PERFORMANCE OF SILVER-IMPREGNATED SILICA NANOCAPSULES ON THE SEDIMENT TOXICITY OF ANTI-FOULING TO BENTHIC TANAIDS (MONOKALLIAPSEUDES SCHUBARTI)

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RESUMO

The prevention of biofouling on ships and marine structures has long been a challenge. The bioincrustation process involves the colonization of ships by diverse marine organisms, compromising vessel performance and presenting relevant environmental concerns. Following the ban on tributyltin (TBT) as a biocidal agent, different compounds, including DCOIT, have been included as active ingredients in third-generation anti-fouling paints. Currently, new anti-fouling compounds have been developed by incorporating silver-impregnated silica nanocapsules containing DCOIT, with the goal of reducing environmental risks and enhancing anti-fouling effectiveness. However, the ecological consequences of these novel materials remain poorly understood, particularly their impact on non-target organisms and the risks associated with sediment. This study aims to determine the toxicity of silver-impregnated silica nanocapsules and their corresponding nanocapsules containing DCOIT (SiNC, DCOIT, SiNC-DCOIT, and SiNC-DCOIT-Ag) on the benthic tanaid *Monokalliapseudes schubarti* (Mañé-Garzón, 1949). The contaminants were diluted in water, and the (defaunated) sediment was spiked with vigorous stirring for 30 minutes with the different substances tested at various concentrations. Subsequently, they were refrigerated (4°C) in the dark for at least 12 hours. Between 50-100 g of sediment per test chamber and 150-300 ml of reconstituted seawater matching the salinity of organism collection (20-35) were used. Between 3 and 4 replicates were employed, with a minimum of 5 organisms per replicate. The tests were kept aerated and exposed to natural light, and after 7 days, the number of living organisms in each concentration was counted. The physicochemical parameters, including dissolved oxygen, salinity, pH, and ammonia, were monitored at the beginning and end of the test. R was utilized to calculate the lethal concentration for 50% of the organisms (LC50) using the Trimmed Spearman Karber method, package “drc”. The

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LC50 – 7 days calculated were: SiNC 55.4[30.0 -100.0] µg/g; DCOIT 0.40[0.141.15] µg/g; SiNC-DCOIT 23.3[10.0- 50.0] µg/g SiNC-DCOIT-Ag 8.0[6.0 -10.0] µg/g. The free form of DCOIT was the most toxic compound, followed by SiNC-DCOIT-Ag, SiNC-DCOIT, and SiNC. As expected, the silica nanocapsules showed much lower toxicity than the anti-fouling agent and its nanoencapsulated forms. The results obtained provided important information for the development of new anti-fouling materials, as well as insights into the ecological effects and risks of environmental contamination by these compounds.

PALAVRAS-CHAVE: Nanotechnology, anti-fouling, invertebrates, ecotoxicology

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