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Toxicity evaluation based on particle size, contact angle and zeta potential of SiO_2 and Al_2O_3 on the growth of green algae

Gopalu Karunakaran[1,2,3], Rangaraj Suriyaprabha[1], Venkatachalam Rajendran[*1] and Narayanasamy Kannan[2]

[1]*Centre for Nanoscience and Technology, K. S. Rangasamy College of Technology, Tiruchengode-637215, Tamil Nadu, India*
[2]*Department of Biotechnology, K. S. Rangasamy College of Arts and Science, Tiruchengode-637215, Tamil Nadu, India*
[3]*Department of Functional Nanosystems and High-Temperature Materials, National University of Science and Technology "MISiS," Leninskiy Pr. 4, Moscow, 119049, Russia*

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Abstract. In this investigation, ecotoxicity of nano and micro metal oxides, namely silica (SiO_2) and alumina (Al_2O_3), on the growth of green algae (*Porphyridium aerugineum Geitler*) is discussed. Effects of nano and micro particles on the growth, chlorophyll content and protein content of algae are analysed using standard protocols. Results indicate that SiO_2 nano and micro SiO_2 particles are non-toxic to *P. aerugineum Geitler* up to a concentration of 1000 mg/L. In addition, Al_2O_3 microparticles are less toxic to *P. aerugineum Geitler*, whereas Al_2O_3 nanoparticles are found to be highly toxic at 1000 mg/L. Moreover, Al_2O_3 nanoparticles decrease the growth, chlorophyll content, and protein content of tested algae. In addition, zeta potential and contact angle are also important in enhancing the toxicity of metal oxide nanoparticles in aquatic environment. This study highlights a new insight into toxicity evaluation of nanoparticles on beneficial aquatic organisms such as algae.

Keywords: nano metal oxides; Porphyridium aerugineum Geitler; chlorophyll content; zeta potential; contact angle; protein content

1. Introduction

The rapid development in the field of nanotechnology enhances the potential applications of nano materials in all fields of science and technology due to their excellent physicochemical properties (Lin 2010). Metal oxide nanoparticles are the most widely used materials in the areas such as thermal barrier coatings, catalysts and biomedical implantations (Mueller and Nowack 2008). Thus, with the increased use, these nanoparticles are certainly released in the environment and may affect aquatic environments and agricultural lands (Klaine 2008). Silica (SiO_2) is the most widely used metal oxide nanoparticle for different applications such as cosmetics, photocatalytic treatment, cancer therapy, bioimaging, and plant growth (Cheng 2010, Suriyaprabha 2012). An increase in the level of silica may lead to an increase in its content in the environment, which

∗Corresponding author, Ph.D., E-mail: veerajendran@gmail.com

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