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## **NICKEL BIOACCUMULATION IN WHOLE BODY TISSUES OF FRESH WATER GASTROPOD SNAIL, *BELLAMYA BENGALENSIS* AFTER CHRONIC NICKEL INTOXICATION**

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### **ABSTRACT**

The objective of present study was carried out to determine the level of bioaccumulation of heavy metal salt nickel (Ni) in freshwater gastropods snail's, *Bellamya bengalensis*. The bioaccumulation of heavy metal salts in snail's was studied under two groups. Group A was maintained as control, group B snail's were exposed to chronic LC<sub>50/10</sub> dose of Nickel chloride (0.267 ppm) for 21 days. Bioaccumulation level in whole body tissues of *Bellamya bengalensis* from A and B groups were collected after every seven days and were dried at 80°C in an oven till constant weight was obtained. The sample were analysed on the instrument atomic absorption spectrophotometer (Chemito). It was found that the freshwater snail, *Bellamya bengalensis* showed the highest concentration of nickel as compared to control, nickel contamination of the aquatic ecosystems affect the life of the snails, altering their metabolic functions. Hence, a scientific detoxification method is essential to improve the health of economic species of snail's in any stressed environmental conditions (accidental or induced discharges of heavy metal).

**Keywords:** *Chronic Nickel Intoxication, Bioaccumulation, Fresh Water Snail*

### **INTRODUCTION**

Persistence of heavy metals in aquatic ecosystem is one of the major environmental concerns in developing countries as they cause adverse effects on the health and reproductive capacity of different organisms including many invertebrates. Nickel(Ni) is an important contaminant present at elevated concentrations in many aquatic ecosystems that are currently, or have previously been, impacted by metal-mining activities (Eisler, 1998).

At present, metals and metalloids from agricultural, domestic, and industrial activities are often discharged excessively into rivers and lakes. Thus, assessment of their toxicity threshold has since become an important component of water pollution monitoring (Canivet *et al.*, 2001; Ansaldo *et al.*, 2009).

The heavy metals are a serious threat to aquatic environment because of their toxicity and tendency to accumulate in organism and biomagnifications in food chain (Weis, 1977). Once trace metals enter the food chain, they may accumulate to dangerous levels and be harmful to human health (Manahan, 2000). Non-essential metals are usually potent toxins and their bioaccumulation in tissues lead to intoxication, decreased fertility, tissue damage and dysfunction of a variety of organs (Ribeiro *et al.*, 2000; Damek-Proprawa and Sawicka-Kapusta, 2003).

Nickel is a silver-white metal with siderophilic properties that facilitate the formation of Nickel-iron alloys. In contrast to the soluble nickel salts (chloride, nitrate, and sulfate), metallic nickel, nickel sulfides, and nickel oxides are poorly water-soluble. Nickel carbonyl is a volatile liquid at room temperature that decomposes rapidly into carbon monoxide and nickel. Nickel is a common sensitizing agent with a high prevalence of allergic contact dermatitis. Nickel and nickel compounds are well-recognized carcinogens. However, the identity of the nickel compound or compounds, which cause the increased risk of cancer, remains unclear.

Currently, there are little epidemiological data to indicate that exposure to metallic nickel increases the risk of cancer, or that exposure to the carcinogenic forms of nickel causes cancer outside the lung and the nasal cavity. Balkas (1982) reported that, heavy metal pollution of terrestrial and aquatic ecosystems have

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long been recognized as a serious environmental concern. This is largely due to their non-biodegradability and tendency to accumulate in plants and animals tissues.

As a result, metal bioaccumulation is a major route through which increased levels of the pollutants are transferred across food chains/web, creating public health problems wherever man is involved in the food chain (Tuzen, 2003; Otitolaju and Don-Pedro, 2002, 2004). The objective of the present study was to determine the heavy metal concentrations of Ni in whole body.

**MATERIALS AND METHODS**

The snail, *Bellamya bengalensis* were acclimatized to laboratory condition for 2-3 days and healthy active snail's of approximately medium size and weight were chosen. These snail's were divided into two groups, such as group A and B. The snail's of group A were maintained as control. The snail's from group B were exposed to chronic concentration (LC 50 value of 96 hr/10) of heavy metal salt, nickel chloride (0.267 ppm) upto 21 days.

During experimentation snails were fed on fresh water algae. The whole body mass of snails from all groups were collected after every seven days and were dried at 80 c in an oven till constant weight was obtained. The 500 mg sample was taken for digestion.

The tissue was digested in 10 ml of acid mixture (HCL:HNO<sub>3</sub> in (3:1) ratio) on hot plate till dryness. The digested mixtures were kept in water bath for 6-7 hours until the samples were cooled. Cool digested samples were filtered (Whatman grade 541). The total volume was diluted to 50 ml by double glass distilled water in volumetric flask.

The sample were analysed on the instrument atomic absorption sepctrophotometer (Chemito). The concentration of Ni accumulation in the tissue of each exposure period was recorded and the results are given in the table 1.

**RESULTS AND DISCUSSION**

Nickel contents in *Bellamya bengalensis* after exposure to concentrations of nickel chloride (0.267ppm) up to 21days. After 7, 14 and 21 days of chronic exposure to heavy metal, it was observed that there was an increased in concentration of accumulated heavy metals in the body of *B. bengalensis* with respect to time as compared to those of control snails.

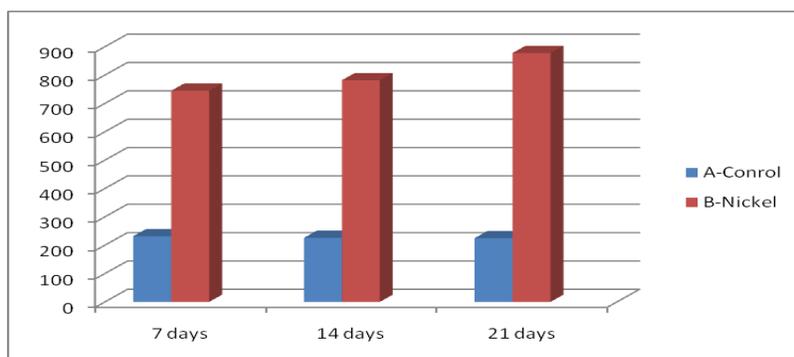
The accumulation data from table indicates that the concentration of bioaccumulation Ni in presence of NiCl<sub>2</sub> (0.267ppm) increased with increase in exposure period as compared to control. The nickel content is expressed in µgm/kg. dry weight. The control group of animals showed minute quantity of Nickel as compared to the experimental groups. The control group of animal showed 232.0 µgm/kg, Ni in whole body tissue while the bioaccumulated Nickel in presence of NiCl<sub>2</sub> (0.267ppm) after 7 days exposure was 745.0µgm/kg. The concentration in the tissues was raised after 14 days to782.0µgm/kg, while after 21 days increases to 878.0µgm/kg. There was more change in the bioaccumulation of Ni in control animals.

**Table 1: Nickel Content (µgm/kg Dry Weight) in Whole Body of *Bellamya Bengalensis* (Lamarck) After Chronic Treatment of Lead Nitrate**

Treatment	Sr No.	Body Tissue	Ni Content (µgm/kg Dry Weight)		
			7 Days	14 Days	21 Days
(A) Control	i	W.B.	232.00	226.00	225.00
(B) 0.267 ppm NiCl <sub>2</sub>	ii	W.B.	745.00 + 68.85*	782.00 + 71.09*	878.00 + 74.37*

W.B.- Whole Body / • -Compared with respective A

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Exposure Period  
Figure 1

### Discussion

In the present study, the freshwater gastropod snail's *Bellamya bengalensis* were exposed to LC<sub>50/10</sub> concentrations of for twenty one days in the laboratory to examine the effects of the heavy metals on their survival and their fate through their soft parts. From the obtained results it is clear that the analysis of the investigated gastropods snail's (whole body tissue's) indicated that these organisms can accumulate Ni in high concentrations in their whole bodies, so they can be used as bioindicators for heavy metals pollution in aquatic ecosystems. Bakre and Garg (1994) studied bioaccumulation of Pb in experimentally exposed freshwater mollusc, *Pila globosa* and maximum accumulation was found in Intestive, followed by digestive gland and less degree of accumulation of Pb occurred in mantle and foot. The accumulation of Pb increased with increasing exposure period.

Many workers found that the accumulation patterns of heavy metals are dependent on both uptake and elimination rates (Hakanson, 1984, Gomaa *et al.*, 1995). According to the Gundacker (1999), a zebra mussel accumulates high amounts of potentially toxic metals and was widely used as a bio-monitoring organism. Avelar *et al.*, (2000) reported that Oyster and mussels can accumulate Cd in their tissues at levels up to 100,000 times higher than the levels observed in the water in which they live. Passow *et al.*, (1961) reported that lead can induce synthesis of specific proteins which selectively bind them. Inhibition of enzyme activities by heavy metals is either due to the direct binding with enzyme protein or due to damage of cell organelles or by toxic effect produced. The specific amoebocytes and or digestive vesicles within the cell may engulf metals outside the cell membrane (i.e. in the human digestive tract), then move back into the tissue carrying their particulate burden (Owne *et al.*, 1966).

### Conclusion

It could be concluded that the snail, *Bellamya bengalensi* (Lamarck) could be considered as good bioindicators for pollution of heavy metals in aquatic ecosystems.

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