

# Treatment of Chelated-Metals Containing Wastewaters by Fenton-like Process

李德倫、申永順

E-mail: 9805413@mail.dyu.edu.tw

## ABSTRACT

The purpose of this study is to use Column Fenton-like Process and Cementation Process to treat wastewater of single heavy metal ( $\text{Cu}^{2+}$ ) and various chelating agents (EDTA, NTA) to study various operating factors in reaction system (initial pH of solution, zero-valent iron addition level, initial concentration of pollutant, inflow rate and  $\text{H}_2\text{O}_2$  addition level), in order to understand reactant reaction behavior and removal efficiency. Through pollutant-oxidizer mass balance calculation, this study evaluated consuming efficiency of sacrificed metal and oxidizer, and analyzed through BDST column kinetic simulation, so as to select treatment performance of Advanced Oxidation Process plus Cementation Process and its optimum operating condition. When the solution containing CuEDTA or CuNTA (treated by means of Cementation Process) ran column reaction, total copper removal rate would fall with increasing initial pH of solution, decreasing zero-valent iron level, increasing initial concentration of pollutant, and higher inflow rate. In addition, the experiment on copper topography distribution during reaction in mass balance perspective showed that, after reaction, solid-state copper growth rate tended to rise with decreasing initial pH of solution, increasing zero-valent iron level, higher initial concentration of pollutant, and lower inflow rate. In Fe $^0$ /CuEDTA system, the optimum operation condition is: initial pH of solution is 3.0, zero-valent iron level is 0.25g/L, initial concentration of CuEDTA is 5.0mM and inflow rate is 6ml/min. Total copper removal rate reached 98% after reacting 60min. After 4h, the total copper removal rate amounted to 64%. In Fe $^0$ /CuNTA system, the optimum operation condition is: initial pH of solution is 3.0, zero-valent iron level is 0.2g/L, initial concentration of CuNTA is 5.0mM and inflow rate is 6ml/min. Total copper removal rate reached 73% after reacting 2.5min; and after 4h, the total copper removal rate amounted to 28%. When the solution containing CuEDTA or CuNTA (treated by means of Fenton-like Process) ran column reaction, total copper removal rate would fall with increasing initial pH of solution, decreasing zero-valent iron level, increasing initial concentration of pollutant, higher inflow rate, and increasing  $\text{H}_2\text{O}_2$  level. In addition, the experiment on copper topography distribution during reaction in mass balance perspective found that, after reaction, solid-state copper growth rate tended to increase with decreasing initial pH of solution, increasing zero-valent iron level, higher initial concentration of pollutant, lower inflow rate, and decreasing  $\text{H}_2\text{O}_2$  level. In Fe $^0$ / $\text{H}_2\text{O}_2$ /CuEDTA system, the optimum operation condition is: initial pH of solution is 3.0, zero-valent iron level is 0.25g/L, initial concentration of CuEDTA is 5.0mM,  $\text{H}_2\text{O}_2$  level is 2.5mM and inflow rate is 6ml/min. The total copper removal rate reached 70% after reacting 2.5min; and after 4h, the total copper removal rate amounted to 15%. In Fe $^0$ / $\text{H}_2\text{O}_2$ /CuNTA system, the optimum operation condition is: initial pH of solution is 3.0, zero-valent iron level is 0.2g/L, initial concentration of CuNTA is 5.0mM,  $\text{H}_2\text{O}_2$  level is 2.5mM and inflow rate is 6ml/min. The total copper removal rate reached 51% after reacting 2.5min; and after 4h, the total copper removal rate amounted to 12%. Compared to other treatment processes, such as Sulfide treatment method, Chelating Ion Exchange Resin method, Bio-treatment method, Electrocoagulation-Flotation Method, Electrochemical Method and Membrane Filter Method. This study only added an appropriate amount of zero-valent iron and  $\text{H}_2\text{O}_2$ , and excellent total copper removing efficiency could be achieved. Therefore, it not only shortens treatment time, but is also more cost efficient.

Keywords : Fenton-like process、Cementation Process、heavy metal、chelating agent

## Table of Contents

封面內頁 簽名頁 授權書iii 中文摘要iv 英文摘要vi 誌謝viii 目錄ix 圖目錄xviii 表目錄x1v 第一章前言1 1.1研究動機1 1.2研究目的與內容3 第二章理論背景及文獻回顧4 2.1整合重金屬之特性及處理方式4 2.1.1整合重金屬之污染源4 2.1.2整合重金屬對人體及生物之危害7 2.1.3目前產業界對整合重金屬之處理方式7 2.1.3.1硫化物處理法8 2.1.3.2整合型離子交換樹脂法8 2.1.3.3生物處理法9 2.1.3.4電聚浮除法 9 2.1.3.5電化學法10 2.1.3.6薄膜過濾法11 2.2整合重金屬於水溶液中平衡之探討11 2.2.1整合劑之形式12 2.2.2重金屬離子與氫氧根離子之反應行為13 2.2.3重金屬離子與整合劑之整合反應13 2.2.4整合劑與氫離子之水解反應14 2.2.5化學平衡之理論計算結果14 2.2.6整合重金屬系統之pC-pH圖17 2.2.6.1 Cu-EDTA系統之pC-pH圖17 2.2.6.2 Cu-NTA系統之pC-pH圖18 2.2.7整合重金屬系統之百分率濃度圖19 2.2.7.1 Cu-EDTA系統之百分率濃度圖20 2.2.7.2 Cu-NTA系統之百分率濃度圖21 2.3化學置換之處理程序22 2.3.1零價鐵-氧化之反應理論22 2.3.2化學置換反應之原理22 2.3.3影響化學置換之因素23 2.3.3.1溶液pH值23 2.3.3.2零價鐵與污染物濃度之比例關係24 2.3.3.3水中化合物之影響25 2.4 Fenton程序25 2.4.1 Fenton程序之理論26 2.4.2 Fenton程序之反應機制26 2.4.3影響Fenton程序之因素28 2.4.3.1溶液pH值28 2.4.3.2亞

鐵離子劑量29 2.4.3.3過氧化氫劑量31 2.5 Fenton-like程序33 2.5.1 Fenton-like之理論33 2.5.2 Fenton-like程序之反應機制34  
2.5.3影響Fenton-like程序之因素35 2.5.3.1溶液pH值35 2.5.3.2亞鐵離子劑量38 2.5.3.3過氧化氫劑量39 2.5.3.4汙染物初始濃  
度41 2.6管柱式Fenton-like之動力反應模式51 2.6.1 BDST模式52 第三章研究目的與架構54 第四章實驗程序與設備56 4.1實驗  
設備與儀器56 4.2實驗藥品57 4.3實驗裝置58 4.4實驗步驟59 4.4.1背景實驗59 4.4.2以零價鐵去除水溶液中整合重金屬之實  
驗61 4.4.3以Fenton-like 程序處理含整合重金屬廢水之實驗61 4.5分析測定方法65 4.5.1吸光度分析65 4.5.2過氧化氫定量分  
析(KI滴定法)65 4.5.3亞鐵離子濃度測定66 4.5.4銅、鐵之檢量線製作68 4.5.5 EDTA及CuEDTA之檢量線製作69 4.5.6掃描式  
電子顯微鏡分析70 4.5.7能量散佈光譜分析70 第五章結果與討論72 5.1背景實驗72 5.1.1吸光度實驗72 5.1.2整合重金屬之分  
析實驗73 5.1.3過氧化氫分解含整合重金屬水溶液之實驗75 5.1.4以零價鐵化學置換銅離子水溶液之實驗77 5.2以零價鐵處理  
含CuEDTA水溶液80 5.2.1溶液初始pH值效應80 5.2.1.1銅之去除率80 5.2.1.2溶液中銅之成份分佈85 5.2.1.3鐵粉利用率之探  
討90 5.2.1.4動力模擬與質傳分析92 5.2.2零價鐵添加劑量效應98 5.2.2.1銅之去除率99 5.2.2.2溶液中銅之成份分佈103 5.2.2.3  
鐵粉利用率之探討108 5.2.2.4動力模擬與質傳分析109 5.2.3汙染物初始濃度效應115 5.2.3.1銅之去除率115 5.2.3.2溶液中銅之  
成份分佈119 5.2.3.3鐵粉利用率之探討123 5.2.3.4動力模擬與質傳分析125 5.2.4進流液流速效應131 5.2.4.1銅之去除率131  
5.2.4.2溶液中銅之成份分佈135 5.2.4.3鐵粉利用率之探討139 5.2.4.4動力模擬與質傳分析140 5.2.5 Fe<sub>0</sub>/CuEDTA系統之彙整  
分析145 5.2.6 Fe<sub>0</sub>/CuEDTA系統之反應機制圖146 5.3以Fenton-like程序處理含CuEDTA水溶液147 5.3.1溶液初始pH值效  
應147 5.3.1.1銅之去除率147 5.3.1.2溶液中銅之成份分佈151 5.3.1.3鐵粉利用率之探討155 5.3.1.4動力模擬與質傳分析157  
5.3.2零價鐵添加劑量效應163 5.3.2.1銅之去除率163 5.3.2.2溶液中銅之成份分佈168 5.3.2.3鐵粉利用率之探討173 5.3.2.4動力  
模擬與質傳分析175 5.3.3汙染物初始濃度效應180 5.3.3.1銅之去除率180 5.3.3.2溶液中銅之成份分佈185 5.3.3.3鐵粉利用率之  
探討189 5.3.3.4動力模擬與質傳分析190 5.3.4進流液流速效應196 5.3.4.1銅之去除率196 5.3.4.2溶液中銅之成份分佈200  
5.3.4.3鐵粉利用率之探討204 5.3.4.4動力模擬與質傳分析205 5.3.5過氧化氫添加劑量效應210 5.3.5.1銅之去除率211 5.3.5.2溶  
液中銅之成份分佈216 5.3.5.3鐵粉利用率之探討220 5.3.5.4動力模擬與質傳分析222 5.3.6 Fe<sub>0</sub>/H<sub>2</sub>O<sub>2</sub>/CuEDTA系統之彙整分  
析228 5.3.7 Fe<sub>0</sub>/H<sub>2</sub>O<sub>2</sub>/CuEDTA系統之反應機制圖229 5.4以零價鐵處理含CuNTA水溶液231 5.4.1初始溶液pH值效應231  
5.4.1.1銅之去除率231 5.4.1.2溶液中銅之成份分佈235 5.4.1.3鐵粉利用率之探討238 5.4.1.4動力模擬與質傳分析239 5.4.2零價  
鐵添加劑量效應244 5.4.2.1銅之去除率245 5.4.2.2溶液中銅之成份分佈248 5.4.2.3鐵粉利用率之探討252 5.4.2.4動力模擬與質  
傳分析254 5.4.3汙染物初始濃度效應258 5.4.3.1銅之去除率258 5.4.3.2溶液中銅之成份分佈262 5.4.3.3鐵粉利用率之探討266  
5.4.3.4動力模擬與質傳分析267 5.4.4進流液流速效應272 5.4.4.1銅之去除率272 5.4.4.2溶液中銅之成份分佈276 5.4.4.3鐵粉利  
用率之探討280 5.4.4.4動力模擬與質傳分析281 5.4.5 Fe<sub>0</sub>/CuNTA系統之彙整分析286 5.4.6 Fe<sub>0</sub>/CuNTA系統之反應機制  
圖287 5.5以Fenton-like程序處理含CuNTA水溶液288 5.5.1初始溶液pH值效應288 5.5.1.1銅之去除率288 5.5.1.2溶液中銅之成  
份分佈292 5.5.1.3鐵粉利用率之探討296 5.5.1.4動力模擬與質傳分析297 5.5.2零價鐵添加劑量效應302 5.5.2.1銅之去除率303  
5.5.2.2溶液中銅之成份分佈306 5.5.2.3鐵粉利用率之探討310 5.5.2.4動力模擬與質傳分析312 5.5.3汙染物初始濃度效應317  
5.5.3.1銅之去除率317 5.5.3.2溶液中銅之成份分佈321 5.5.3.3鐵粉利用率之探討325 5.5.3.4動力模擬與質傳分析327 5.5.4進流  
液流速效應331 5.5.4.1銅之去除率331 5.5.4.2溶液中銅之成份分佈335 5.5.4.3鐵粉利用率之探討339 5.5.4.4動力模擬與質傳分  
析340 5.5.5過氧化氫添加劑量效應345 5.5.5.1銅之去除率345 5.5.5.2溶液中銅之成份分佈349 5.5.5.3鐵粉利用率之探討352  
5.5.5.4動力模擬與質傳分析353 5.5.6 Fe<sub>0</sub>/H<sub>2</sub>O<sub>2</sub>/CuNTA系統之彙整分析359 5.5.7 Fe<sub>0</sub>/H<sub>2</sub>O<sub>2</sub>/CuNTA系統之反應機制圖360  
5.6各系統之綜合比較362 5.6.1 CuEDTA系統之不同處理程序之綜合比較362 5.6.2 CuNTA系統之不同處理程序之綜合比  
較365 5.6.3 Cementation系統之不同汙染物之綜合比較369 5.6.4 Fenton-like系統之不同汙染物之綜合比較370 5.7反應前後零  
價鐵之定性分析371 5.7.1掃描式電子顯微鏡分析371 5.7.2能量散佈光譜分析377 第六章結論與建議380 參考文獻382

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