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## Hydrometallurgical Process for Recovery of Metals from Two Industrial Sludge Types

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Treating of industrial sludge can be considered as a challenging task in the field of solid waste management because of their elevated content of trace metals and increasing producing rates. Although, several types of hydrometallurgical methods have been employed for treating of industrial wastes, leaching techniques yield promising results for recovery of valuable metals. In this work, acid leaching with malic and sulphuric acids were utilized to recover metals from two industrial based sludge types from battery manufacturing and electronic product industries. Best solid to liquid ratio for metal recovery for both sludge type was found out using 20, 60 and 100 g/ L ratios of sludge in 2 M solutions of each acid. The best acid concentration for maximum recovery of metals was determined using 0.1, 0.5, 1.0, 1.5 and 2 M solutions of each acid. All the leaching procedures were done for 12 hours of period with 100 rpm of shaking at room temperature. According to the results, the best solid to liquid ratio for metal recovery from both sludge types was 20 g/ L for each acids except that the Cu in the sludge from electronic product industry shown highest recovery in 60 g/ L solution. Malic acid at 0.5 M concentration shown highest recovery of metals from the sludge from battery industry. Highest values of metals recorded in these sludge were Pb and Cr and recovered at 4153.30 and 1361.74 mg/ kg respectively. However, for electronic industry sludge sulphuric acid at 0.1 M concentration gave highest recovery. Here, Cu and Zn recovered respectively at 5774.22 and 2579.11 mg/ kg.

Key words: Hydrometallurgy, Leaching, Solvent extraction, Trace metals, Malic acid media