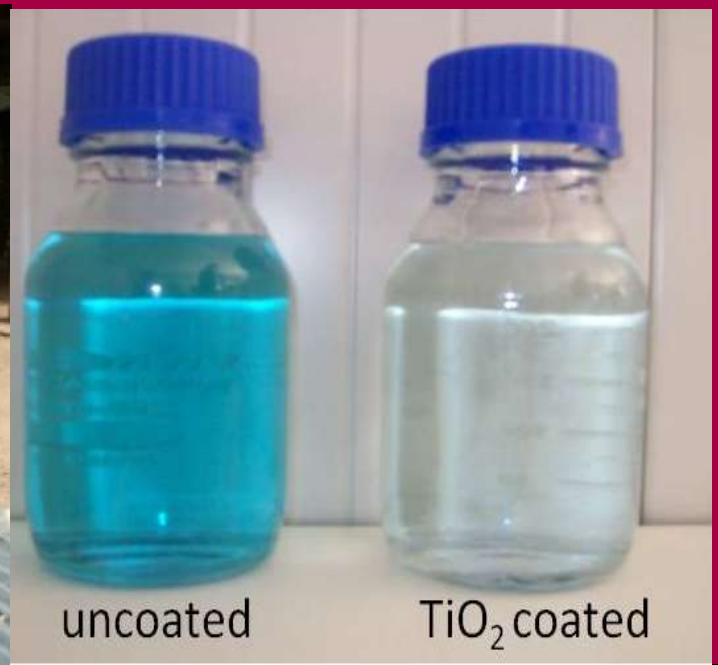


Solar photocatalysis experiments at PSA DETOX-DESINF facilities

McGuigan K.G., Pillai S.C., Fisher M.B., Keane D.A.,
Fernández-Ibáñez P., Colreavy J., Hinder S. J



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Royal College of Surgeons in Ireland, Dublin 2, Ireland
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SOLAR DISINFECTION

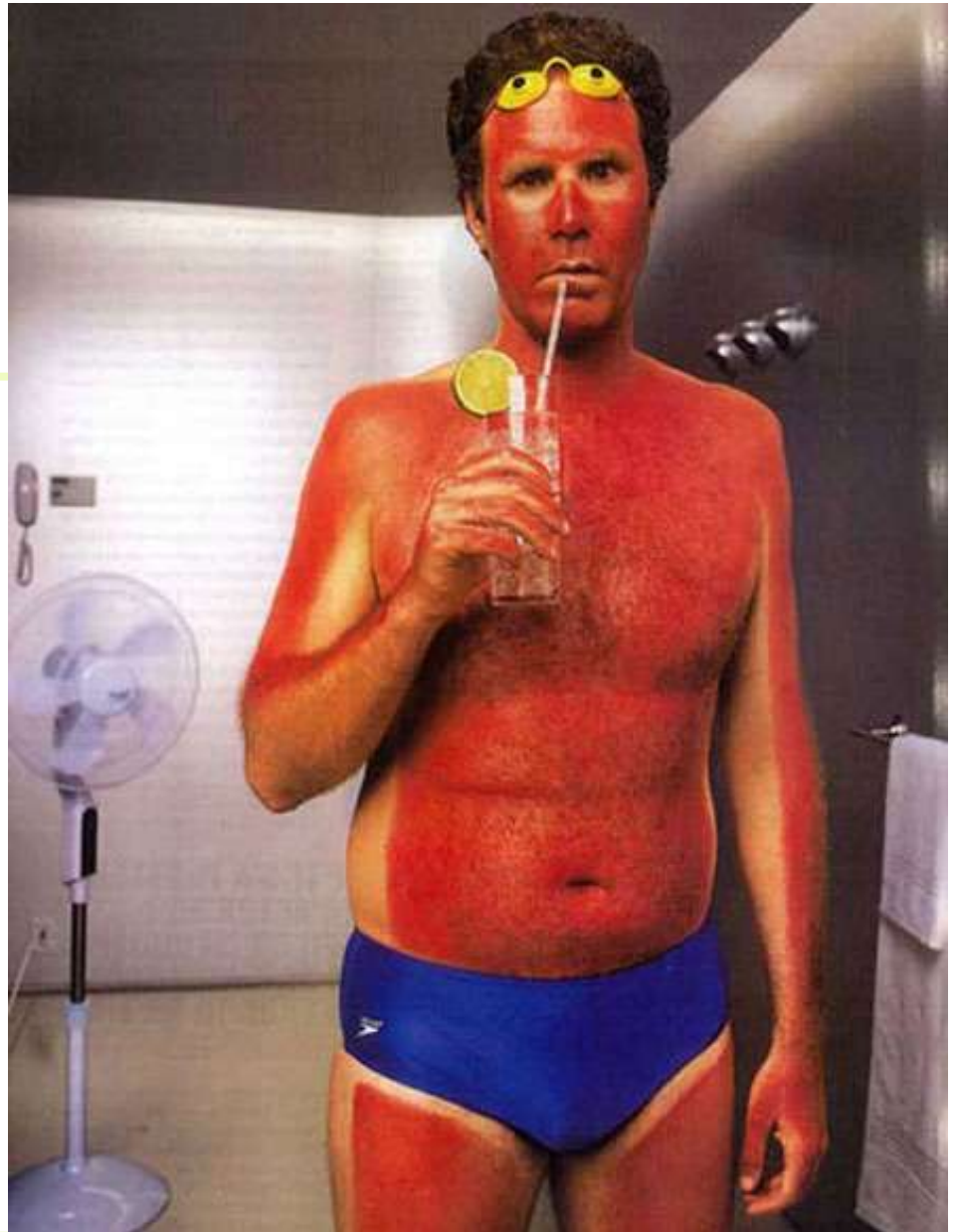
A Point-of-Use Household Water Treatment



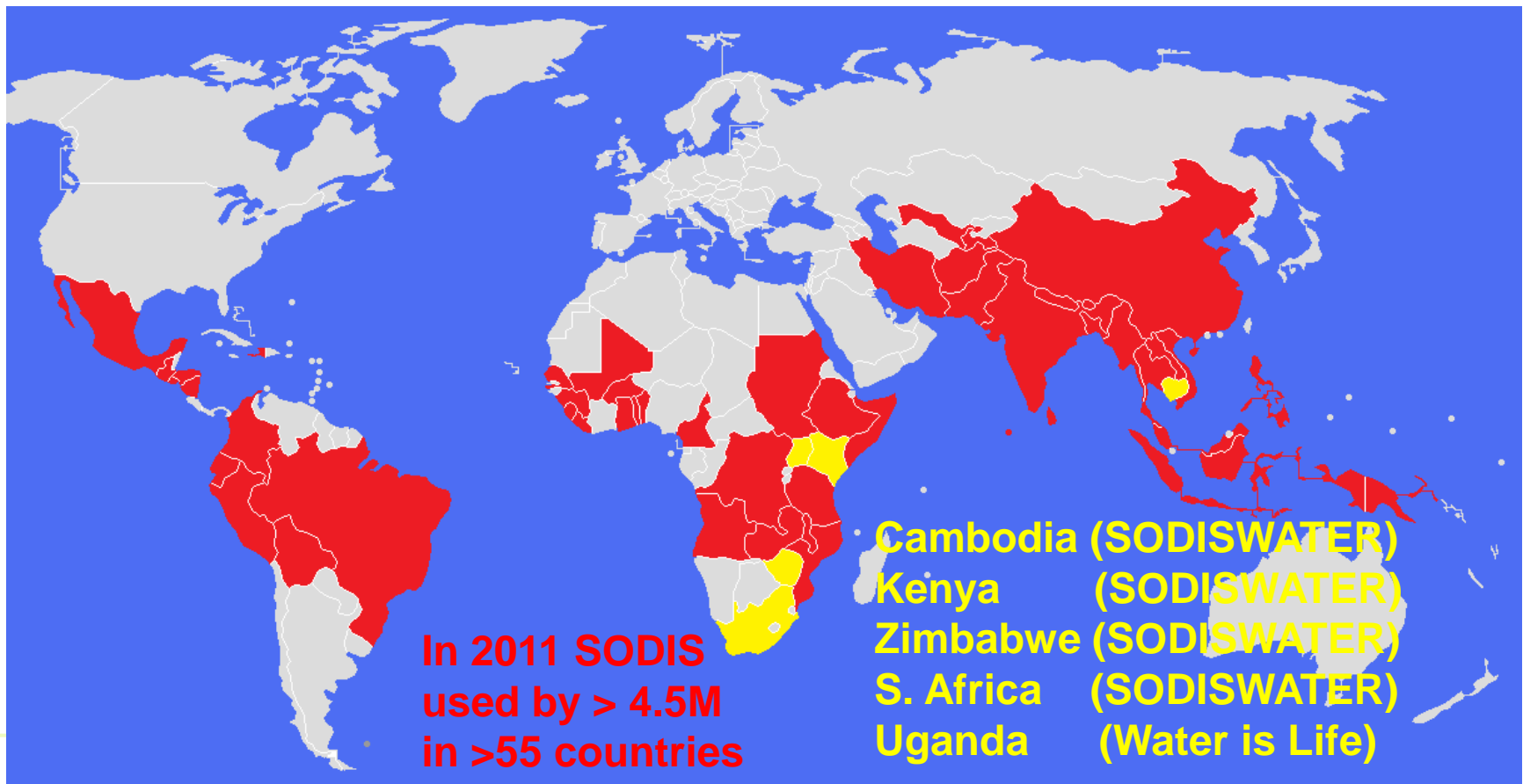
How does SODIS work?

Thru a synergistic combination of
(i) Direct UV damage to the cell membranes and DNA.

(ii) Thermal inactivation



SODIS Usage

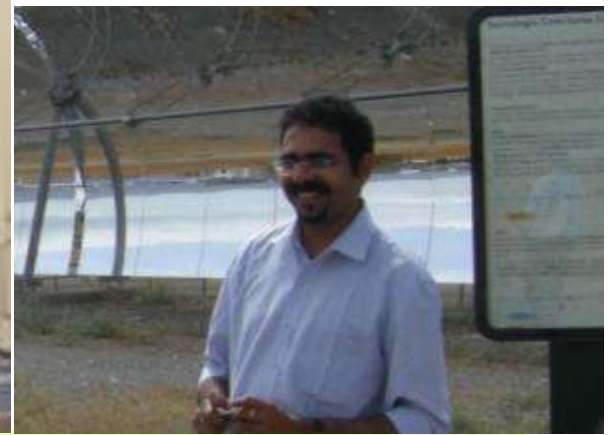


SFERA Project - Evaluation of Photocatalytically coated solar disinfection (PHOTOCAT-SODIS) reactor/bottle

- Joint RCSI, Dublin Institute of Physics project.
- Field test visible-light activated photocatalytic coatings.
- Enhancement technology for speeding up SODIS.
- Based in PSA-CIEMAT, Spain



SFERA Team



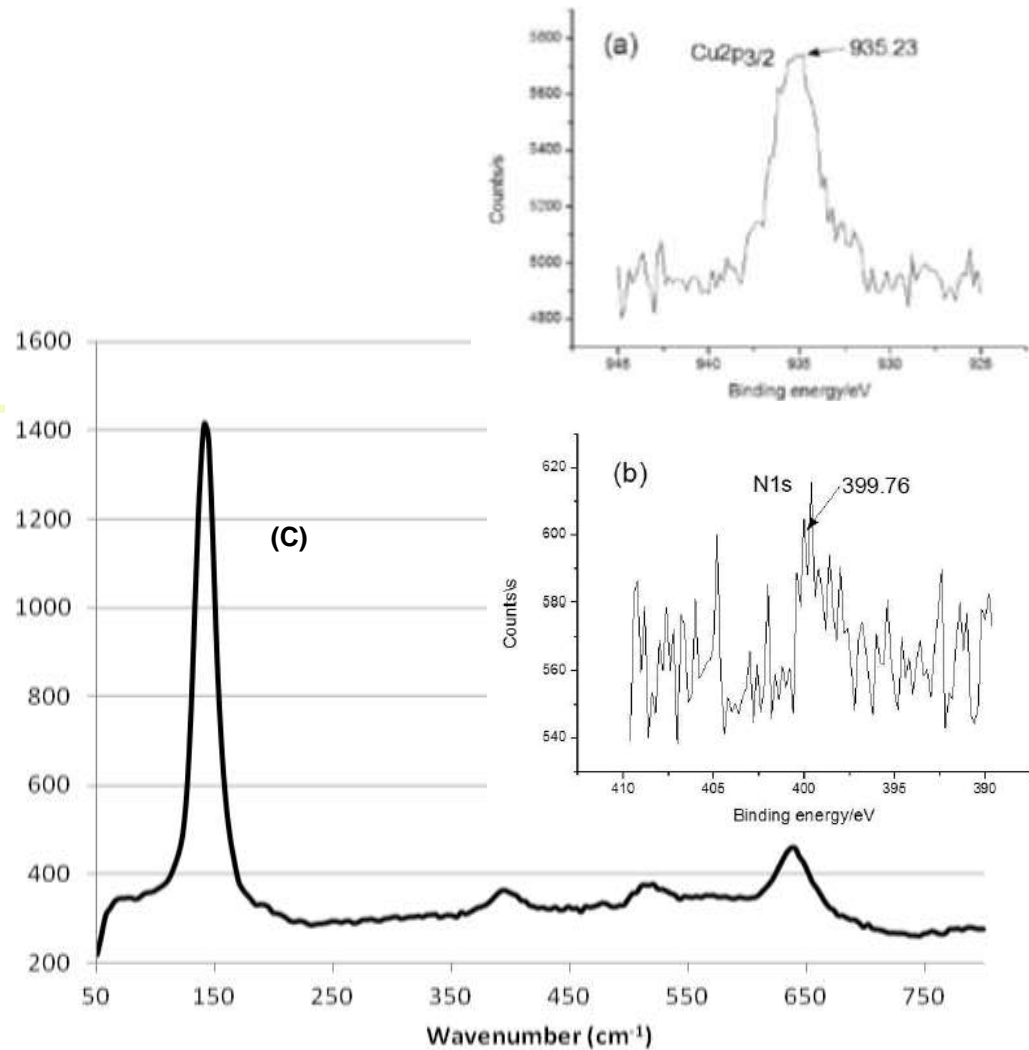
- RCSI, Dublin 2, Ireland.
Kevin McGuigan,
Mike Fisher
- CREST, FOCAS, DIT, Dublin 8, Ireland.
Suresh Pillai,
Donal Keane
- PSA-CIEMAT, Spain
Pilar Fernandez-Ibanez



Titania Coating

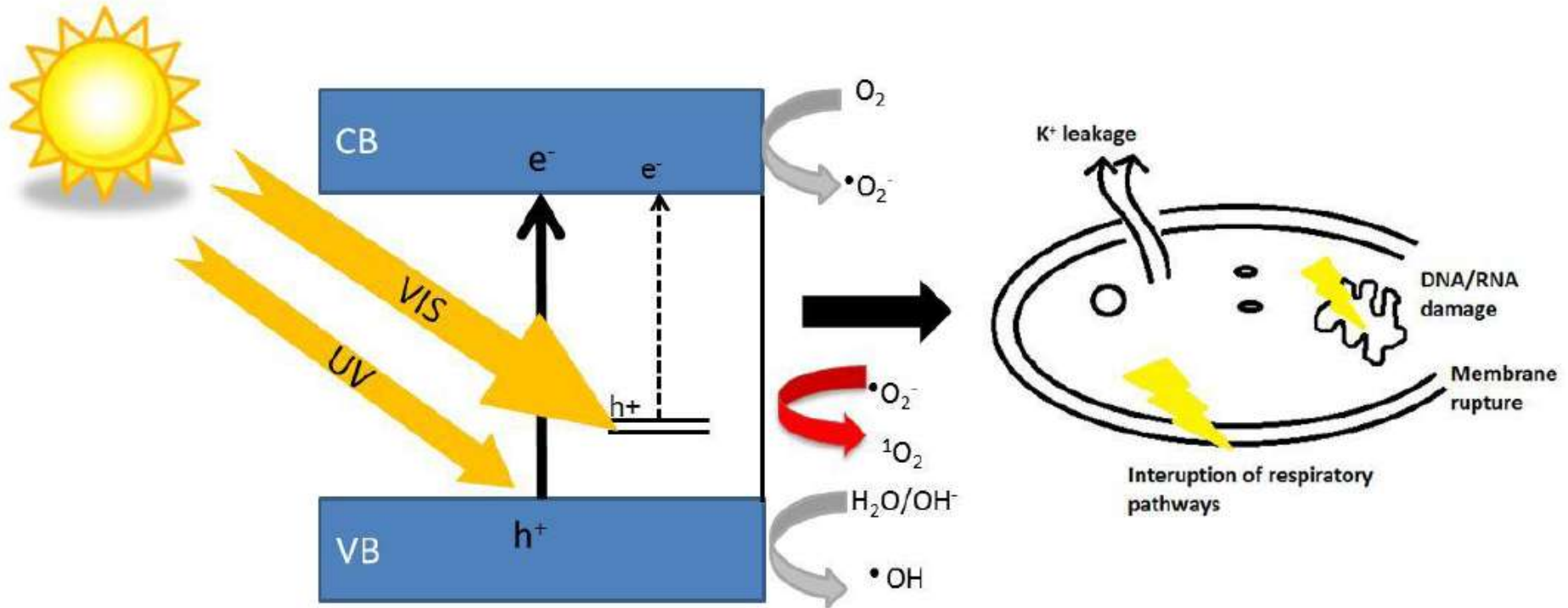
Cu- and/or N- doped sol-gels used to coat standard Durian glass bottles.

(Song *et al.* J. Am. Ceram. Soc., 91 (2008) 1369-1371.)



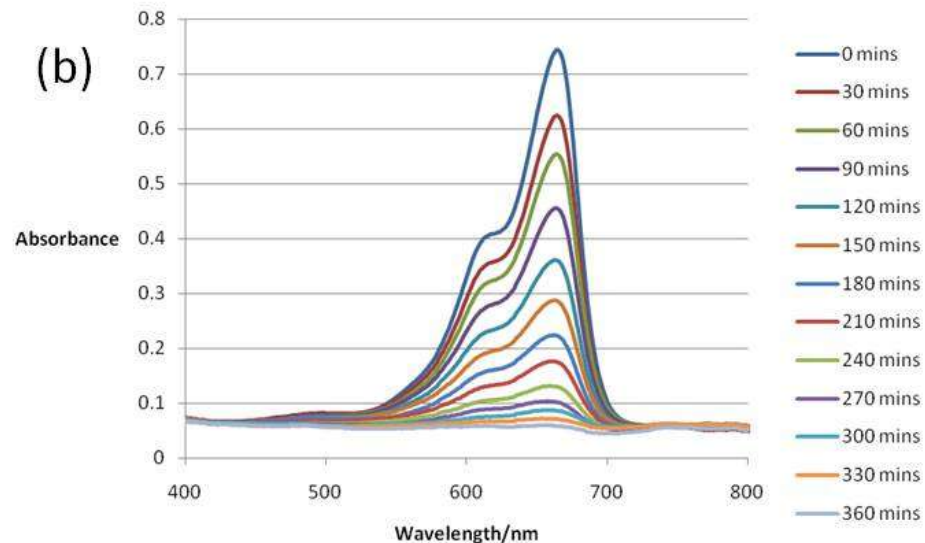
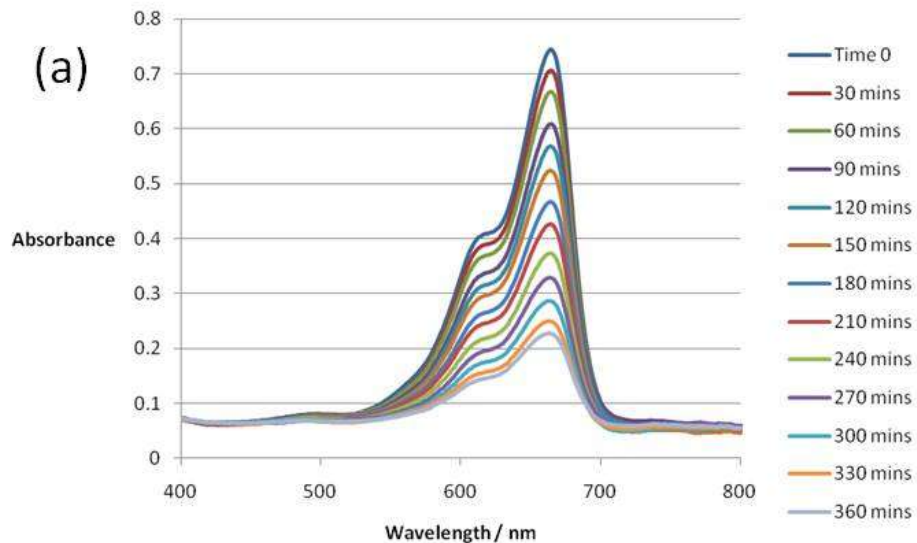
X-ray photoelectron spectroscopy plot of TiO₂ thin films (a) Cu 2p_{3/2} peak in 1 mol % Cu-doped TiO₂ (b) N 1s peak in 100 mol % N-doped TiO₂. (c) Raman spectrum of a thin film annealed at 450 °C clearly shows four bands located at 141, 394, 517 and 637 cm⁻¹, characteristic of the anatase crystalline phase of TiO₂.

Visible Light Activated Photocatalytic Solar Disinfection (PHOTOCAT-SODIS)

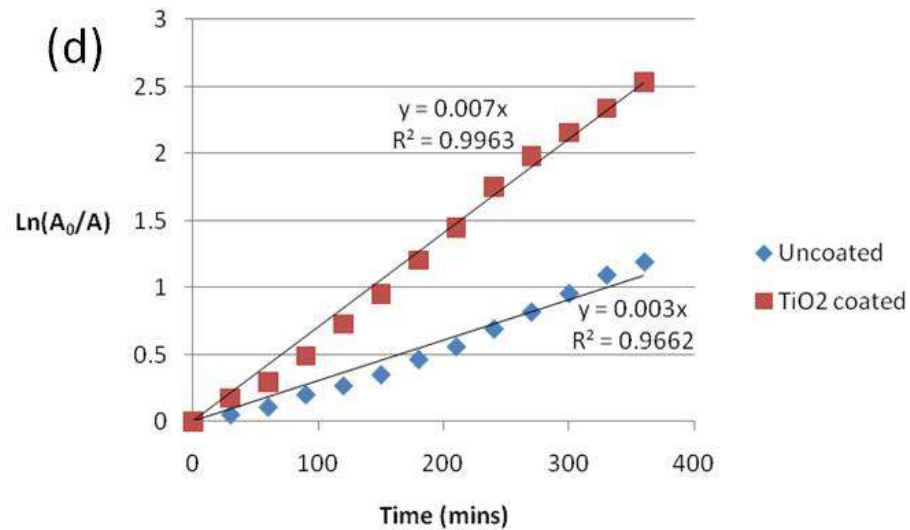


uncoated bottle

coated bottle



After 6 Hours



Solar Exposures

Bottles were filled with sterilized well water, inoculated with 10^6 c.f.u./ml. populations of *E. coli* or *E. faecalis* and set out in the sun.

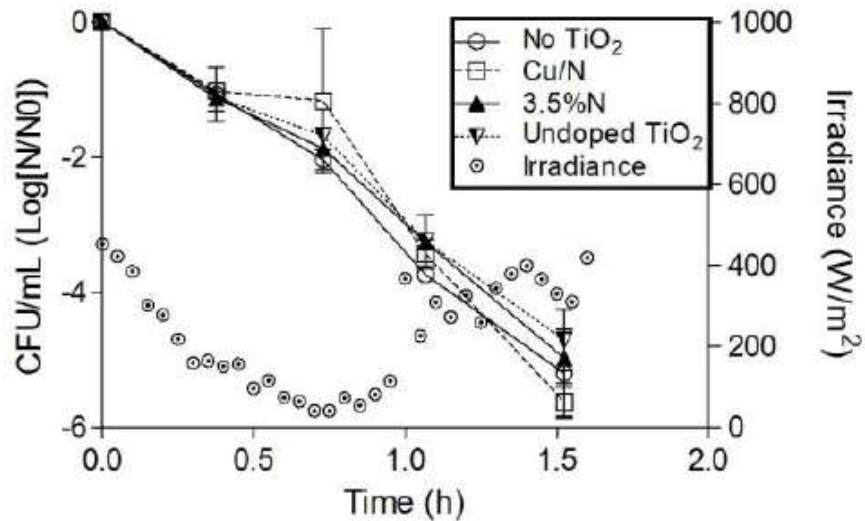
Half of bottles were covered with a UV-blocking acetate filter.

Controls were kept in the dark at room temp.



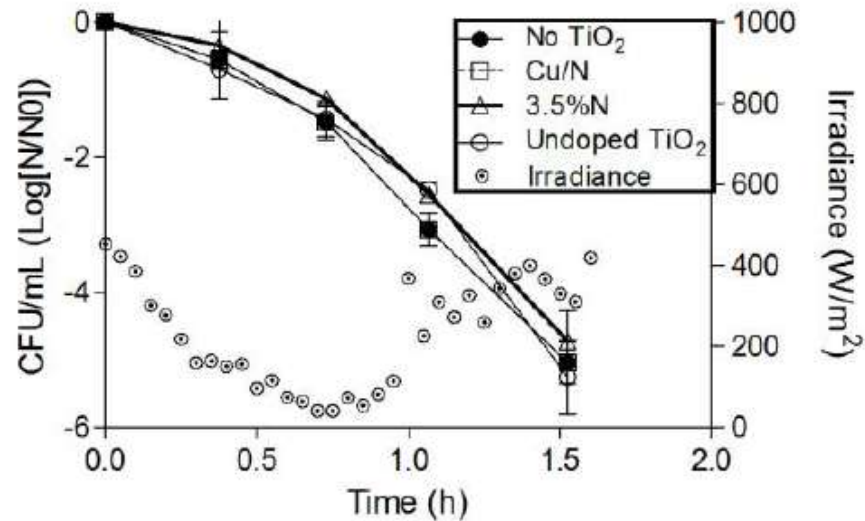
E. coli, Full Sunlight

(a)

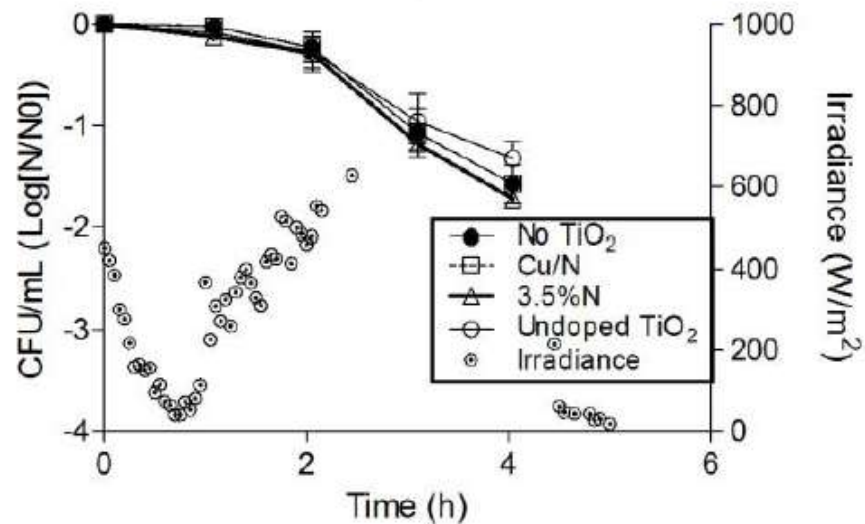


E. faecalis, Full Sunlight

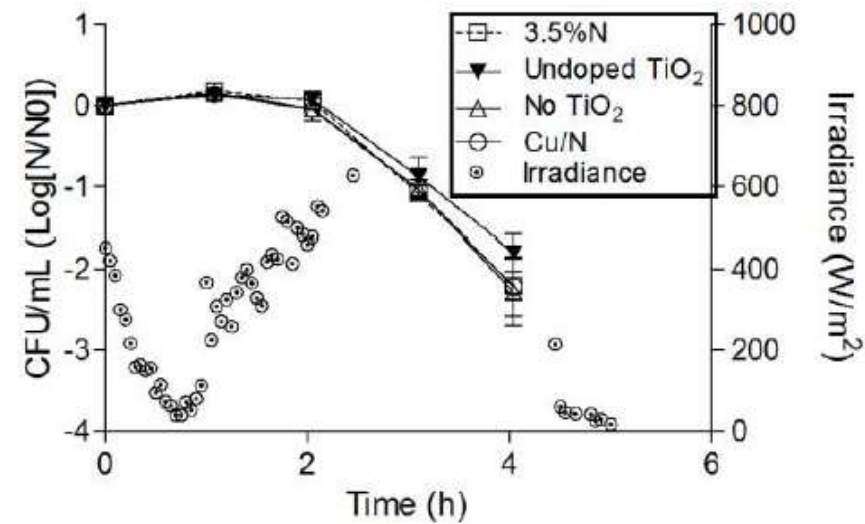
(b)



(c)



(d)

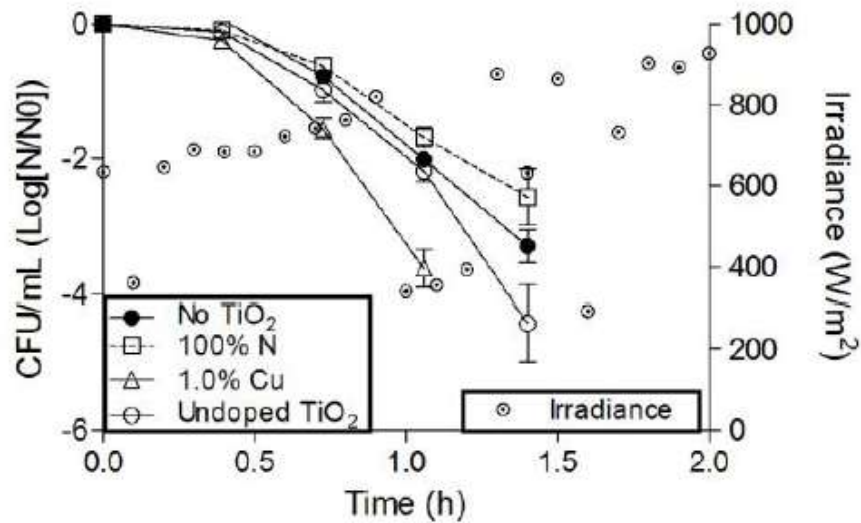


E. coli, No UV

E. faecalis, No UV

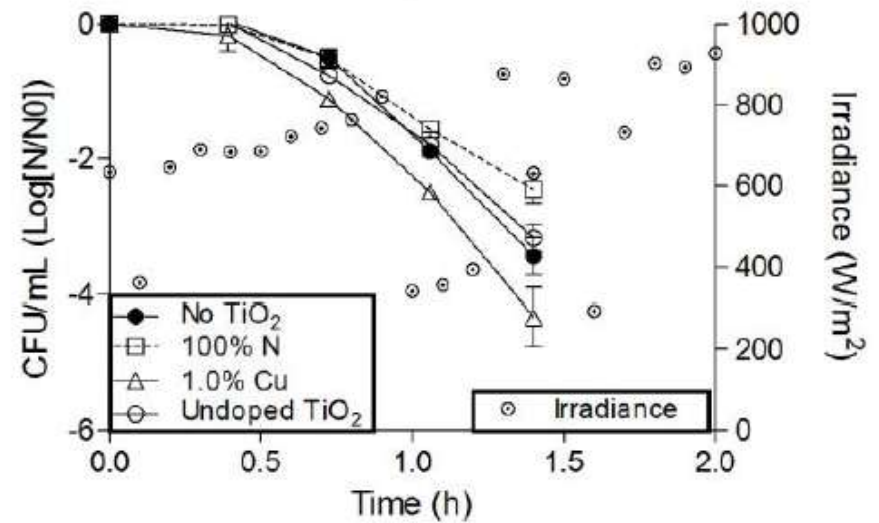
E. coli, Full Sunlight

(a)

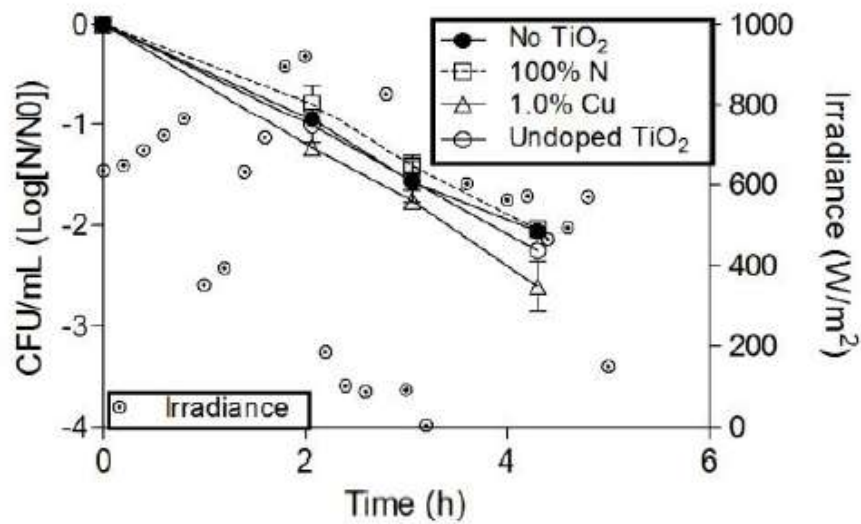


E. faecalis, Full Sunlight

(b)

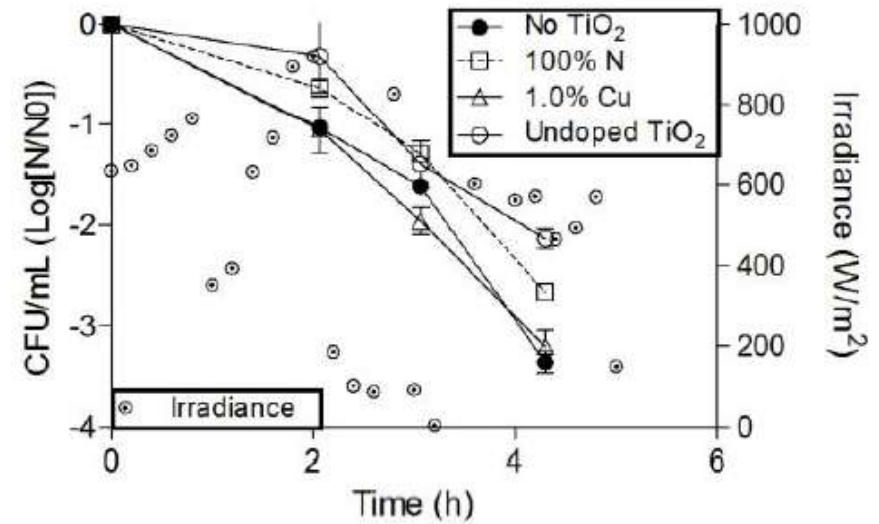


(c)

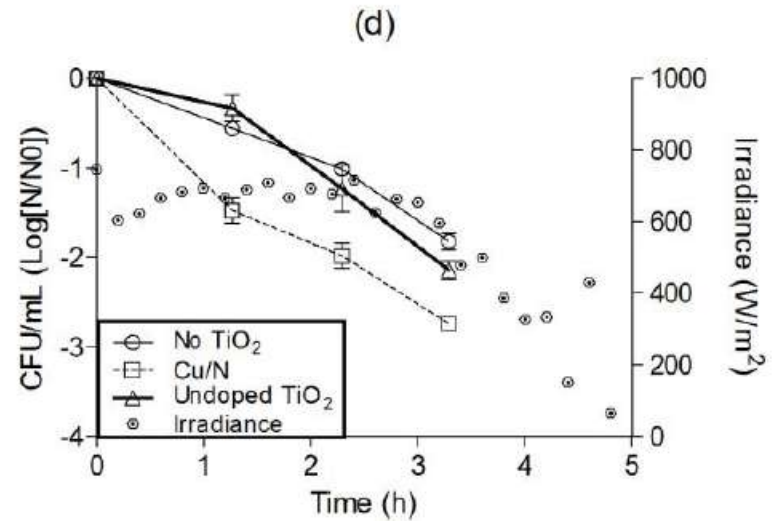
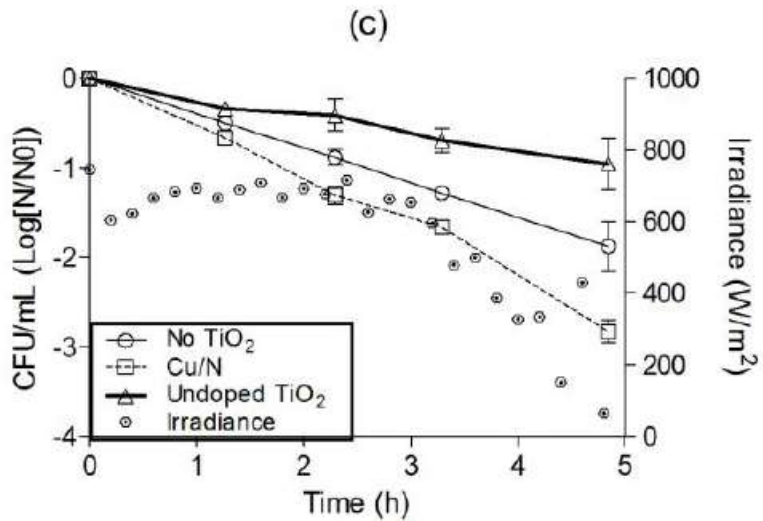
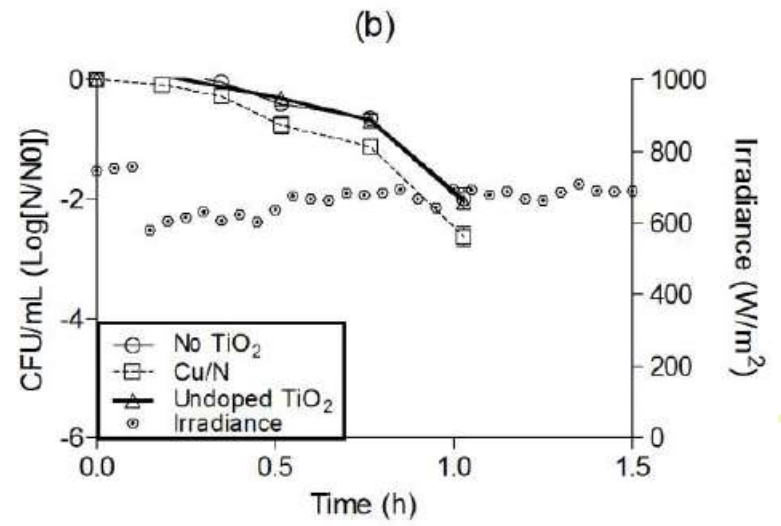
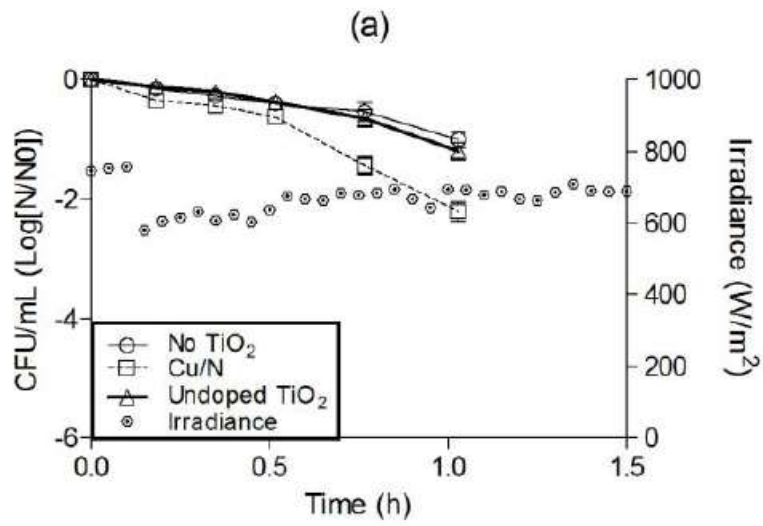


E. coli, No UV

(d)



E. faecalis, No UV



3-mm glass beads coated with undoped TiO₂ thin films and films doped with 1% Cu/3.5% N. (a) *E. coli*, full sunlight (b) *Enterococcus*, full sunlight (c) *E. coli*, no UV (d) *Enterococcus*, no UV

Conclusions

- Cu-doped VLAT-coated bottles appeared to demonstrate improved bacterial photoinactivation relative to undoped titania.
- Coated Glass beads more favourable configuration than coated bottle.
- Problem remains bringing bacteria in contact with photocatalyst (Mass Transfer)

ACKNOWLEDGEMENTS



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