed: e-mail: [a.duta@unitbv.ro](mailto:a.duta@unitbv.ro); Phone/Fax: +40 268 475 597