11th World Congress and Expo on **Recycling**

June 13-14, 2019 | Edinburgh, Scotland

Optimization of copper leaching conditions with RSM followed by electrolytic recovery

Joona Rajahalme, Siiri Perämäki, Roshan Budhathoki and **Ari Väisänen**
University of Jyväskylä, Finland

Increase of waste electric and electronic equipment (WEEE) is one of the alarming phenomenon due to hazardous materials in the WEEE. However, valuable metals, like copper, gold and silver are present at significantly higher concentrations in printed circuit boards (PCB) than in virgin minerals.1 Currently, copper is mainly recovered industrially from PCBs via pyrolytic processes while researchers are focused to find hydrometallurgical techniques for recovery of metals.2–4 Due to low solubility of precious metals, sulfuric acid and hydrogen peroxide was selected as leaching agents for copper in this study. Leaching efficiency of copper was optimized as for five variables, sulfuric acid concentration, hydrogen peroxide volume percentage (v%), pulp density, leaching time and temperature using response surface methodology (RSM). Selected approach provided important information from two-way interactions between variables and proved significant two-way interactions between hydrogen peroxide v% and pulp density and pulp density and temperature. Hydrogen peroxide v% was found to be significant first order effect to copper leaching efficiency. Two optimum conditions was found for leaching of copper with over 99.5% estimated leaching efficiency. The leaching tests were performed using optimum conditions and no significant differences were found between the estimated and obtained concentrations. Silver and other precious metals were remained to solid residue hence precious metals can be recovered efficiently from more concentrated matrix. Recovery techniques of copper from acidic solutions are mainly precipitation, crystallization and electro winning.4,5 Electro winning was used for copper recovery because the addition of chemicals is no needed hence reuse of sulfuric acid is possible. In this study, copper was recovered with extremely high recovery and purity while main impurities were lead and palladium.

Recent Publications

1. Işıldar, A., Rene, E. R., van Hullebusch, E. D. & Lens, P. N. L. Electronic waste as a secondary source of critical metals: Management and recovery technologies. Resour. Conserv. Recycl. 135, 296–312 (2018).

2. Birloaga, I., De Michelis, I., Ferella, F., Buzatu, M. & Vegliò, F. Study on the influence of various factors in the hydrometallurgical processing of waste printed circuit boards for copper and gold recovery. Waste Manag. 33, 935–941 (2013).

3. Naseri Joda, N. & Rashchi, F. Recovery of ultra fine grained silver and copper from PC board scraps. Sep. Purif. Technol. 92, 36–42 (2012).

4. Yang, H., Liu, J. & Yang, J. Leaching copper from shredded particles of waste printed circuit boards. J. Hazard. Mater. 187, 393–400 (2011).

5. Veit, H. M., Bernardes, A. M., Ferreira, J. Z., Tenório, J. A. S. & Malfatti, C. de F. Recovery of copper from printed circuit boards scraps by mechanical processing and electrometallurgy. J. Hazard. Mater. 137, 1704–1709 (2006).

Biography

Joona Rajahalme completed his master studies from inorganic and analytical chemistry in department of chemistry at University of Jyväskylä. Currently, he is working with his doctoral studies in Adjunct professor Ari Väisänen research group in department of renewable resources and chemistry of living environment at University of Jyväskylä. His research topic is valuable metals recovery from printed circuit boards with hydrometallurgical techniques.