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TITLE

MOLLUSCICIDAL ACTIVITY OF COPPER OXIDE NANOPARTICLES AGAINST EMBRY HATCHED BIOMPHALARIA GLABRATA (SAY, 1818): A COMPARATIVE APPROACH

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ABSTRACT

Nanobiotechnology has been identified as a promising tool for the control of gastropods of medical importance, such as Biomphalaria glabrata. In Brazil, this snail serves as the primary intermediate host for the parasite Schistosoma mansoni, which is responsible for the disease schistosomiasis. Copper oxide nanoparticles (CuONPs) have demonstrated toxicity against pests, vectors, and certain intermediate hosts. However, their toxicity to B. glabrata remains unconfirmed, particularly with regard to the early stages of development. This study aimed to assess the toxicity of CuONPs functionalized with mercaptosuccinic acid (MSA) in B. glabrata embryos and newly hatched snails. The nanoparticles were synthesized by chemical precipitation, with copper acetate being used as the metal precursor for the synthesis and the addition of MSA for colloidal stability and surface charge, knowing that this molecule already has known mucosal adhesion activity. Toxicity was analyzed through the embryotoxicity test on Biomphalaria spp. using 9 clutches of eggs per concentration (± 180 embryos at blastula stage) in 12-well microplates in triplicate for 168h (5mL per well) at concentrations from 0.08 to 2.11 mg L-1. The parameters analyzed were mortality, hatching, delayed embryonic development, morphological changes, and cardiotoxicity. The acute toxicity test on newly hatched snails was carried out using 10 animals per concentration in triplicate (± 240 animals), with concentrations ranging from 0.01 to 0.08 mg L-1 for 96 hours. The parameters analyzed were mortality, cardiotoxicity, and behavioral changes (reclusion, distance traveled, average speed, and time at rest). The results showed that exposure to MSA-CuONPs caused mortality in both embryos and newly hatched snails. In embryos, MSA-CuONPs inhibited hatching and embryonic development, and induced cardiotoxicity through a decrease in heart rate. The morphological changes analyzed were mainly hydropic embryos and a reduction in shell size. In the case of newly hatched snails, MSA-CuONPs also showed cardiotoxicity, a decrease in average speed and distance traveled and an increase in resting time, as well as an effect on seclusion time and exposure of the cephalopedial mass of the shell. Therefore, MSA-CuONPs are promising for the control of schistosomiasis, interrupting the biological cycle of B. glabrata.

KEYWORDS

Nanotoxicology; Intermediate Host Control; Schistosomiasis; Nanotechnology.

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