Arsenic Speciation in the Copper Tailings with the Effects of Magnetite Removal

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ABSTRACT: Arsenic is considered as one of severe metalloid pollutants in the copper tailings, which may pose risks to the environment and human health. It is known that iron oxides are one of the most important adsorbents of minor elements due to their reactivity and large specific surface area, which can coprecipitate and adsorb arsenic. Magnetite (Fe₃O₄), counting for up to 30% of in copper tailings, may act as a sink mineral to prevent arsenic mobilization. However, the ore processing has recently changed to remove magnetite as a by-product for economic benefit, which reduce magnetite concentration from 20 – 30% to 5%. Thus may affect arsenic speciation and consequently mobilize arsenic in tailings.

In this study, we compared the sequential leaching results from the old copper tailings (total arsenic concentration 330 mg/kg) with magnetite and new copper tailing without magnetite. There was 34% arsenic adsorbed with iron in old tailing, comparing to 7% arsenic in new tailings. Organic matter (biochar and mulch) were added in those tailings and two types of Australian native plants were planted in the pot experiment. The leachate was collected which may display the different adsorption effects of organic matter on arsenic due to the reduction of the arsenic adsorption caused by magnetite removal.

The results will allow us to understand the changes of arsenic speciation under the effects of magnetite removal in copper tailings and show the effects of organic matter addition to the tailings. The results will be interpreted in terms of the influence of magnetite and organic matter, which will provide essential information for further phytoremediation practice.