Efficient degradation of nitrobenzene by an integrated heterogeneous catalytic ozonation and membrane separation system with active MgO(111) catalyst

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\textbf{ABSTRACT}

An integrated heterogeneous catalytic ozonation and membrane separation system was studied for continuous degradation of refractory organic pollutants in water. MgO nanosheets with dominant (111) facets showed large amounts of medium and strong basic sites due to the particular structure of alternating monolayers of exclusively oxygen and exclusively magnesium atoms. MgO(111) acted as the ozonation catalyst for the first time, it was found that efficient degradation of nitrobenzene was achieved with 25.0 mmol/L of MgO (111) catalysts in a wide pH range of 4.0–12.0. In view of practical application, engineering problems to recover fine size catalysts from the treated water were resolved by applying membrane separation technology in the system. Experimental results showed that the membrane could successfully intercept MgO(111) particles in the reactor by the synergistic cooperative sieving of the bare and dynamic membranes. The long-term continuous experiments demonstrated that the removal rate of nitrobenzene could maintain over 90\% with a constant flux of 3.92 L m\textsuperscript{−2} min\textsuperscript{−1} during the 24 h operation. The continuous system provides a new method for practical application of heterogeneous catalytic ozonation to remove refractory organic pollutants.

\textit{Keywords}: Heterogeneous catalytic ozonation; MgO; Membrane separation

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