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Synthesis of Fe-MOF nanostructure: A Study of Peroxidase-Like behavior for Sensing of H_2O_2

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In recent years, nanotechnology is widely used in sensing, biomedicine, food industry, agriculture and etc. as a newly developed science and technology, in which nanomaterials with enzyme-like catalytic activity, namely nanozyme, have been used in the development of new chemosensors [1]. Recently, nanozymes have drawn extensively studied for their applications in bioanalysis, disease diagnosis, and therapy. In addition to, compared with natural enzymes, nanozymes possess the advantages of low cost, easy-to-scale production, high tolerance to the environment, long-term storage, high stability, and controllability [2]. Studies in this field have shown that nanozymes are suitable substitutes for natural enzymes. Therefore, the development of stable materials exhibiting high substrate affinity and high activity as ideal artificial enzymes is a highly desirable research goal [3]. The nanozymes reported thus far are, for instance, noble metal-based, and carbon-based materials, metals/metal oxides, carbon materials, MOFs, and so on. Among these nanomaterials, MOF nanozymes due to their inherent porous structure, large specific surface area, low density, high porosity, structural diversity, and adjustable pore size open structure for the free transfer of substances and products in the catalytic reaction, have shown special enzyme-like activity [4]. Due to availability effective active sites and enhancing the catalytic activity in MOFs, it has been reported that some of them can simulate natural enzyme activities such as POD-like (peroxidase) activity. Currently, Due to the same Fe metal centers as peroxidase for MIL-(Fe) peroxidase-like nanozymes (such as MIL-53, MIL-88, MIL-100 and MIL-101), the nanozymes based MIL-(Fe) have become a potential platform for exploring catalytic mechanisms and improving performances [5]. Herein, we reported a Fe-MOF with excellent properties and peroxidase-like activity, which is synthesized with a simple method. The synthesized Fe-MOF under weakly acidic conditions, can catalyze the oxidation of TMB substrate to oxTMB by hydrogen peroxide. Therefore, a simple colorimetric assay for the detection of hydrogen peroxide based on the peroxidase-like activity of the Fe-MOF nanozyme has been established.

Keywords: Nanozyme, Fe-MOF, Peroxidase.

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