Design of Piezoelectric Materials for Sonodynamic Therapy

Huiyu Liu

Beijing University of Chemical Technology, College of Life Science and Technology
No. 15 Beisanhuan Road East, Chaoyang District, Beijing, CHINA
liuhy@mail.buct.edu.cn

Sonodynamic therapy, as a novel therapeutic tool, has a wide range of applications in anti-tumor, anti-infection, etc. However, the sonosensitizers used in clinical trials suffer from low stability and catalytic activity, which limit the further development of sonodynamic therapy. Therefore, the development of new sonosensitizers with superior performance is imminent. Piezoelectric materials have a unique stress-induced carrier generation ability, which can respond well to ultrasound to achieve efficient sonodynamic therapy. To construct highly safe piezoelectric sonosensitizers, we have been developing highly biocompatible piezoelectric materials such as molybdenum disulfide and hydroxyapatite to explore their sonodynamic therapeutic effects. To enhance the catalytic activity of piezoelectric sonosensitizers, we are also developing modification strategies based on defect engineering and interfacial engineering, which expand the types of catalytic reactions of piezoelectric sonosensitizers and greatly improve their catalytic performance. In addition, by considering the overall therapeutic process of piezoelectric sonosensitizers, we have developed a therapeutic potentiation strategy based on enhanced cavitation, which is conducive to achieving multiply enhanced sonodynamic therapeutic effects. Based on this strategy, we propose for the first time the concept of the aided-sonosensitizer and develop cavitation enhancement means based on gas generation, surface modification and hollow structure, which provide a solid platform and a powerful tool for expanding the application of sonodynamic therapy. In this talk, we will focus on our group's recent progress in the synthesis and potentiation strategy of piezoelectric sonosensitizers, and discuss their mechanisms and expanded applications during sonodynamic therapy.

References

[1] Q. Wu, F. Zhang[#], X. Pan, et al. *Adv. Mater.* **2021**, *33*, 2007073
[2] Q. Wu, J. Zhang, X. Pan, et al. *Adv. Sci.* **2023**, *10*, 2301152
[3] X. Pan, L. Bai, H. Wang, et al. *Adv. Mater.* **2018**, *30*, 1800180