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Cutting-Edge Perovskite Photocatalysts synthesized by Ultrasound: A Game-Changer in Air Pollution Control

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Air pollution caused by odor molecules is one of the most pressing issues in modern society due to industrialization and urbanization growth. Over the years, many efforts have been done to overcome the aggravating impact of odors on public health and daily life quality. For instance, photocatalytic-based advanced oxidation processes (AOPs) [1], and adsorption by materials with large specific surface area [2] have attracted significant attention among various control techniques available. Photocatalytic oxidation, in particular, can destroy the structure of odor substances to achieve an efficient removal without creation of secondary pollutants. In this work, photodegradation of two volatile organic compounds responsible for odors, particularly propionic acid and ethanol, were studied under LED and UV light irradiation (to simulate both internal and external environments).

A series of non-noble metals-doped $SrTiO_3$ perovskite photocatalysts were fabricated through an efficient method by an ultrasound assisted procedure. Bismuth, iron, and bimetal BiFe were selected as dopants to enhance the photoefficiency of the perovskite. Although the samples did not show notable photoactivity under the LED irradiation, when irradiated by UV light, the Bi-$SrTiO_3$ exhibited an exceptional efficiency in removing both of the pollutants, achieving 100% of ethanol and >70% of propionic acid degradation, in less than 2 hours. These outstanding results are due to the successful doping of $SrTiO_3$ with bismuth that has narrowed the bandgap energy by formation of additional energy levels, allowing more efficient light absorption and electron/hole pairs generation. Moreover, the additional energy levels facilitate the electron/hole separation, leading to enhanced charge carrier mobility and improved photocatalytic activity.

References

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