ABSTRACT:

Tuning the Visible-Light-Drive Photocatalytic Properties of Multi-Decorated TiO2 by Noble Metals Nanoparticles NPs Towards Both Propionic Acid and Nox Degradation

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Unpleasant odors are the most disturbing pollutants and the main reason for air quality complaints in urban and industrial areas. Besides, nitrogen oxide (NOx) emissions represent one of the most hazardous air pollutants, causing environmental and health problems, contributing to ground-level ozone, global warming, acid rain, and urban smog [1]. Among the many technologies available, photocatalysis carried out under solar or artificial light has been widely applied to address many air, and not only, pollution issues [2]. First discovered by Fujishima and Honda [3], TiO2 applications in water and air purification under UV irradiation have multiplied so far: to extend its photo-response to the visible region, thus improving TiO2 photocatalytic performance, surface modification with noble metals nanoparticles (NPs) has been studied as an efficient approach [4]. Nevertheless, noble metals' high prices and resource shortage limit their applications. In the present research we report the employ of multiple noble metals-modified micrometric TiO2-based photocatalysts, prepared by a cheap and sustainable approach based on the use of metal-enriched wastewaters (Ag, Au, Pt) and used for the photodegradation of propionic acid (PA) and NOx under LED irradiation. Properly tuning the metal decoration step, the photoactivity of the materials was optimized: in particular, 0.1%Pt @Ag/TiO2 led to 60% PA removal, whereas the strong PA adsorption on the 0.1%Au @Ag/TiO2 surface caused a partial deactivation. In contrast, 0.1%Au @Ag/TiO2 showed the highest photoactivity in the NOx decomposition (90%) due to the high tolerance of Au to HNO3 produced on the catalyst surface.

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