

Ecotoxicology and Environmental Fate of Nanomaterials from Nano-enhanced Products in Natural Water and Wastewater

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Abstract

Currently, nano-enhanced products are widely available in the consumer market. Many types of nanomaterials have been used to obtain the exceptional properties of the products, from mobile phones to sunscreens, airplanes to medicines. From many published researches during past 5 years, scientific community is observing on nanoparticles ecotoxicity and the human health risk of these materials. Our recent research has been revealed the releasing of nanomaterials from the nano-enhanced products to the environment. The physico-chemistry aspect has been used to understand the fate and behavior of nanoparticles in the environment especially in natural water. Many factors such as solution pH, heat, and light exerted impact on the releasing of nanomaterials from the products to water and wastewater. The accumulation of nanomaterials in ecosystem has been detected. The simulation of the fate and behavior of nanomaterials in wastewater treatment plant was conducted. The intrusion of nanoparticles was found both on the surface and inside of the bioflocs in wastewater treatment plant. The nanoparticles tentatively exerted an adverse effect on the microbial population, causing the reduction of microorganisms (both bacteria and protozoa) in the aerobic sequencing batch reactor. The respiration inhibition rate of the bacteria was increased, and the viability of the microbial population was reduced at the high concentration (50 mg L^{-1}) of nanoparticles. The accumulation of the nanoparticles in ecosystem has been monitored. The data on bioconcentration factor show that the nanoparticles can be toxic to bacteria, protozoa, algae, and fish species in water. These results suggested that the nanoparticles finally can reach the human and release the adverse impact on the human health. Data from this work can benefit to all involved sectors such as community, industry, government, and public in developing the nanosafety policy to protect the human and environment as well as raising awareness among the consumers in using nano-enhanced products that can lead to the harmful effect on human.