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Extraction of heavy metals in aqueous solution by vegetable oils

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Nowadays heavy metals together with their chelating agents have commonly appeared in many different applications from soil washing of heavy metal polluted soils to metal plating operations. After their usage, a large quantity of metal-containing wastewater is generated. From the point of view of sustainability, a cost-effective approach to concentrate heavy metals in the wastewater to a degree suitable for recycle is still much needed. The aim of this study is to explore the feasibility of using vegetable oils, a natural green solvent, to extract and concentrate heavy metals from solution. Conventional chelating agents such as EDTA and NTA have now been replaced by biodegradable chelating agents such as EDDS (Ethylenediamine Disuccinic Acid) and HIDS (Hydroxyiminodisuccinic Acid). In this study, biodegradable chelating agents were first equilibrated with heavy metals (Ni, Zn and Cu) in solution under various molar ratios at pH 7.0. Then, vegetable oils were utilized as liquid membrane to extract chelated metals. demonstrates one of the results when Ni is the target heavy metal. From this figure, it is seen that non-chelated HIDS's (or $HIDS^{3-}$) always have higher extraction efficiencies than Ni-chelated HIDS (or $[Ni(HIDS)]^{2-}$). The maximum extraction efficiencies are 30% for non-chelated HIDS's and around 15% for Ni-chelated HIDS. Also, it is evident that molar ratios between $HIDS^{3-}$ and Ni^{2+} do have significant effects on the extraction efficiency. The maximum extraction efficiency for Ni-chelated HIDS occurs at the ratio of 1:5 between $HIDS^{3}$- and Ni^{2+}. More experiments on the other two metals (Zn and Cu) have also been conducted. From our current results, we have found that vegetable oil liquid membrane is able to extract complexed-metals to different degrees, which renders it a potential metal-recycling method. More tests are underway to examine effects of different chelating agents and vegetable oils, pH, and temperature on the overall extraction efficiency.

Biography

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