

Fabrication of O₂-TiO₂/CuO heterojunction photocatalyst as a nanocorals for the photocatalytic inactivation of bioaerosols

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Indoor particles and workplace aerosols has significant impact on human health and its effect depends on characteristics and nature of pollutants originating from varied sources. In recent years, outbreaks of middle East respiratory syndrome-associated coronavirus (MERS-CoV), severe acute respiratory syndrome (SARS), COVID-19 and its recent variants (e.g., Delta and Omicron) has attracted the global attention for the airborne microbial prevention and control measures (Lu et al., 2021; Zacarías et al., 2020; Zacarías et al., 2021). Therefore, for protecting the public health effective air sterilization and purification are critical to mitigate the challenges of airborne pathogen transmission (Liu et al., 2023). In this regard, photocatalytic disinfection was performed for the purification of indoor air in a continuous flow reactor and its performance was evaluated. Herein, the O₂ doped TiO₂/CuO nanocrystalline materials was synthesized as a novel photocatalyst for the disinfection of *Serratia marcescens* as an airborne bacterial model. Various properties of the synthesized photocatalyst was characterized using different characterization techniques such as XRD, XPS, SEM-EDX, Raman spectroscopy, diffuse reflectance spectroscopy, and photoluminescence spectroscopy. The study showed that maximum disinfection of 95.21% and 58.82% was achieved under photocatalytic and photolytic processes at optimal conditions. Thus, the study revealed that O₂-TiO₂/CuO photocatalyst has tremendous potential for the disinfection of *Serratia marcescens*. The possible reason for the disinfection was the active participation of reactive oxygen specieses (OH• and O₂•-) disrupting the genetic materials as well as the cell wall of bacteria. Consecutively, it also restricts the bacterial regrowth which usually happens in case of photolytic treatment (Negishi et al., 2023). Now, due to poor maintenance of heating, ventilation and air conditioning (HVAC) systems of different indoor settings, excessive dirt may be collected and serve as a breeding ground for the microorganisms. Therefore, economical and effective inactivation of bioaerosols and air cleaning systems are needed and this study could provide the possible solutions to these problems.

Keywords: Bioaerosols, Heterojunction photocatalyst, Photocatalysis, Reactive Oxygen Species (ROS).

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