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Optimization Analysis of Separation Conditions of Heavy Metal Contaminated EDTA Wastewater by Sulfide Precipitation

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Extended Abstract

Soil washing technologies with agents such as ethylenediamine-tetraacetic acid (EDTA) was known to be an effective means due to its relatively low cost and wide applicability for various metal pollutants.The development of EDTA-based soil washing technologies was hampered by the lack of treatment approaches of the spent solution, especially for the multi-metal contaminated EDTA wastewater. The objective of present study was to evaluate the feasibility of removing heavy metals from actual soil washing wastewater of EDTA employing sodium sulfide precipitation process and washing abilities of recycled EDTA. In our study, four divalent Heavy metals were investigated, namely, Pb, Cd, Cu and Zn. Metals were extracted from the soil by washing with a 0.05M aqueous solution of EDTA sodium salt (E-Na_2), and metal-EDTA was found to be predominant fractions among metal species in washing-waste water. This study discussed the operating variables for integrating EDTA recovery and metal precipitation using Na_2S, including reaction time, initial pH of wastewater, the concentration of Na_2S and the dosage of PAM. Results showed that the optimal reaction time was 40 minutes. At the range of pH value from 8 to 11, it had a higher elimination rate of heavy metals and produced a smaller amount of H_2S. When the concentration of Na_2S ranged from 0 to 0.15mol/L, the removal rates of heavy metals would increase with the rising concentrations of Na_2S, and the removal rate of heavy metals in soil attained its maximum as the concentration of Na_2S reached 0.15mol/L, and when the concentration of Na_2S continued to rise, the removal rate of heavy metals no longer changed. It appeared possible to use lower concentration of Na_2S to promote acceptable recovery provided it was carried out at an alkaline pH. Adding PAM had little influence on EDTA recovery and metal precipitation, but it could promote the precipitation of sulfide particles. Under the optimal operating conditions identified in this study，a total of 91.7%, 89.3%, 94.6% and 65.1% of the extracted Pb, Cd, Cu and Zn, respectively, could be precipitated from the spent EDTA solution. At the same condition, the precipitation percentages of Zn by adding Na_2S were lower than those of other metals, the precipitation of Zn required the addition of $Ca(OH)_2$. Experimental results showed that the recycled EDTA solution had similar extraction ability as fresh EDTA solution; the reused EDTA maintained more than 85%of its preceding extraction power in cycle of reuse.

In conclusion，this study demonstrated that the optimum condition established through sodium sulfide precipitation approach could precipitate 91.7%,89.3%,94.6% and 65.1% Pb, Cd, Cu and Zn, respectively, the spent and the reused EDTA solution demonstrated that less than 15% decrease in its extraction power in cycle for Pb, Cd, Cu and Zn extraction from the soil. The results showed that metals

and EDTA in the extracts could be separated almost completely by addition of Na_2S. The sulphide precipitates contained a high concentration of metals and could be treated conveniently for final disposal or metal recovery. The recycling procedure may be applied to wastewater generated during soil washing of heavy metal-contaminated soil, resulting in a reduction in wastewater generated and savings in the amount of EDTA used. The success of these treatment processes would make the use of EDTA in soil washing economically viable and environmentally friendly.