

Ultrasound-Assisted Soil Washing Process for the Removal of Heavy Metals from Clays

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Abstract : The proportion of soil contaminated by a wide range of pollutants (heavy metals, PCBs, pesticides, etc.) of anthropogenic origin is constantly increasing, and it is becoming urgent to address this issue. Among remediation methods, soil washing is an effective, relatively fast, and widely used process. This study assesses its coupling with ultrasound: indeed, sonication induces the formation of cavitation bubbles in solution that enhance local mass transfer through agitation and particle erosion. The removal of target toxic elements Ni(II) and Zn(II) from vermiculite clay has been studied under 20 kHz ultrasound and silent conditions. Several acids were tested, and HCl was chosen as the solvent. The effects of solid/liquid ratio and particle size were investigated. Metal repartition in the clay has been followed by Tessier's sequential extraction procedure. The results showed that more metal elements bound to the challenging residual phase were desorbed with 20 kHz ultrasound than in silent conditions. This supports the promising application of ultrasound for heavy metal desorption in difficult conditions. Further experiments were performed at high-frequency US (362 kHz), and it was shown that fragmentation of the vermiculite particles is then limited, while positive effects of US in the decontamination are kept.

Keywords : desorption, heavy metals, ultrasound, vermiculite

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