Remediation of contaminated sediments by mineral additives and thermal processing

Agnieszka Baran[1], Tomasz Koniarz[2], Marek Tarnawski[3], Magdalena Szara-Bąk[4]

[1, 4]Department of Agricultural and Environmental Chemistry,
University of Agriculture in Krakow, al. Mickiewicza 21, Krakow, Poland
[2,3]Department of Water Engineering and Geotechnics,
University of Agriculture in Krakow, Poland

Phone: +48 696724960
E-mail: Agnieszka.Baran@urk.edu.pl

Introduction: Nowadays several possible directions in bottom sediment management include agricultural or horticultire utilisation, landfill regeneration, applications in civil engineering (aggregate manufacture, construction) and in the electrical power industry [1]. One of the major problems associated with land-based management of bottom sediment is its contamination with heavy metals. A promising ways to the utilization of sediment contaminated by heavy metals employs a two approaches: thermal processing and using mineral additives [2, 3]. The aims of study were: 1) to evaluate the effect of three incineration temperatures on the content of heavy metals and properties of bottom sediment 2) to use of mineral additives (cellulose waste, biomass ash) to immobilization of heavy metals, 3) to evaluate ecotoxicological properties of bottom sediments after both remediation processes, 4) to assess the opportunity to apply the sediment.

Methods: The bottom sediment was sourced from the Chechło reservoir situated in the southern part of Poland, between Kraków and Katowice cities. The Chechło reservoir is located in an area with a zinc and lead ore mining industry. In the first experiment, was tested hypothesis by a 4 month scale experiment under controlled laboratory conditions. The experimental design covered 3 treatments with a combination of 50% bottom sediment and 50% of each additives, and a control sample which was only bottom sediment. In the second experiment, samples of contaminated bottom sediment were incinerated in a muffle furnace at three temperatures (500ºC, 800ºC and 950ºC). After the end of the experiment, the chemical and ecotoxicological properties of the materials were analyzed

Results: The obtained results suggest that the use of mineral additives and thermally treated are a good ways to immobilize the heavy metals present in bottom sediments, and the good way to transform the sediments from waste material to a valuable resource.

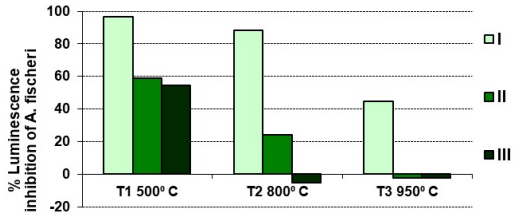

Fig. 1: Ecotoxicity of aqueous extracts prepared from bottom sediments after thermal process depending on the washout cycle (I, II, III) and thermal transformation temperature

References: [1] Baran et al. (2019) *Environmental Engineering and Management Journal*: 18(8): 1647-1656; [2] Urbaniak et al. (2020). *Science of the Total Environment***:** 738:139841, [3] Szara et al. (2020) *Journal of Environmental Managment*:1(273):111176