

Influence of Metal-Organic Framework ZIF-8 Nanomaterials on *Escherichia coli*

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Abstract

Metal organic framework (MOF) nanomaterials have attracted special attentions in recent decades, because of unique structures, outstanding properties and wide applications. Among the most popular commercial MOF products is ZIF-8, due to the easy synthesis, high stability, and excellent gas separation performance. To ensure the safe applications, it is essential to investigate the toxicity of ZIF-8, in particular the environmental toxicity to microbial community. In this study, the microbial toxicities of ZIF-8 MOF were evaluated using *E. coli* as the model bacterium. ZIF-8 of 0 to 900 µg/mL was dispersed thoroughly in Luria–Bertani (LB) culture medium for *E. coli* exposure. The bacteria were counted in terms of colony forming units (CFU) on LB agar plates, and the growth curves were recorded on UV-vis spectrophotometer. The results indicated that the growth was retarded with the increase of ZIF-8 concentration and completely annihilated at 900 µg/mL. The CFU was slightly stimulated at 400 µg/mL and reduced with the increase of ZIF-8 concentration to 600 and 800 µg/mL. The CFU value dropped to 0 at 900 µg/mL. Consistently, growth curves of *E. coli* showed the inhibitive effect of ZIF-8. Dose-dependent decreases were observed at 200-600 µg/mL, while the growth was completely lost at 800 and 900 µg/mL. It should be noted that the starting material zinc nitrate hexahydrate (metal core of ZIF-8) showed even higher toxicity to *E. coli* which completely inhibited the growth at 400-900 µg/mL. In contrast, the chelating ligand 2-methylimidazole was nontoxic. Therefore, it is speculated that the toxicity of ZIF-8 was from the released Zn²⁺ rather than the chelating ligand from 2-methylimidazole. Our results suggested that ZIF-8 was toxic to bacteria at high concentration and the discharge of ZIF-8 should be restricted to avoid environmental pollution.

Keywords: CFU, *E. coli*, Environmental toxicity, Growth curve, Metal-organic framework

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