Advances in Automobile Engineering

Extended Abstract

Recycling 2018 : Using iron filings for copper recovery from spent copper etching solution by cementation process.

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Abstract

This research aimed to study cementation technique to recover copper from spent copper etching solution using iron filings. High acidity spent etchant (pH 0.56) containing total Cu concentration of 17,260mg/L (>99 % is soluble Cu form). Conditions to enhance the efficiency of Cu recovery including reaction time, temperature, initial pH and amount of iron filings were optimized. Initial pH was tested at 0.5, 1.5, 2.0, 2.5 and 3.0 with iron filings amount of 0.5, 1, 2 and 3-folds of stoichiometry under reaction time of 0-60 mins and reaction temperature of 27 (room temperature), 50 and 80 C. After cementation, settling parameters of metals flocs were assessed as a guideline for solid-liquid separation process. Obtained metals sludge samples have been dried and ground, thereafter, morphologies of metal powders were observed by SEM. SEMEDS also adopted to examine semi-quantitative elemental results of samples regions. Crystalline components analyzed by XRD and copper content in dried sludge were evaluated.

The iron filings were found distributing in range of 45-1,000?m with majority size of 125-500?m (???79% w/w). Results indicated that cementation requires reaction time for at least 6 mins. Among the optimal conditions examined, the amount of iron filings showed a pronounced positive effect. Temperature and initial pH (0.5-3), however, clearly demonstrated an insignificant effect on Cu recovery yield. High Cu recovery for all adopts initial pH was found with 2- folds of stoichiometry for iron filings applying amount. The effective initial pH is suggested to be 0.5 (without adjustment), corresponding to 99% of Cu recovery. Zero-valent iron acts as a reducing agent/ an electron donor for Cu ion by metallic replacement or cementation mechanisms. The blue Cu solutions immediately changed to colorless after cementation process. Dense easily settled metals sludge was formed. Cu was the majority element for the obtained reddish-brown sludge which the remainders were Pb, Fe, Sn, Si, Ni, Cr, and O. Cu fraction in dried sludge was 80.4% (w/w) which metallic copper (Cu) and copper (I) oxide (Cu2O) were mainly detected.

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Nanthanat Sriprasert and Pakpong Sriprasert Mahasarakham University, Thailand