



Catalytic formaldehyde removal by “storage-oxidation” cycling process over supported silver catalysts

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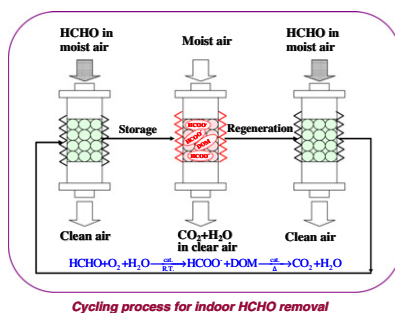
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HIGHLIGHTS

- The “storage-oxidation” cycling process for the removal of HCHO is a promising approach for indoor air purification.
- Water in fact enhances the storage capacity of the Ag–MnO_x–CeO₂ catalyst.
- The catalyst could be *in situ* regenerated without production of secondary pollutants.

GRAPHICAL ABSTRACT



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ABSTRACT

Catalytic removal of indoor HCHO was proposed to proceed in a “storage-oxidation” cycling process. Two kinds of supported silver catalysts, namely Ag/HZSM-5 and Ag–MnO_x–CeO₂, were investigated as catalysts for this cycling process. Due to the highly dispersed silver clusters formed and its good redox properties, the Ag–MnO_x–CeO₂ catalyst showed better HCHO oxidation properties in both the storage phase (HCHO partial oxidation to HCOO[−] at room temperature) and oxidation-regeneration phase (total oxidation of the formates into CO₂ and H₂O at elevated temperatures). The presence of H₂O (RH = 50%, 25 °C) was found to enhance the HCHO storage capacity for Ag–MnO_x–CeO₂ catalyst, while competitive adsorption of HCHO with H₂O was observed over Ag/HZ catalyst. The results of DRIFTS indicate that the partial oxidation of HCHO into HCOO[−] is accelerated by the presence of H₂O over the Ag–MnO_x–CeO₂ catalyst. In addition, the catalyst saturated with HCHO can be *in situ* regenerated without production of secondary pollutants and can be used repeatedly. It is suggested that this is a promising approach for indoor HCHO elimination.

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1. Introduction

Formaldehyde (HCHO), which is emitted from widely used construction and decorative materials, is one of the most common vol-

atile organic compounds (VOCs). It is recognized that long-term exposure to indoor air containing even a few ppm of formaldehyde may cause cancer or other medical conditions [1]. Consequently, significant efforts have been made to reduce indoor HCHO emissions.

Physical adsorption and/or chemical reaction with supported potassium permanganate or organic compounds has been reported but is typically effective for short periods due to the limited removal capacities and difficulty of regenerating adsorbents [2,3].

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