# Field Testing of Low-cost Titania-based Photocatalysts for Enhanced Solar Disinfection (SODIS) in Rural India

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## Introduction

- To widen access to safe potable water in rural areas, many novel photocatalysts have been developed, with the potential to be used in conjunction with simple solar disinfection (SODIS) techniques, showing successful removal of a range of contaminants.
- However, it is often the case that investigations into new photocatalytic systems are limited to laboratory tests, which do not take into account many practical limitations of real-world conditions.
- We have conducted tests under sunlight using real water sources from rural villages in India to verify the results of successful laboratory tests on a novel photocatalyst (bismuth titanate and titania mix: BTO-$TiO_2$).
- It was found that BTO-$TiO_2$ showed better performance under solar irradiation relative to titania or SODIS alone, consistent with our lab studies.
- Areas for further optimisation before the technology can be effectively implemented were also highlighted

*Figure 1 – Water sources used for the study*

## Methods

Water samples were collected from rural villages that are used daily for drinking purposes. Figure 1 shows the five samples used. Testing involved filling plastic bottles with the relevant water sample and exposing to sunlight. The following treatment methods were tested using each of the five water samples:

- $TiO_2$ catalyst in 500 mL water
- BTO-$TiO_2$ catalyst in 500 mL water
- No catalyst (SODIS only)

The catalyst used was immobilised on glass beads to prevent the need to recapture the powder after use. 45g of beads were used in each bottle, which gave approximately 0.2g of immobilised catalyst in the system.

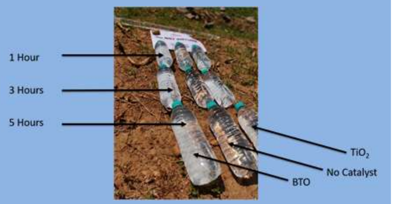


*Figure 2 – experimental set-up*

The bacterial content was measured before and after treatment.
This was repeated for 1, 3 and 5 hours to track the fall of bacteria with time.
This is shown in Figure 2.

## Results

The enhanced catalyst (BTO-$TiO_2$) showed the lowest average colony counts across all water samples and treatment types after 3 hours in sunlight.

The enhanced catalyst had a faster rate of degradation and reached the lowest bacterial content after 5 hours in the sunlight.

Turning the bottle containing catalyst at 15 minute intervals increased the rate of degradation, which can easily be implemented to reduce treatment time.

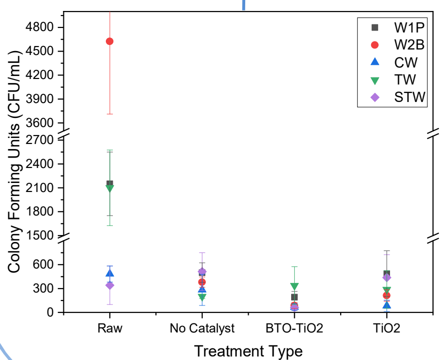


*Figure 3*

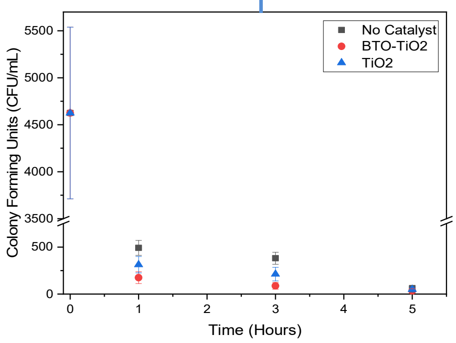


*Figure 4*

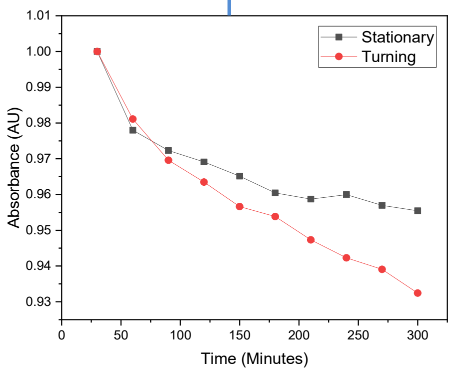


*Figure 5*

## Future Work

Follow-up trips to India will take place to continue this work. During these trips, more robust testing will be conducted on:

- The analysis of the photocatalysts' abilities to remove microbial content (more thorough profiling of contaminant types)
- The long-term stability of the catalysts and the robustness of the coating
- The best support material to coat the catalysts onto
- Further chemical modification to further enhance the photocatalytic activity under visible light illumination, using only low-cost and safe materials.

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