Removal of Trace Amounts of Copper from Concentrated Hydrochloric Acid Solutions

Metehan Erdoğan¹, Esra Karakaya^{2,3}, Mustafa Serdal Aras³, Sedef Çift Karagül⁴,
Merve Kolay Ersoy⁴, Abdullah Öztürk², İshak Karakaya²

¹ Department of Metallurgical and Materials Engineering, Ankara Yıldırım Beyazıt University; Ayvalı Mahallesi, 150. Sok. & Takdir Cad. No:5, 06010 Etlik – Keçiören, Ankara, TURKEY

² Department of Metallurgical and Materials Engineering, Middle East Technical University; Üniversiteler Mahallesi, Dumlupınar Bulvarı No:1, Çankaya, Ankara, 06800, TURKEY

³ MEGAP Co. ODTÜ Teknokent Gümüş Blok (A) No:15-A, Çankaya, Ankara, 06800, TURKEY

⁴ Borusan Technology Department and R&D Co.; Büyükhaneli Plaza Defne Sok. No:3, Ataşehir, İstanbul, 34758, TURKEY

*E-mail: metehanerdogan@ybu.edu.tr

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Pickling process is recognized as one of the strongest acid consuming processes in the steel industry. A pickling solution that contains hydrochloric acid (HCl) is used for the metal surface treatment of steel plants. The same acid can be used for a long period of time by means of a regeneration process, in which iron concentration of the acid is decreased to insignificant concentrations. However, regenerated pickling solutions contain copper, especially when scrap is used to produce steel. Furthermore, copper deposits on the metal in the following pickling processes when its concentration exceeds a certain critical value. This study describes an electrochemical treatment process for collecting copper from regenerated pickling solutions of steel plants. Copper concentration, electrolysis time, and current density were selected as the operation variables and pH and conductivity of the acid together with the amount and morphology of the deposition were considered as the response variables for optimization. Graphite was used as the anode due to its high conductivity and stability and copper or stainless steel was used as the cathode in this study. The results showed that electrochemical treatment process decreased copper concentration to about 80 from 127 ppm using stainless steel cathode under the optimum constant current density of 2.0 A/dm² and electrolysis time of 4 hours, without any acid loss, which was verified by pH, conductivity and acidity measurements.

Keywords: Copper electrodeposition; Copper recovery; Pickling solution; Current density

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