Development of Low-cost Titania-based Photocatalysts for Enhanced Solar Disinfection (SODIS) of Water in Rural India

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Introduction

***Photocatalysis* – The process of using light in the presence of a semiconductor material to initiate a reaction to breakdown contaminants in water, such as hazardous chemicals and pathogens.**

Potential to be an excellent water treatment method, as it is less chemically intensive than conventional methods (e.g. chlorination) and safe to conduct.

However, there is **still a disconnect between academic advancement and practical application regarding photocatalysis in rural settings.**

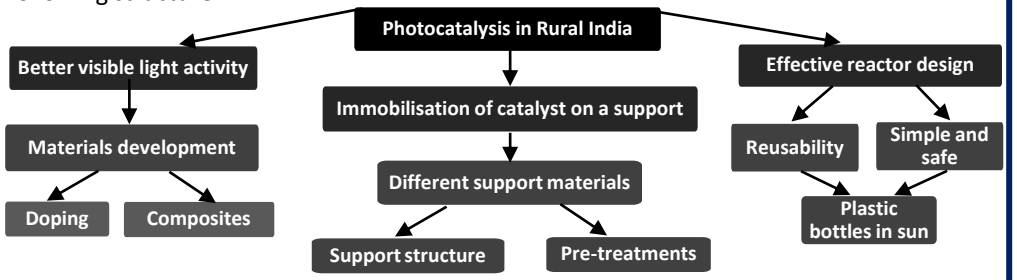
This research aims to **bridge this gap**, by developing photocatalytic materials that are safe, inexpensive, re-usable and stable, and apply them to the context of an enhanced solar disinfection (SODIS) method.

Field testing is also a crucial part of this research, taking the materials out of the lab and into real-world use.

Scan to read more about SODIS and photocatalysis

Methods

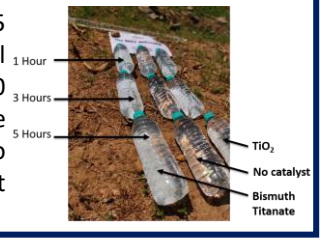
Lab-based research to develop a highly functioning photocatalyst based on the TiO_2 (which is very effective only under UV light, just 5% of the solar spectrum) takes the following structure:



Once chemical and microbial testing in the lab is complete and a promising material found, field testing can take place. Tests on a novel material (bismuth titanate) were conducted at the Indian Institute of Technology Kharagpur.

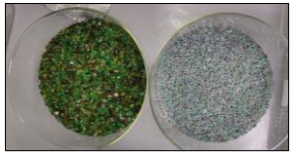
Scan to read more about field testing in India!

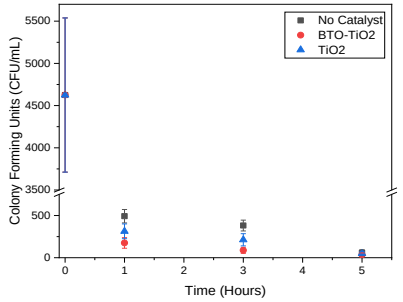
Tests were performed by collecting 5 different samples of water from local rural villages, which were placed into 500 mL plastic bottles containing the catalysts. These were then exposed to sunlight, and the bacterial content tracked.



Results

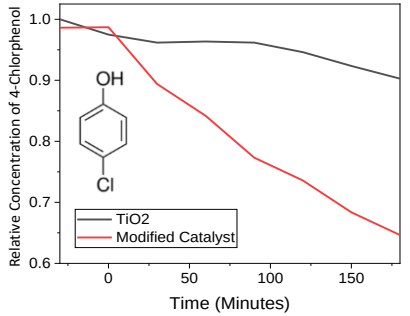
Immobilisation of the catalyst onto recycled glass chips, rather than previously used smooth glass beads, improves adhesion, reduces the extent of chemical treatment needed, and lowers costs.





From initial field tests, it was shown that the enhanced bismuth titanate material performed well, and better than the commercial TiO_2 photocatalyst, and almost all bacteria was removed after 5 hours sunlight exposure.

New materials developed to improve upon the ones taken to India also show promise, and have simpler synthetic routes. The fall in concentration of an organic pollutant during treatment is shown here.



Scan to read more about my published work on the Hydro Nation Scholars website!

Acknowledgements

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Future Work

Continue materials development and immobilisation testing in the lab
More in-depth microbial studies
Follow-up field placement with new materials