

Title:

Application of semiconducting nanoparticles supported on fibers for industrial dyes removal by photocatalysis

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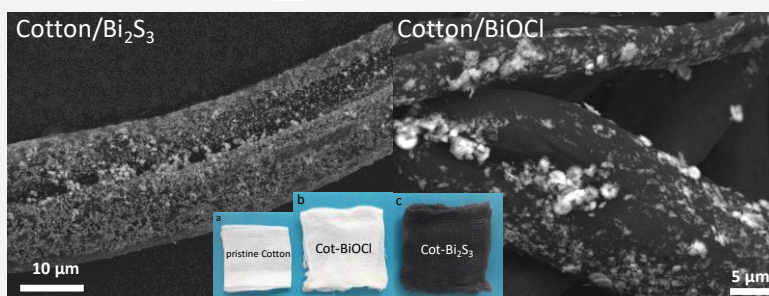
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Abstract:

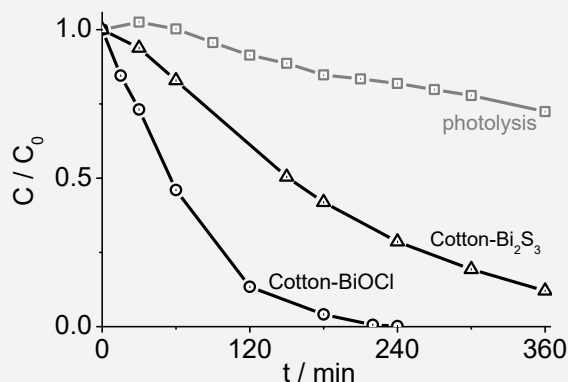
This work aimed to stably support semiconducting nanoparticles (NPs) onto fibers envisaging the preparation of photoactive hybrid materials for application in environmental remediation and facilitate catalyst recovery. Here, bismuthoxychloride (BiOCl) and bismuthsulphide (Bi₂S₃) NPs supported on cotton fibers have been successfully used for collagen dye removal by adsorption and photocatalytic degradation under light irradiation.

The cotton surface was modified using *in situ* straightforward methodologies by precursors impregnation followed by synthesis in water at RT (Cot-BiOCl), and acetone at 56°C (Cot-Bi₂S₃). The morphological, structural and optical characterisation was performed using several techniques including XRD, DRS, TEM and SEM. Both samples display similar surface loading of NPs.



SEM images for Cotton-Bi₂S₃ and Cotton-BiOCl samples. Inset pictures: pristine and modified cotton fibers.

The as-prepared Cot-BiOCl absorbs mainly in the UV range whereas Cot-Bi₂S₃ and BiOCl (after sensitisation) absorbs in the UV and visible regions. The Bi₂S₃ modified cotton shows excellent dye removal by adsorption, while the Cot-BiOCl displays improved photocatalytic response under UV-vis light removing all collagen dyes studied. Further advantage is taken from the Cot-BiOCl allowing the dyes removal under visible light due to the formation of oxygen vacancies on the catalyst surface. The high activity of those materials under UV and visible radiation enabling the efficient use of solar light, together with an easy and fast catalyst recovery, has more economical viability for application in industrial pollutants removal under solar light.



Time profile for a dye degradation under visible light irradiation.

Therefore, the use of supported semiconductor catalysts proved to be a promising and suitable approach for future wastewater treatment technologies to be applied for pollutants removal by combined adsorption/photodegradation methodologies with advantage on catalyst recovery.

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