**NanoZymes as an alternative antibacterial to conventional antibiotics**

*Pyria Rose Divina MariathomasA, Mandeep SinghA, Rajesh RamanathanA & Vipul BansalA*

ANanoBiotechnology Research Laboratory, Sir Ian Potter NanoBioSensing, School of Science, RMIT University, Melbourne, VIC 3001, *Australia*



**Introduction**

Antimicrobial resistance (AMR) is a growing concern across the globe. Each year, antibiotic resistant microbes cause at least 2,049,442illnesses 700,000 deaths (globally). Therefore, there is a growing urgency to search for a new generation of antimicrobial agents that are constructive. Nanotechnology offers a fantastic solution in the form of nanomaterials performing as nano-antimicrobial for fighting the multi-drug resistant microbial infections, acting as an alternative to conventional antibiotics.

**Aim**

The current research focuses on the synthesis of 2D Iron sulfide (FeS) nanosheets and explores its enzyme-mimicking catalytic behaviour to enhance the production of reactive oxygen species to kill bacteria.

***Fig.*** *Antibacterial activity of FeS nanosheets in the*

*presence of H2O2 under dark and light conditions.*

**Results and Discussion**

* A facile method to fabricate high surface area, magnetic FeS nanosheetshas been developed.
* The FeS nanosheets show high enzyme-mimicking catalytic behaviour.
* The rich optical property of FeS allows enhanced photoinducedproduction ofreactive oxygen species (ROS) that results in efficient killing of bacteria.
* The ability to fine tune the catalytic activity of the enzyme-mimicking 2D FeS reduces the amount of nanomaterial required to µg/mlconcentrations and H2O2 to sub mM concentrations while increasing the efficiency of bacterial killing.

**Impact to society**

* Efficient antibacterial system to tackle AMR.
* Visible light used as an external trigger to modulate killing of bacteria.
* Viable alternative for antibiotics.
* Improves quality of life.

**References**

# Aminov, R. I. (2010). A Brief History of the Antibiotic Era: Lessons Learned and Challenges for the Future. Front. Microbiol. 1: 134.

# Marlieke et al. (2016).Will 10 Million People Die a Year due to Antimicrobial Resistance by 2050?. PLoS Med.

# Karim et al. (2018). Visible-Light-Triggered Reactive-Oxygen-Species-Mediated Antibacterial Activity of Peroxidase-Mimic CuO Nanorods. ACS Appl.Nano Mater*.*,1 (4), pp 1694–1704.