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Selective removal of heavy metals from mining wastewaters using physicochemical treatment technology

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Extensive industrialization has caused many water bodies to receive loads of toxic metals which affect the quality of drinking water. Mining industry in particular is responsible for this type of pollution. Among many remediation techniques for metal ions removal, polymeric adsorbents are efficient and widely applied. This has made them comparable in terms of technical and economic efficiency, feasibility and green technology. This research was dedicated to the development a physico-chemical water treatment technology to abstract heavy metal ions from mining wastewaters. Polyethylenimine (PEI) (a well known polymer for its metal chelating potential) and its derivatives were developed and used as adsorbents on their insoluble form which gave the possibility of regeneration and re-use. The binding affinity and regeneration of the synthesized materials were determined and they showed different trends. PEI exhibited high affinity to Cr and some divalent metal ions such as Fe, Zn, and Ni, but it showed very poor ability to bind oxo-anions such as SeO_3^{2-} and AsO_{2-} which has been attributed to the unavailability of suitable functional groups to interact with these ions. The phosphonated derivative of polyethylenimine (PCPEI) showed high selectivity for U and As. The sulphonated derivative (SCPEI) showed high affinity towards Hg and Se. The existence of the chelating groups in SCPEI and PCPEI thus facilitate the removal of oxo-anions. This study gave a background to a wider study intended to introduce polymers of this type for use in household filter systems. Another configuration is the multilayer's packing of different functionalised polymers into columns for total removal of different toxic ions.

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