Fall 12-1-2012

Engineering Titanium Dioxide Nanoparticles for Bacterial Biofilm Treatment

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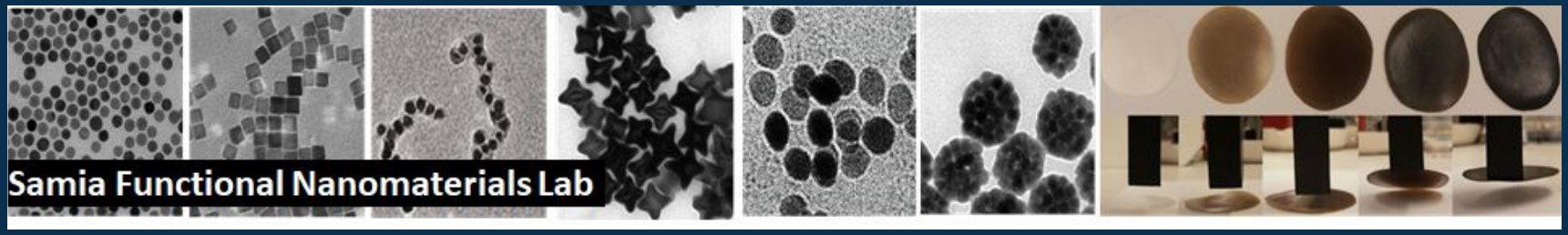

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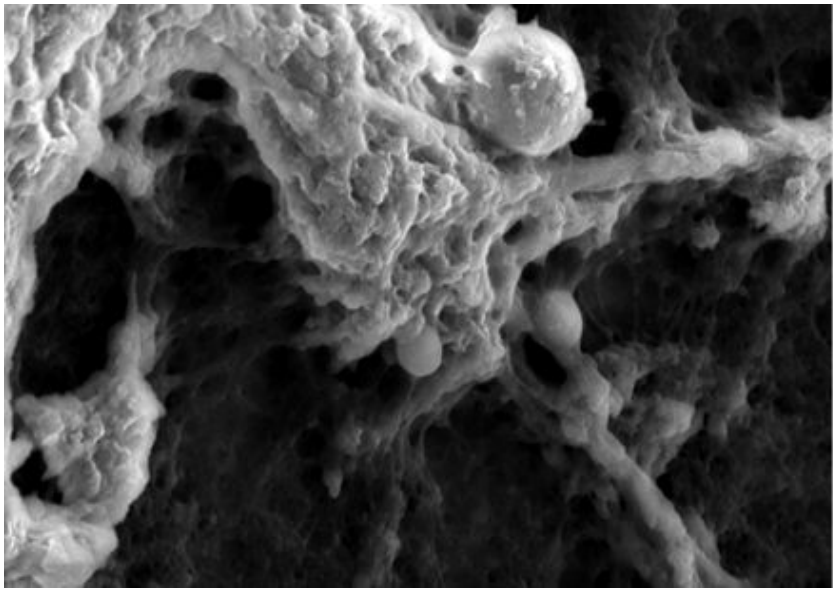
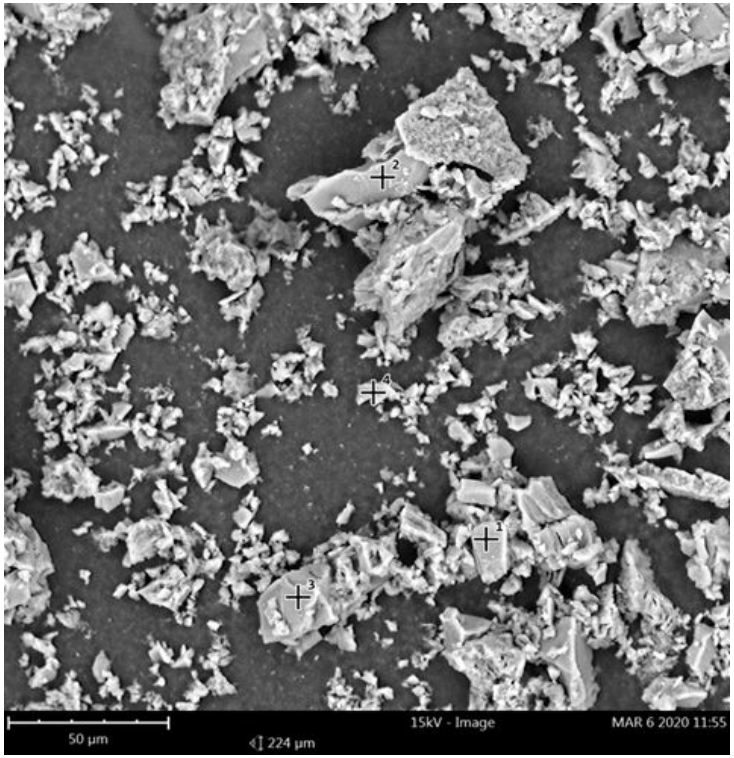
Bacterial Biofilms

- Biofilms are layers of microorganisms that have adhered to biological or nonbiological surfaces.
- The extracellular polymeric matrix resists the host immune response and prevents antibiotics from reaching the bacteria cells.
- *Streptococcus mutans*, is the most common of these bacteria, resulting in dental caries and periodontal disease. Poor oral health increases the risk of cardiovascular diseases

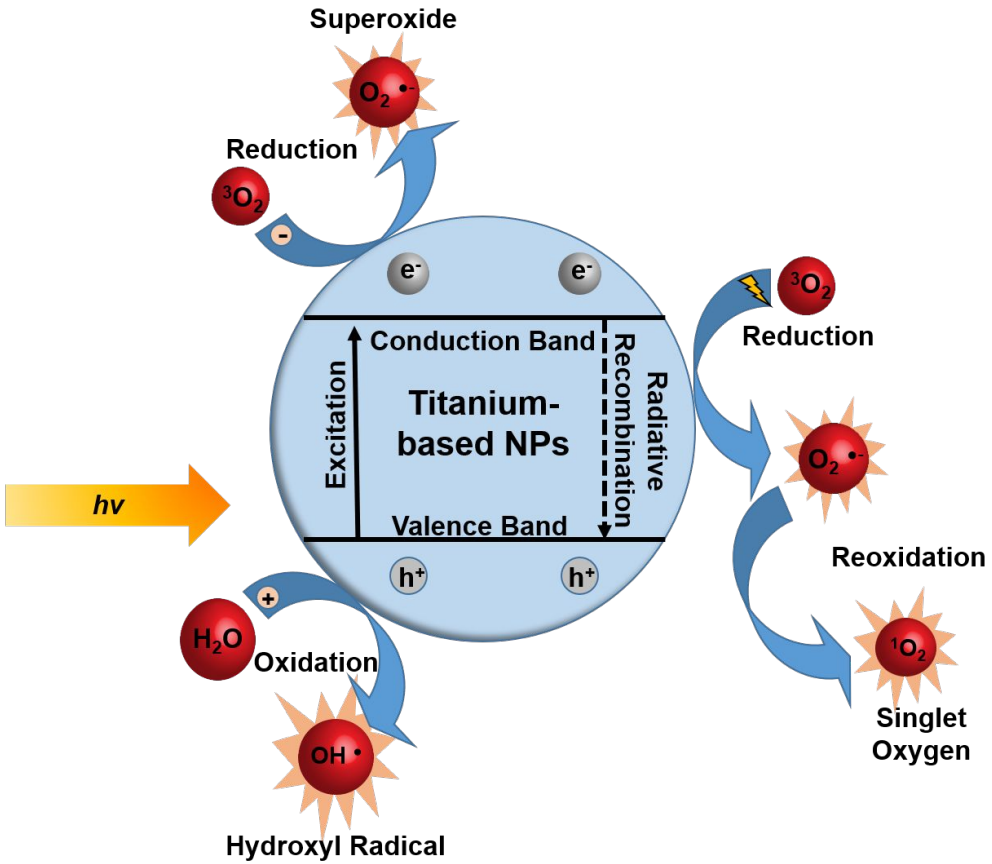


Titanium Dioxide Nanoparticles

- Titanium dioxide nanoparticles (TiO2 NPs) are non-toxic and biocompatible materials.
- TiO_2 possesses a large band gap of 3.2 eV, making it active primarily in the UV light wavelength range.
- By heteroatom doping or by molten salt/hydrogen assisted reduction, this band gap can be narrowed to allow for activity, or excitation, within the visible light spectrum.



SEM image of TiO_2 nanoparticles obtained from Phenom Desktop SEM in Samia Lab



Disruption of biofilm by reactive oxygen species

Methods

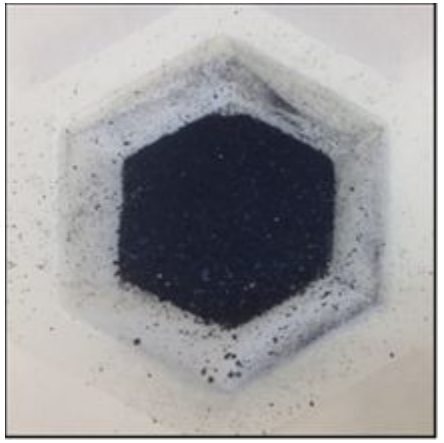
TiO_2, Mg, NaCl, & $AlCl_3$

210°C / 20 hrs

Ultrasonication

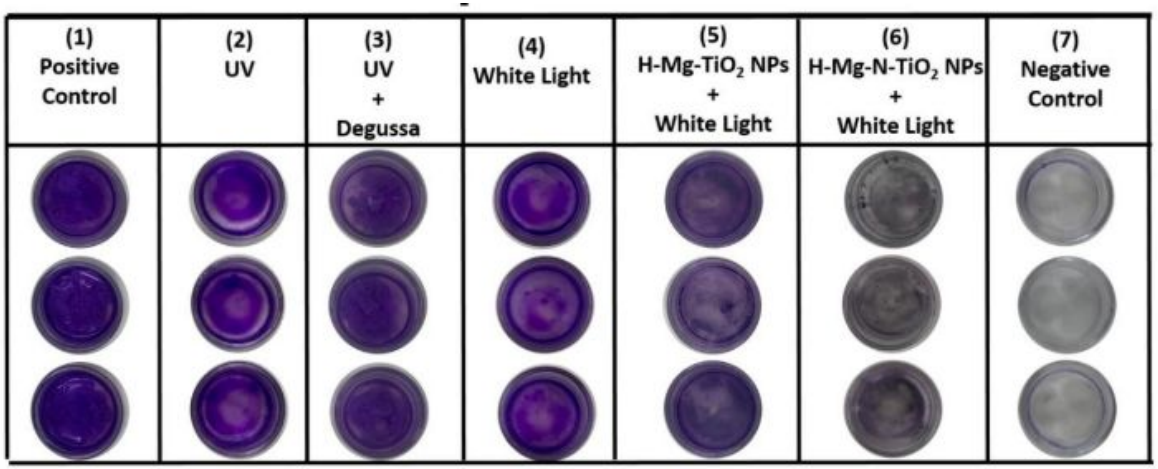
Stir with dil. HCl

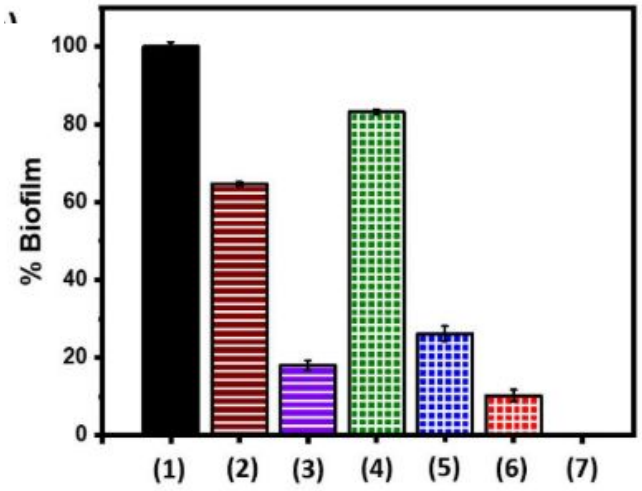
H_2 Annealing



Methods

Findings





Both H-Mg-TiO2 and H-Mg-N-TiO2 NPs produced via two-step reductive annealing method were able to disrupt approximately 75% and 90% of the S. aureus biofilm with visible light (white light), respectively.

Further Exploration

Acknowledgements

I would like to thank:

My Primary Investigators and Project Mentor: Dr. Anna Cristina Samia

Current PhD candidates: Yu Hsin (Terence) Tsai, Nathalie Milbrandt, and Stella Ju

The SOURCE office and WISER for Summer 2020 funding

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Thank you!