Original Article

Toxicity and Bioconcentration of Cadmium and Copper in *Artemia Urmiana* Nauplii

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ABSTRACT

Background: *Artemia urmiana* are small crustaceans that because of its non-selective filter feeder pattern potentially may absorb high level of heavy metals through their living environment. In this study, the effects of different levels of cadmium and copper on survival, catalase activity and metals bioconcentration rates in *A. urmiana* nauplii have been investigated.

Methods: The research was carried out in February 2012 at University of Tehran, Tehran, Iran. First experiment was conducted in nine concentrations with six replication, then LC_{50} and probable interactions between experimental metals were evaluated. In the second experiment, concentrations of metals absorbed by *Artemia* and catalase activity were measured based on the acute toxicity indices, including NOEC, LOEC and LC_{50} at individual and mixed concentrations.

Results: The toxicity of copper sulphate (LC_{50}= 29.87) was 2.5 times greater than cadmium chloride (LC_{50}=79.08) and the toxicity interaction between cadmium and copper was synergistic. The rate of copper uptake in *Artemia* was higher than cadmium and increased concentration of heavy metals significantly decreased the bioconcentration factor. Comparison of mixed and individual concentrations showed that cadmium significantly decreased copper uptake, while it seems that cadmium bioconcentration was improved consequently. Biochemical analysis showed that the catalase activity was affected undesirably in different individual and mixed concentrations; however, these changes were not significant.

Conclusion: *A. urmiana* nauplia seems to be highly resistant toward cadmium and copper in their culture medium and demonstrated excessive potential for uptake of heavy metals from their rearing environment.

Keywords: *Artemia Urmiana* Nauplii, Bioconcentration, Catalase Activity, Heavy Metal, Survival.

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INTRODUCTION

Due to the industrial and agricultural developments and the improvement in the standard of living in recent decades, the application of heavy metals in variety of industrial and agricultural fields has been expanded [1]. Heavy metals from mining, combustion and industrial products can enter into the aquatic environment through atmospheric deposition and agricultural, industrial and municipal wastewater discharges [2, 3]. Industrial using of cadmium and copper, in particular, has been increased over the last century and seems to have reached to their peaks during the last 20-30 years [4, 5]. The increased concentration of heavy metals and their mixture are found in natural aquatic ecosystems, so their combined effects on living organisms has become serious concern. There are many investigations on the impact of individual pollutants on *Artemia* species [6-9], but a few researchers have considered their mixed effects [10, 11].

Organisms in the environment are continuously exposed to a variety of natural and anthropogenic stressors. If these stressors are present at a high level or for a long period, they will eventually influence the organism's physiological integrity (oxidative stress), thus the overall fitness would be decreased concomitantly [12, 13]. Plenty of physical and chemical stressors in nature (such as heavy metals) can enhance the production of reactive oxygen species (ROS). Some ROS is produced through natural processes of cellular metabolism, but antioxidant defense of the organism usually can control the harmful effects of these free radicals. However, external factors, including pollutants may intensify the

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