Production of copper powder from synthetic wastewaters by cementation on a longitudinal finned rotating zinc cylinder

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ABSTRACT

This study aims to enhance the removal of Cu²⁺ ions from wastewaters and recovery of the metal value by cementation on a longitudinal finned rotating zinc cylinder. The effect of different parameters such as cylinder rotational speed (rpm), initial Cu²⁺ ion concentration, and the effect of the fin height to cylinder diameter (e/d) on the rate of Cu²⁺ ions cementation was investigated. In addition, the effect of drag reducing polymer on the rate of Cu²⁺ cementation was examined. The rate of cementation was expressed in terms of the mass transfer coefficient. The results revealed that the mass transfer coefficient increases with increasing rpm, initial Cu²⁺ concentration, and e/d ratio. The present results show that finned rotating cylinder enhances rate of cementation compared to smooth rotating cylinder by percentage ranges from 28.79 to 134.85 depending on the operating conditions. On the other hand, the presence of drag reducing polymer retards the rate of cementation. The present data fit the following dimensionless equations: For smooth cylinder: Sh = 0.74 Re⁰.⁶⁹ Sc⁰.₃³. For finned rotating cylinder: Sh = 0.38 Re⁰.⁹ Sc⁰.₃³ (e/d)⁰.₂⁵. The importance of the above correlations in the design and operation of industrial-scale rotating cylinders cementation reactors was pointed out.

Keywords: Cementation; Removal of heavy metal; Rotating cylinder; Recovery of metals; Wastewater treatment

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