Neoteric Clay-Based Material for Heavy Metals Removal from Mining Waters

INCDTIM

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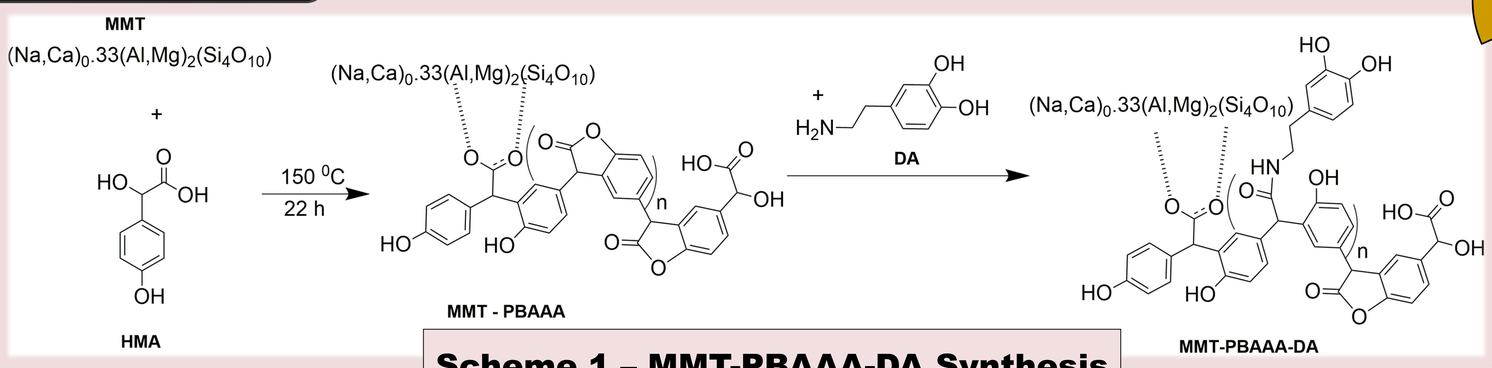
INTRODUCTION

The acceleration of urban development and the continuous population growth has dramatically increased the contamination of waterbodies with heavy metals, toxic anions or organic pollutants [1]. As a result, scientists focused on developing new "environmentally-friendly" materials for adsorption procedures to eliminate various pollutants from wastewaters [2]. Herein, we report the preparation of a neoteric clay-based material (**MMT-PBAAA-DA**), obtained from montmorillonite (**MMT**) and dopamine (**DA**) functionalized poly(benzofurane-co-arylacetic) acid (**PBAAA**), able to complex metal ions.

METHODS

Various analytical techniques such as **SEM, TGA, XPS, FTIR** and **AAS** were applied to investigate the structure, morphology and chemical composition of the synthesized material and the heavy metals content. Stock solutions of Cu^{2+}, Zn^{2+}, Mn^{2+}, Fe^{3+}, Pb^{2+}, Cd^{2+}, Cr^{3+}, Ni^{2+} and contaminated water samples collected from **Roșia Montană Mining Area** (Alba County, Romania) were used to evaluate the material's suitability for metals removal from wastewaters.

RESULTS



Scheme 1 – MMT-PBAAA-DA Synthesis

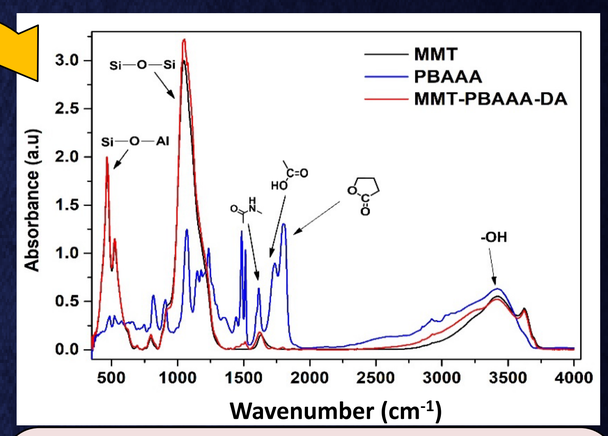
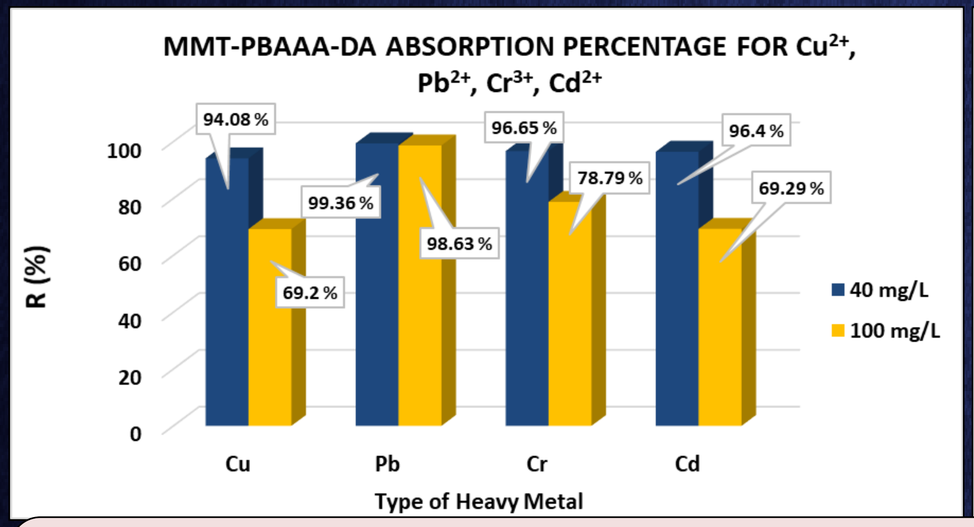


Fig. 1. FTIR Spectra of MMT, PBAAA & MMT-PBAAA-DA



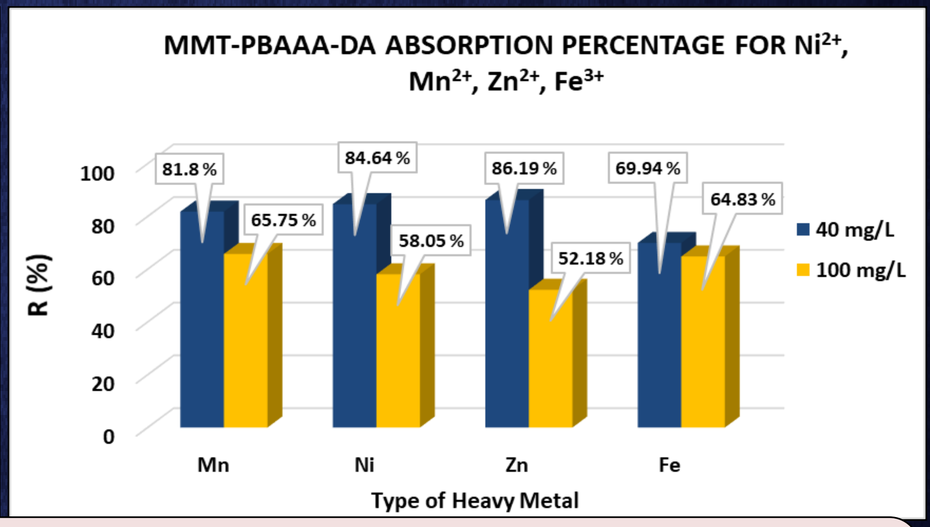


Fig. 2. Batch Experiments – Heavy Metals Adsorption with MMT-PBAAA-DA

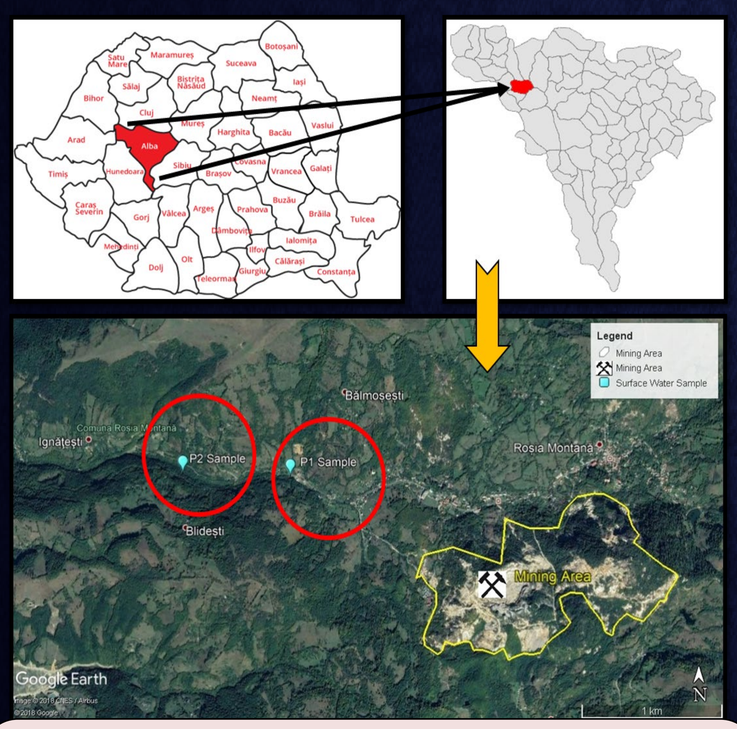


Fig. 3. Map of the Collected Water Samples (Rosia Montana Mining Area)

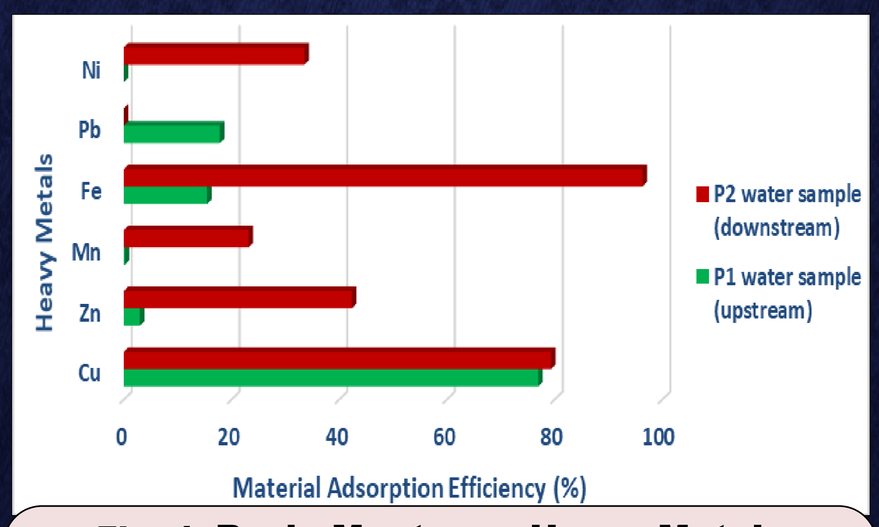


Fig. 4. Rosia Montana - Heavy Metals Adsorption with MMT-PBAAA-DA

Parameter / Sample		EC (µS /cm)	TDS (mg/L)	S (%)	pH	ORP (mV)
P1 Roșia Montană (upstream)		2550	1655	1.3	2.80	+238.1
P1 Roșia Montană after adsorption with MMT-PBAAA-DA		1639	1067	0.8	3.39	+201.8
P2 Roșia Montană (downstream)		3060	1989	1.6	2.52	+254.1
P2 Roșia Montană after adsorption with MMT-PBAAA-DA		486	316	0.2	4.47	+138.7
Regulations						
Drinking Water – Law no. 458/2002		< 2500	-	-	6.5-9.5	-
Surface Water – Order 161/2006 (5 quality classes)	I (Excellent)	-	-	-	6.5-8.5	-
	II (Good)	-	-	-		-
	III (Moderate	-	-	-		-
	IV (Poor)	-	-	-		-
	V (Bad)	-	-	-		-

Table 1. Physico-Chemical Parameters of Rosia Waters before/after adsorption

CONCLUSIONS

- ✓ A new type of hybrid material based on **PBAAA** was developed through an **extremely easy and green synthesis**
- ✓ The resulting material shows **good cost-benefit ratios** and is **easily separated by filtration**
- ✓ **MMT-PBAAA-DA** exhibits **good performances** in removing heavy metals, which makes it attractive for **applications in wastewater treatment.**

ACKNOWLEDGMENTS

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