

In vitro* Toxicity Evaluation of Carbonized Metal-Organic Framework ZIF-8 on the Growth of *E.coli

RMD Rathnayake^{1*}, Sheng-Tao Yang², Bowei Ouyang² and KL Wasantha Kumara¹

¹Department of Agricultural Biology, Faculty of Agriculture, University of Ruhuna, Kamburupitiya, Sri Lanka

²School of Chemistry & Environmental Protection Engineering, Southwest Minzu University, Chengdu, China

Abstract

Cytotoxicity of carbonized metal-organic framework ZIF-8 on *E. coli* was evaluated in terms of growth curves and colony forming units (CFU) counts after 36 hrs exposure. Broth cultures of *E. coli* with carbonized ZIF-8 concentrations ranging from 0 to 900 µg/ mL were placed in a shaker at a speed of 120 rpm and temperature of 37 °C. The growth curve and CFU determination of all concentrations affirmed carbonized ZIF-8 was nontoxic to *E. coli*. Separate growth curves were derived for broth cultures with the raw materials of ZIF-8, including zinc nitrate hexahydrate and 2-methylimidazole. Zinc nitrate hexahydrate completely inhibited the bacterium growth at ZIF-8 equivalent concentrations of 800 and 1000 µg/mL, while in all the concentrations of 2-methylimidazole, the typical growth pattern of *E. coli* was observed. The phenomena suggested that zinc ions were the chemical origin of toxicity. Characterization of carbonized ZIF-8 by X-ray photoelectron spectroscopy, x-ray diffraction spectroscopy, and infrared spectroscopy suggested the formation of nano ZnO, Zn, and C during the 2 hrs carbonization at 800 °C. Nano-pores were formed due to the dissociation of framework to encapsulate ZnO. As a result, the toxicity of ZnO to *E. coli* decreased. Carbonization is applicable to reduce the toxicity of metal-organic frameworks that would be used at high doses. Further toxicology evaluations using *S. aureus* also showed similar results.

Keywords: Carbonization, Cytotoxicity, *E. coli*, Nanoporous carbon, ZIF-8

***Corresponding authors:** dilinarmada14@gmail.com