GAS-PHASE PHOTOCATALYTIC REACTOR FOR THE STUDY OF TiO_2 THIN FILM ACTIVITY

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Pure indoor air is an important resource for all living organisms to sustain life. Volatile organic compounds (VOC) are the major group of indoor air pollutants. Different techniques like incineration, bio-filtration, absorption and adsorption can be used for VOCs removal from air. All these methods have some limitations and drawbacks. TiO_2-mediated heterogeneous photocatalytic oxidation (PCO) is a promising, efficient and cost-effective technology for a degradation of a wide range of VOC that are presented in indoor air [1].

The main purpose of the current study was to test the multi-section gas-phase photocatalytic reactor performance. The design of the reactor that was used for the present experiments allows investigating the photocatalytic activity of coatings with different material properties and characteristics attached to different plane supports, although in present study experimental series were restricted to the evaluation of activity of tetrabutyl orthotitanate-based (TBOT-based) sol gel synthesized TiO_2 thin film under different working conditions. Photocatalytic reactor consists of five sequentially placed sections, accordingly the surface area of catalyst varied from 120 to 600 cm^2. The influence of residence time, air humidity, initial concentration of air pollutants and irradiation source on the PCO of methyl-tert butyl ether (MTBE) and acrylonitrile were evaluated.

The photocatalytic activity of TBOT-based TiO_2 thin film was high enough to obtain complete MTBE mineralization. Unfortunately, under studied operating conditions this TiO_2 thin film was inefficient in degradation of acrylonitrile toxic by-product HCN achieving maximum ca. 70% acrylonitrile conversion. More active photocatalytic coatings are needed for complete photocatalytic mineralization of acrylonitrile. The influence of working parameters on MTBE and acrylonitrile photocatalytic degradation will be discussed.

References

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