以電解系統處理化學銅廢水研究

學生：李威霖　　指導教授：黃志彬

國立交通大學工學院永續環境科技學程

摘 要

化學銅廢水為IC基板廠於製造產品過程中所排放之螯合性廢水，其螯合能力極強，若貿然排入廢水處理系統處理，可能造成化學混凝系統出流水之含銅量超過放流水標準；生物系統因高濃度銅離子進入造成微生物死亡，而使出流水含銅量偏高。本研究係以妥善處理化學銅廢液為主，回收有價金屬為輔，電解後廢液可進入生物系統處理，並達放流水標準。本研究係以電解氧化法進行試驗，並以製程生產後的化學銅廢水進行實驗，探討不同pH、電流及時間下之最佳操作參數，並將此參數以實廠所建置之電解設備進行驗證。經電解八小時後，不同pH值下之銅離子去除效率為pH2＞pH3＞pH4，故最佳操作參數為pH2；以電流驅動力與銅離子去除效率而言，則呈現正相關，銅離子之去除效率為4 A＞3 A＞2 A＞1 A。因此，自實驗中可知銅離子去除率於pH2及電流4 A下可得最佳銅離子去除率99%；而最差去除效率為操作條件於pH4及電流1 A，其去除率為83%。COD去除效率亦隨著pH的增加而降低，即pH2＞pH3＞pH4，而增加電流趨動力則為4 A＞3 A＞2 A＞1 A；因此，在不同pH跟電流驅動力下，COD去除效率為22~55%。將經實廠電解後之廢水排放至生物處理系統處理，發現其重金屬離子並未造成生物抑制，且COD去除率仍可維持50%以上；此外，經處理後之放流水均可符合放流水排放標準。因此，結合化學銅電解回收系統與生物處理系統可有效降低銅離子與COD濃度，並可藉化混系統處理以降低放流水異常之風險，故可證明此系統去除化學銅螯合物為確實可行之方法。

關鍵字：電解、銅、螯合、電子業

Treatment of wastewater containing chelated copper by electrolysis system

Student: Wei-Lin Li Advisor: Chihpin Huang

College of Engineering
National Chiao Tung University

Abstract

Effluent discharged from IC substrate manufactures contains high strength of the chelated copper. Once the factory discharge chelated copper into sewerage collection system, it may easily allow the copper concentration exceed the effluent limit. More than that, high strength chelated copper would damage the stability of bio-systems operation by causing the death of microorganism. The purposes of this research are to deal with wastewater containing chelated copper and retrieve copper as a valuable metal. The electrolysis-oxidization processes were applied in the study. The effluent sample discharged from the manufacturing process was also taken and used to investigate their treatability as well as the optimal conditions by a lab-scale of electrolysis system with the parameters of pH, electric current and the retention time. After that, the optimal parameters were applied to ensure the experimental feasibility as well as verify the applicability of electrolysis facility in the full plant. The results have revealed that the cupric ion removal efficiency decreases with increasing pH (pH2>pH3>pH4) after reaction for eight hours. Regarding to the effect of electric current, the result has showed that the cupric ion removal efficiency is proportional to electrical current (4A>3A>2A>1A). The highest removal efficiency of cupric ion is found to be 99% at pH2 and 4A, and the lowest is 83% at pH4 and 1A. The effects of pH and current density on COD removal were also evaluated. The COD removal increases with decreasing pH (pH2> pH3> pH4) and increases with current density (4A>3A>2A>1A). Therefore, the COD removal efficiency was approximately between 22% and 55%. The wastewater treated by electrolysis system was then flowed into the biological process. It was found that the COD removal maintained more than 50% with no biological inhibition in this system. Hence, this electrolysis/biological hybrid system can effectively reduce the concentration of copper and COD from the wastewater containing high strength chelated copper, and then lower the risk of effluent.

Key word: electrolysis, chelation, copper, IC