Oxygen-Vacancy-Rich MXene Nanonetworks: A Novel Strategy for Antimicrobial Sonodynamic Therapy[1]

Lingqing Zong, and Zi Gu

Science and Engineering Building (E8), International Rd, UNSW Sydney, Kensington NSW 2052
University of New South Wales
Sydney, New South Wales
Lingqing.zong@unsw.edu.au (Lingqing Zong), zi.gu.1@unsw.edu.au (Zi Gu)

Multi-drug resistant bacteria have induced significant burden on public health system and caused relentless pain on patients. Currently, laser triggered therapies normally referred as phototherapy including photothermal and photodynamic therapies gradually emerged as potential substitute for the traditional antibiotics[2]. However, limited penetration depth. hyperthermia and phototoxicity towards the healthy tissue have limited the application of phototherapies. Hence, we design and investigate an ultrasound (US)-responsive nanomaterial[3] that is an oxygen-vacancy-rich MoO_x on the Mo_2C MXene possessing unique neuro-nanonetworks-like structure, named as MoO_x@Mo_2C. MoO_x@Mo_2C nanonetworks exhibit efficient bacteria eradication capacity originated from the US-induced reactive oxygen species (ROS) and innate bacteria-capturing ability according to bactericidal exploration on both gram-positive and gram-negative bacteria models. Furthermore, *in vivo* antibacterial investigation on both drug-resistant bacteria infected superficial wound model and deep osteomyelitis model validated the robust broad-band antibacterial capacity and amiable biosafety. In conclusion, US-responsive MoO_x@Mo_2C nanonetworks bactericidal nano-system exhibit ultimate potential to tackle with drug-resistant bacteria induced disease.

Reference

[1] Zong, L., Yu, Y., etc. *Biomaterials* **2023**, 296, 122074.
[2] Lin, H., Chen, Y., & Shi, J. *Adv Sci (Weinh)* **2018**, 5(10), 1800518.
[3] Zhang, Y., Zhang, X., etc. *Chem Soc Rev* **2021**, 50(20), 11227-11248.