

# Designing bimetallic, Fenton-like, cobalt-based catalysts on silica for advanced oxidation membrane processes

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## Abstract:

Hazardous and persistent organic dyes and antibiotics are toxic to the environment if they are not properly treated before wastewater discharge. The mesoporous cobalt oxide-silica (Co-Si) catalyst comprises of highly dispersed Co sites, has been reported in the research of the Fenton-like oxidation process to treat these organic compounds. Although, the CoSi catalyst has shown very promising results for the degradation of different model azo dyes such as Acid Orange, there has not been much research carried out for the degradation of antibiotics including tetracycline hydrochloride (TCH). In this work, CoSi catalyst with the incorporation of cerium was prepared by using sol-gel derived soft-templating technique to enhance the catalytic degradation performance of TCH. The best CoCeSi catalyst achieved a 92% removal of TCH within 30 mins using catalyst loading of 50 mg L<sup>-1</sup>, H<sub>2</sub>O<sub>2</sub> (50 mM) and NaHCO<sub>3</sub> (3.6 mM) at pH of 7-8 with a 30% higher kinetic rate value of 0.21 min<sup>-1</sup> compared to the CoSi catalyst and the literature. We will demonstrate the integration design of the CoCeSi catalyst into a continuous membrane reactor for concurrent treatment of TCH removal and water purification processes to achieve a high permeate water production and purity.

**Keywords:** Fenton-like oxidation, Tetracycline Hydrochloride, Cobalt-Cerium-Silica catalyst