以電聚浮除法處理含多成分重金屬螯合物混合廢水反應行為之研究

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摘 要

本研究旨在探討以電聚浮除程序處理含單成分及多成分之螯合重金屬水溶液之反應行為，針對不同的反應條件進行探討，以瞭解污染物去除效率與反應行為之影響，並進行螯合重金屬於水溶液中之反應動力行為之探討，以及各因子下之螯合重金屬的去除型態，作為未來應用研究之參考。 本研究以內循環批式反應系統進行實驗，分別探討螯合劑種類及濃度、重金屬種類及濃度、水溶液之pH值、電流密度、電極板數目、電極板材質等不同實驗因子下的重金屬及螯合劑之去除率，並與添加H2O2的電解Fenton法程序處理效果進行比較，以了解添加H2O2對去除的影響。本研究提出二種螯合重金屬之電膠凝反應去除模式：⑴以螯合重金屬分子型態去除及⑵螯合重金屬先經斷鍵，重金屬再以自由離子型態被氫氧根離子沉澱；並經由重金屬與螯合劑二者之去除情形，加以描述整體反應中兩種去除模式的傾向與比例。另針對本實驗反應時所消耗的電能以及去除量的計算分析，以探討各反應因子下之最小耗能參數。 以電聚浮除程序處理含單一重金屬溶液時，三種重金屬的去除率大小分別為Zn2+＞Cu2+＞Ni2+，在含有螯合劑的情況下，Zn2+和Cu2+的去除率會減少，而Ni2+的去除率會略微增加。針對螯合劑而言，在本程序中若是其單純存在，則去除率甚微，但在添加重金屬的情況下，去除率約可達到30%左右。整體重金屬去除行為推估大多都以斷鍵去除型態的比例較多，以螯合重金屬分子型態直接去除的比例佔少數。 以電聚浮除程序處理含混合重金屬溶液時，三種重金屬的去除率大小與單成份反應時有所不同，分別為Cu2+＞Zn2+＞Ni2+，經發現Zn2+的去除率比單成份反應時差，顯示水中若同時存在Cu2+或Ni2+時，會對Zn2+去除率造成競爭反應。螯合劑的去除率跟單一重金屬時的情況相差不大，去除形式的判斷大多都為斷鍵去除的比例較多。而經由單一重金屬的實驗結果得知，三種螯合重金屬的斷鍵去除比例大小依次為Zn2+＞Cu2+＞Ni2+。 以電解Fenton程序處理含混合螯合重金屬之溶液時，在三種不同的重金屬中，Cu2+之去除率隨著添加H2O2的量而減少，Zn2+則變化不大，Ni2+在H2O2使用的濃度為螯合重金屬的一倍時，去除率會增加，但在添加更高劑量時則無影響，而COD的去除率則會隨著H2O2的添加量增加而減少。

關鍵詞 : 電聚浮除程序 ; 螯合重金屬廢水 ; 電流密度

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