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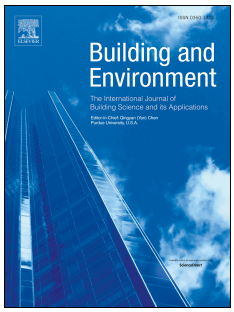

Photocatalytic degradation of VOCs on various commercial titanium dioxides: Impact of operating parameters on removal efficiency and by-products generation

Alireza Haghighat Mamaghani, Fariborz Haghighat, Chang-Seo Lee

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Photocatalytic degradation of VOCs on various commercial titanium dioxides: Impact of operating parameters on removal efficiency and by-products generation

Alireza Haghighat Mamaghani, Fariborz Haghighat*, Chang-Seo Lee

Department of Building, Civil and Environmental Engineering,
Concordia University, Montreal, Canada

Abstract

Ultraviolet photocatalytic oxidation (UV-PCO) is regarded as one of the promising technologies for indoor air remediation. The present study examines the photocatalytic activity of four commercialized titanium dioxide photocatalysts (P25, PC500, UV100, and S5-300A) in a small-scale single-pass continuous flow reactor. Challenge compounds have been chosen from two prevalent VOC families in indoor environment: toluene (aromatics) and methyl ethyl ketone (ketones). The influence of key experimental conditions including concentration (100-1000 ppb), relative humidity (0-50% at 23 ˚C), light intensity (1.25-5 $W \cdot m^{-2}$), and residence time (0.02-0.1 sec) on removal efficiency are evaluated. Due to the fact that one of the main shortcomings of PCO air purifiers is by-products generation, a special emphasis is put on identification and quantification of gaseous by-products using HPLC and GC-MS methods. The obtained efficiencies on various photocatalysts are explained considering crystalinity, crystalline phase, crystal size, surface area, and population of surface hydroxyl groups. Despite possessing lower crystalinity, PC500, UV100 and S5-300A outperformed P25 in toluene and MEK removal efficiency, primarily owed to their larger surface area, smaller crystal size, and higher

* Corresponding author, fariborz.haghighat@concordia.ca
E-mail addresses: : alireza.haghighatmamaghani@mail.concordia.ca (A. Haghighat M), chang-seo.lee@concordia.ca (C.S. Lee)