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SOLUBILIZATION OF HEAVY METALS IN SLUDGE DURING SONICATION: IMPACT OF SONICATION TIME AND POWER DENSITY

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Abstract

Heavy metals in sludge have been one of the limiting factors for sludge reclamation, and therefore the changes of heavy metals during sludge treatment process should be concerned. This study investigated the detailed profile of changes of seven typical heavy metals (As, Cd, Cr, Cu, Ni, Pb, and Hg) in the activated sludge during ultrasonic treatment process. The influences of sonication time and ultrasonic power density were studied. Results showed that heavy metals in sludge were released into the aqueous phase under ultrasound irradiation, but the solubilization degree was low. After sonication of 1.2 W/mL for 30 min, the solubilization degree of organic matter (S_{COD}) in sludge increased to 36.0%, while the solubilization degree of total heavy metals (S_{HM}) only increased to 7.0%. Sonication time and power density greatly affected the heavy metals solubilization degree. S_{HM} increased almost linearly with sonication time within the first 15 min and then stabilized. A minimum power density of 0.8 W/mL was required for heavy metal solubilization. Pearson correlation coefficient analysis showed that the effect of sonication time on heavy metal release was higher than that of power density. Each heavy metal behaved differently during the ultrasonic treatment. Arsenic and nickel release were easier and the solubilization degree reached 58.4% and 34.9% after 30 min of sonication, respectively. The content of copper was high in the activated sludge; but the solubilization degree was low. Cadmium was stable and could not be released by sonication.

Key words: heavy metals, power density, sludge, solubilization, sonication time

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