Study of acute toxicity of aqueous suspensions of chemical and biogenic silver nanoparticles produced by marine algae, *Sargassum boveanum* on *Artemia fransiscana* (Nauplius and adult) as model organism

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Abstract

Bioassay *Artemia* toxicity is one of the common methods in marine Nano ecotoxicology to predicting the negative impacts of the release of nanomaterials. Due to the increasing in production and applications of silver nanoparticles in the various industrial areas, in this study, we evaluated the toxicity of chemical and biogenic silver nanoparticles using the aqueous extract of brown seaweed *Sargassum boveanum* and assessment their effects on the sensitivity of different developmental stages of *Artemia fransiscana*, (Nauplius and adult). For this purpose, the OECD standard method was used. The number of 30 artemia nauplii and 10 adults were placed in each well of 24-well plates and 6-well plates respectively, and for testing the toxicity were exposed to an additive serial concentration of biosynthetic and chemical silver nanoparticles (each concentration in 3 repetitions). Mortality in each group at the times of 12, 24, 36 and 48 hours after exposure to silver nanoparticles were recorded and analyzed via Probit software. The result showed that not only the toxicity of these two types of silver nanoparticles on artemia nauplii and adult increased in a dose-dependent manner, but also their toxicity increased along with the duration of exposure time. The toxicity if these nanoparticles were significantly different ($P < 0.05$). So that after 48 hours, the LC_{50} value of chemical AgNPs in the artemia nauplii was 31.8 mg/l, while 48h LC_{50} for biosynthesis AgNPs produced by seaweed was 141.1 mg/l. While the concentration of the chemical AgNPs in adults artemia during exposure was 47 mg/l and for biosynthesis form of AgNPs was 132.5 mg/l, were assessed. Comparison of the toxicity result in both of Nauplius and adult stages of artemia showed that the chemical form of AgNPs was more toxic potential (up to 5 times in nauplii) than a biosynthetic form of AgNPs (up to 3 times in adult). It seems, the sensitivity of artemia nauplius to chemical silver nanoparticles more than to mature stage, but compared to biosynthesis form produced by algae is less than adult stage. This research recommends the development and replacing the green approach in the production of nanoparticles to prevent future environmental risks.

Keywords: Toxicity, *Artemia fransiscana*, Marine macroalgae, Silver nanoparticles.

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