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PII: S0926-3373(17)31212-2
DOI: https://doi.org/10.1016/j.apcatb.2017.12.063
Reference: APCATB 16298

To appear in: *Applied Catalysis B: Environmental*

Received date: 30-10-2017
Revised date: 20-12-2017
Accepted date: 23-12-2017

Please cite this article as: Judith Ouwehand, Erik Van Eynde, Els De Canck, Silvia Lenaerts, An Verberckmoes, Pascal Van Der Voort, Titania-functionalized diatom frustules as photocatalyst for indoor air purification, Applied Catalysis B, Environmental https://doi.org/10.1016/j.apcatb.2017.12.063

Titania-functionalized diatom frustules as photocatalyst for indoor air purification

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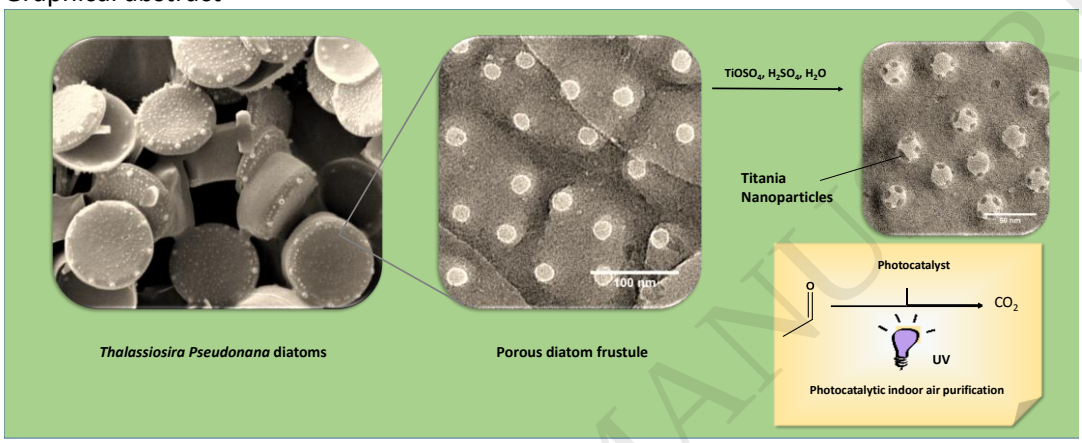
Graphical abstract



Highlights

- Silica frustules were extracted from diatoms, with a high surface area of 115 m²/g.
- The frustules were functionalized with titania nanoparticles.
- These materials are active in the photocatalytic degradation of acetaldehyde.
- The materials perform well in humid air for 48 hours of continuous reaction.

Abstract

Diatom frustules were extracted from the species *Thalassiosira pseudonana* and functionalized with titania to be used as photocatalysts in the abatement of acetaldehyde. The synthetic procedure is water-based and environmentally friendly. The synthesis parameters were optimized to give the highest possible photocatalytic activity. The optimized material, visualized with TEM and STEM-EDX, shows the TiO_2 nanoparticles grafted inside the frustule pores, as well as on the silica surface. The titania particles, stabilized by the frustules, are 2.5 times more active than the P25 benchmark material. The photocatalyst is then tested in conditions of elevated relative humidity, to simulate indoor air. The catalytic activity only shows a minor decrease at 50% relative humidity, which is a better result than for the P25 benchmark. When tested over an extended period of time, the photocatalyst only shows a minor decrease in activity.

Keywords

Titania, diatom frustule, photocatalysis, acetaldehyde degradation