以連續迴流式紫外線/過氧化氫程序處理含染料及異丙醇廢水之光反應器設計研究

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摘 要

本研究旨在分別發展與建立以均相(以迴流式UV/H2O2程序(以染料及異丙醇為目標污染物)水溶液之連續環狀雙套管式光反應器設計方程式，探討模式係藉由結合光氧化系統中之反應動力、各反應成份之質量平衡方程式，以及紫外線光強度分佈模式，並經由不同反應條件(如水力停留時間、氧化劑、光反應器幾何尺寸、水溶液pH值、紫外線光強度及污染物起始濃度等)之實驗驗證，以及配合計算流體力學(computational fluid dynamics, CFD)軟體進行流場穩態分析所得之結果，進而評估光反應器設計方程式之合理性與可行性。 本研究規劃目的在於將未反應完全的氧化劑H2O2迴流再利用，達到最佳的使用效率。經由有機污染物反應速率之分析及氧化劑質量平衡之計算，在不同迴流比下，評估氧化劑及紫外線之使用效率，以做為均相高級氧化程序效能及操作條件之取決依據，並比較不同類型之有機污染物在光氧化系統中反應特性的差異，從而建立合理之光反應器設計方程式；此外，亦配合以Fluent5.0之CFD軟體進行流場穩態分析，探討反應器中流體流場分佈與有機污染物反應效率間的關連性。 實驗結果顯示，以迴流式UV/H2O2程序處理含染料Red141、異丙醇水溶液時，染料去除率隨染料本身初始濃度之降低、混合後溶液pH值之將低、紫外線光強度之提高、H2O2添加劑量之提高及光反應器內外半徑比之降低而升高，其中紫外線光強度與H2O2添加劑量為主要影響染料光氧化速率之反應因子。在迴流式UV/H2O2系統中，結合系統染料及異丙醇之反應動力式、質量守恆方程式及紫外線無限線光源模式，所推導與建立之光反應器設計方程式，可合理模擬染料及異丙醇溶液在各操作條件下之分解行為及濃度分佈情形，可做未來為光反應器設計之基礎。 關鍵詞：高級氧化程序、染料廢水、異丙醇、環狀雙套管式光反應器、設計方程式

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