

Original Articles

Heterogeneous Catalytic Ozonation of Refinery Wastewater over Alumina-Supported Mn and Cu Oxides Catalyst

アルミナ担持 Mn および Cu 酸化物触媒を用いた製油所廃水の不均一系触媒によるオゾン処理

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Abstract

An economical method was proposed to develop an efficient alumina-supported manganese (Mn) and copper (Cu) oxides (Mn-Cu-O/Al<sub>2</sub>O<sub>3</sub>) catalyst with a high surface area, 184.06 cm<sup>2</sup> g<sup>-1</sup>. The catalyst was utilized for degradation refinery wastewater by heterogeneous catalytic ozonation. The effects of various operating variables including pH, ozone and catalyst dosages, and temperature were systematically investigated in detail to obtain the optimized conditions for accelerated degradation of refinery wastewater. The optimum values were as follows: ozone dose 50.0 mg L<sup>-1</sup>, catalyst dose 3.0 g L<sup>-1</sup>, initial pH = 6.8, T = 17 °C. Refinery wastewater samples were analyzed by chemical oxygen demand (COD) and the results indicated that kinetics of COD followed a pseudo-first-order degradation. Moreover, hydroxyl radical mechanism rather than absorption was proposed, indicating that the surface hydroxyl groups were the active sites that played a significant role in catalytic ozonation.

184.06 cm<sup>2</sup>/g の広い表面積を有する効率的なアルミナ担持マンガン、および銅酸化物触媒 (Mn-Cu-O/Al<sub>2</sub>O<sub>3</sub>) 開発の経済的な方法を提案した。この触媒は、不均一系触媒オゾン処理による製油所廃水の分解に利用された。製油所廃水の分解促進のための最適条件を得るために、pH、オゾン量、触媒量、温度などの操作変数の影響を詳細に系統的に検討した。最適値は、オゾン量 50.0 mg/L、触媒量 3.0 g/L、初期 pH=6.8、T=17°Cであった。製油所廃水試料を化学的酸素要求量(COD)で分析した結果、COD の速度論は疑似的な一次分解に従うことが示された。また、吸収ではなくヒドロキシルラジカルのメカニズムが提案され、表面の水酸基が触媒的オゾン化に重要な役割を果たす活性部位であることが示唆された。

Keywords: Ozone, Advanced Oxidation, Catalytic Ozonation, Kinetics, Wastewater Treatment

キーワード: オゾン、促進酸化、触媒オゾン処理、速度論、廃水処理