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APPLICATION OF NEW SYNTHESIZED MATERIALS IN THE WATER DECONTAMINATION FROM ROSIA MONTANA MINING AREA (ROMANIA)

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Introduction

Integrated study of both natural water quality and wastewater provides important information regarding the human impact activities in the environmental landscape. Heavy metal pollution due to rapid industrialization and population growth worldwide is posing a serious threat on the environment and all life forms. The persistent nature of these compounds raises even more significant toxicological concerns for the ecosystems and thereby human health. Thus, worldwide, researchers have been focusing on developing new materials through „green chemistry methods" as efficient means to remove this type of pollutants from the environment. Nature provides a wide range of materials with different functions, which serve as a source of bioinspiration for materials scientists.

We report here the preparation through non-catalytic synthesis of 3 new types of materials based on poly(benzofurane-*co*-arylacetic acid) (**PBAAA**), namely: magnetic nanostructures coated with (benzofurane-*co*-arylacetic acid) functionalized with dopamine (**MNP-PBAAA-DA)** and Nα, Nα'–bis(carboxymethyl)-L-lysine (**MNP-PBAAA-NTA**), montmorillonite modified with poly(benzofurane-*co*-arylacetic acid) functionalized with dopamine (**MMT-PBAAA-DA**) and chitosan modified with poly(benzofurane-*co*-arylacetic acid) (**CHIT-PBAAA**). All these materials are able to complex metal ions and were applied on contaminated water samples collected from Rosia Montana area (Romania). The newly synthesized materials were investigated by Fourier-Transform Infrared spectroscopy (FTIR), transmission electron microscopy (TEM), scanning electron microscopy (SEM) and thermogravimetric analysis (TGA) before and after the adsorption/absorption tests. Heavy metals in the samples were analysed by Inductively Coupled Plasma Optical Emission Spectroscopy (ICP-OES) and exposure doses used to estimate the human health risks associated with water ingestion were calculated according to US EPA protocols.

Materials and methods

The synthesized materials were structural investigated by SEM, EDX, TGA, XPS, FTIR and the heavy metals were determined by ICP-OES analysis. The resulting materials were further applied for metal ions absorption from contaminated water samples collected from Rosia Montana Mining Area (Romania).

Results and conclusions

Significant changes were recorded regarding the physico-chemical parameters (electrical conductivity, pH), the anions and heavy metals after absorption. **Figure 1a** displays the results on the efficiency of the synthesized materials in removing heavy metals from P1 water sample collected from upstream Rosia River. **MMT-PBAAA-DA** exhibited high adsorption percentage for Cu^{2+} (76.96 %), **CHIT-PBAAA** for Pb^{2+} (77.27 %), Fe^{3+} (41.95 %), Mn^{2+} (45.09 %) and Al^{3+} (30.64 %), while **MNP-PBAAA-NTA** had better selectivity for Cd^{2+} (60 %) and Sr^{2+} (6.87 %) and **MNP-PBAAA-DA** for Cu^{2+} (38.52%). On the other hand, **Figure 1b** shows the adsorption efficiencies of the new materials after tests on P2 water sample collected downstream Rosia River. **MNP-PBAAA-NTA** had the best efficiency for Cu^{2+} (98.26%) and Sr^{2+} (86.19%), **CHIT-PBAAA** for Zn^{2+} (86.19%), Mn^{2+} (80.43%), Ni^{2+} (69.56%) and Al^{3+} (80.38%), while **MMT-PBAAA-DA** had excellent adsorption percentages for Fe^{3+} (96.33%).

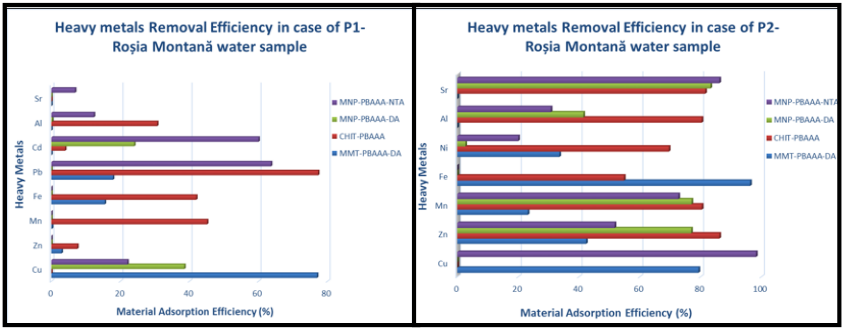

Figure 1. Heavy metals removal efficiencies from Rosia Montana P1 (a) and P2 water samples (b)

In conclusion, new types of material based on **PBAAA** were developed through extremely easy and non-catalytic synthesis methods. The resulting materials can be prepared with low costs, easily separated by filtration and exhibit good absorption properties which makes them attractive for applications in water treatment.

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