Bioactive 2D Monolayer Nanosheets

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2D nanomaterials with large surface areas and unique physicochemical properties have attracted vast interest for various high-performance biomedical applications.[1] We have developed a surfactant-free, bottom-up synthetic method to construct 2D monolayer layered double hydroxide (LDH) nanosheets by using a biocompatible polymer as both layer growth inhibitor and stabiliser. The LDH nanosheets are featured with stimuli-responsive property, catalytic-therapeutic activity, chemostasis, and high drug loading capacity. We have shown that the nanosheet has high catalytic activity to disproportionate hydrogen peroxide in tumours, and consequently generates a considerable amount of hydroxyl radicals at a high reaction rate under tumorous acidic condition.[2] The highly toxic hydroxyl radicals, as a result, cause the death of tumour cells *in vitro* and suppress the tumour growth *in vivo* without the use of any supplementary toxic agent.[2] We also found that the nanosheet generates oxygen bubbles and promotes the long travel distance with presence of stimuli in the tumour microenvironment. This responsive movement has chemostatic properties, evidenced by the directional movement of the nanosheet toward hydrogen peroxide. Also, the nanosheet can serve as a high drug loading system that exhibits higher therapeutic efficacy and reduced systemic toxicity compared to the multilayer LDH nanoparticle. Meanwhile, the desirable biodegradation of the LDH nanosheet render a high degree of biosafety to the organism.

References

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[2] Cao, Z.; Zhang, L.; Liang, K.; Cheong, S.; Boyer, C.; Gooding, J.J.; Chen, Y.; Gu, Z. *Advanced Science* **2018**, 1801155.