# Effect of *Coriandrum* on Arsenic trioxide ($AS_2O_3$) accumulation in fresh water Bivalve *Lamellidens consobrinus*

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The present work conducted, to study the effect of coriander extract on Arsenic accumulation in the fresh water Bivalve *Lamellidens consobrinus*. The effect was studied under five groups. Bivalves of Group 'A' was maintained as Control, group 'B' Bivalves were exposed to chronic $LC_{50/10}$ dose of Arsenic trioxide (0.304 ppm) for 18 days, while group 'C' Bivalves were exposed to respective chronic concentration of Arsenic trioxide along with 5 ml/lit of coriander extract. Accumulation of Arsenic in Bivalves from all groups were estimated after 6, 12 and 18 days. After 18 days exposure to arsenic trioxide. Bivalves from 'B' group was divided into two groups into 'D'&'E' groups. Bivalves of 'D' group were allowed to cure naturally while those of 'E' were cured with coriander extract (5 ml/lit). Accumulation of Arsenic in bivalves from these D & E groups was studied after 6, 12& 18 days. Significant accumulation of Arsenic was observed in 'B' group bivalves as compared to group 'A' (control). The group 'C' bivalves showed less accumulation of Arsenic than those group 'B' bivalves. The group 'E' bivalves showed fast recovery and less accumulation of Arsenic with coriander extract than those of group 'D' bivalves which were allowed to cure naturally. Accumulation of Arsenic was estimated by Atomic Absorption Spectrophotometry.

Key words: - *Lamellidens consobrinus*,Arsenic-tri-oxide Coriander extract.

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## Introduction

The industrialization, urbanization, advancement in technology and humanactivities are causing rapid degradation of water quality affecting the vast freshwater sources. Migration of these contaminants into no contaminated areas as dust or leachates through the soil and spreading of heavy metals containing sewage sludge are a few examples of events contributing towards contamination of the ecosystems. Heavy metals are persistent pollutants in aquatic ecosystems. The trace metal occurs in all compartments of the aquatic environment and has a tendency to accumulate in organisms from different tropic levels of food webs. The accumulation of trace metals in aquatic organisms can pose a long-term burden on biogeochemical cycling in the ecosphere. Bioaccumulation becomes an environmental problem when chemicals accumulated are toxic. Toxicity may occur along the food chain when the contaminated species or a substance is consumed. An unaltered chemical element can be eliminated rapidly residues will not accumulate and tissue less likely damaged. Once trace metals enter the food chain, they may accumulate to dangerous levels and be harmful to human health. molluscs such as bivalves, mussels have been widely employed as biomonitors for heavy metals pollution due to their ability to accumulate metals without harming themselves. Particularly bivalve molluscs have been considered as a potential bio monitor for metallic contamination in aquatic ecosystems. They are sedentary and sessile filter-feeders, having a wide geographical distribution. Because of their abundance in water and their ability to accumulate several classes of pollutants, they have been chosen as a suitable organism for bivalve watch monitoring programs. Filter feeding bivalves capable to accumulate heavy metals like Arsenic in their tissues.

Heavy metals are most hazardous pollutants because of their non-degradable nature and property to affect all kinds of ecological systems. The salts of metal, released from commercial, industrial sources passes into aquatic ecosystem. The heavy metals enter into body of animal and reaches up to non-target animal i.e. man through the food chain. These heavy metals have high biological activity and have tendencyto accumulate in organism. Arsenic (atomic number 33) is silver-grey brittle crystalline solid Arsenic is a semi metallic element with the chemical symbol “As”. It is odorless and tasteless. The trivalent methylated arsenic species have been found to be more toxic than inorganic arsenic because they are more efficient at causing DNA breakdown. Arsenate which is in the pentavalent state (As5+) is also considered to be toxic and carcinogenic to human Arsenic is highly toxic and is much used in different industrial processes. It is a chronic cumulative poison and causes cancer.

The coriander is annual herb used in flavoring curries and soups.It is widely used as folk medicine as carminative, spasmolytic, digestive and galactagogue; seed extract antimicrobial; used in lotions and shampoos; with castor oil useful in rheumatism (Anonymous, 1950; Asolkar et al., 1992; Chopra et al., 1956; Ghani, 2003; Yusuf et al., 1994)[7].Coriander (Coriandrum*sativum* L.) is currently chiefly grown in India, Asia and central Europe. In Europe it's grown almost exclusively for the seeds which when dried have a mild aromatic flavor. *CoriandrumSativum*.L constitutes an important source of natural products which differ widely in their structures, biological properties and mechanism of action. It works as diuretic and thus is used in urinary related disorders and diabetes. It is very effective in fever and also in avoiding the related symptoms in fever like dehydration, burning sensation and nausea. (Health and Lifestyle Food, US).While there is still limited understanding of the mechanism through which they act, initial research indicates that *corandrumsativum* is effective as both treatment and preventive agent for several chronic diseases. Coriander chelate with heavy metal can be excreted out by the biological system. However no attempt has been made to study the role of coriander on in heavy metal detoxification.

In present research work, bioaccumulation is considered as tool to evaluate the toxic effect of heavy metal as salt of Arsenic trioxide and effect of coriander extract on this physiological alteration.

## MATERIALS AND METHODS

The selected model animals, the freshwater Bivalves,*Lamellidensconsobrinus* were collected from Darana River Nasik. After collection, the bivalves were acclimatized in the laboratory condition at roomtemperature for 2-3 days. The active acclimatized bivalves ofapproximately same size& weight were selected for experiment.Before starting the experiment; these bivalves were divided into'A' group was maintained as control, 'B' groupwas exposed to the chronic dose of $AS_2O_3$ $LC_{50/10.}$ (0.304 ppm) upto 21 days while 'C' groupBivalveswas exposed to the chronic dose of $AS_2O_3$ $LC_{50/10}$with coriander extract (5 ml/lit)upto18days.after exposure of 18 days to heavy metal, the bivalves from group B were divided into two sub groups'D'&'E'groups.The bioaccumulation of Arsenicin the whole body of bivalves from 'A','B'and'C' groups were determined at 6 days interval. After 18 days, Bgroup animals were divided into 'D'&'E'groups.Bivalves from'D'groupanimals were allowed to cure naturally in normal water while bivalves of 'E'group were cured with Coriander extract(5 ml/lit) for next 18 days. The oxygen consumption of bivalves from 'D'&'E' groups, were determined at 6 days interval. During experimentation bivalves were fed on fresh water algae. For Bioaccumulation of heavy metals in bivalves *Lamellidens consobrinus*the experimental and control

bivalves were dissected after6 days interval &whole body were removed from shell and dried at $60^0$C, made fine powder and measured by atomic absorption spectrophotometry.

## OBSERVATION AND RESULT

The bioaccumulation data from table indicates that the amount of arsenic (AS) accumulated in whole body tissue of animals on exposure to arsenic trioxide (0.304 ppm) gets increased with increase in exposure period from 6,12 and 18 days as compare to control group 'A'. The arsenic (AS) contents are expressed in µgm/kg dry wt . The control group of animals showed minute quantity arsenic (As) as compared to the experimental Group 'B' and 'C". The control group of animals showed 8260 to 7910 µgm/kg dry wt.upto 18 days. Arsenic in whole body tissue, while the amount of accumulation of Arsenic in Presence of arsenic trioxide in the bivalves group 'B' for 6 days 34870µgm/kg dry wt. The concentration in the tissue was raised after 12 days which was 42840 µgm/kg dry wt. While after 18 days the rate of accumulation was 50210 µgm/kg dry wt. There was a minute change in the accumulation in control group animals. The rate of accumulation was lower in Arsenic trioxide and *Coriandrum sativium (L)* extract (5 ml/Lit.) exposed bivalve group 'C' as compared to those exposed Arsenic trioxide treated group 'B' in respective period of exposure for 6 days it was 16960 µgm/kg dry wt., after 12 days it was 33740 µgm/kg dry wt. while after 18 days it was 41940 µgm/kg dry wt.

The bivalve *L. consobrinus* pre-exposed to arsenic trioxide (0.304 ppm) showed fast detoxification and recovery in presence of *Coriandrum sativium (L)* extract (5 ml/lit.) than those allowed to cure naturally in normal water. The accumulation as observed after 24 days was 8170µgm/kg dry wt. After 30 days was 4270 µgm/kg dry wt. while after 36 days the amount of mercury was 2110 µgm/kg dry wt. Than those allowed to cure naturally in normal water, the rate of accumulation observed for 24 days the concentration of accumulated Arsenic was 19120 µgm/kg dry wt after 30 days 14120 µgm/kg dry wt and after 36 days 10120 µgm/kg dry wt.

**TABLE 1**

Arsenic content (µgm/kg dry weight) in whole body of *Lamellidens consobrinus*, after chronic exposure to heavy metal salts Arsenic trioxide without & with Coriander extract.

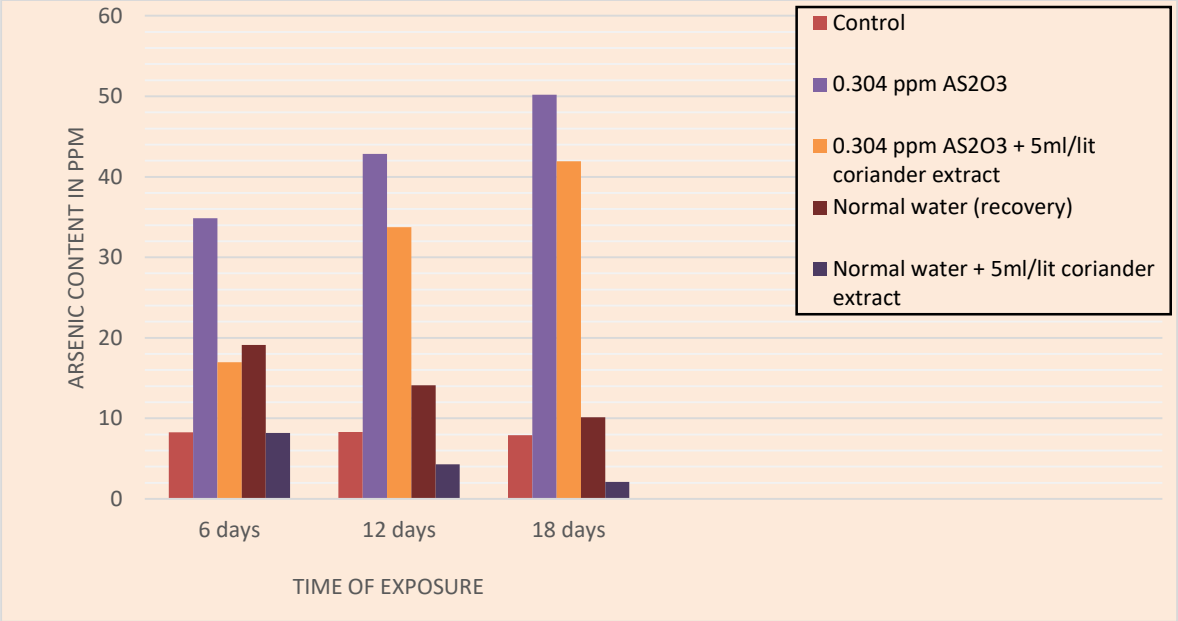
| **Sr. no.** | **Bioaccumulation of Arsenic metal content (µgm/kg dry wt.)** | | | | | |
|---|---|---|---|---|---|---|
| **Treatment** | **6 days** | **12 days** | **18 days** | **24 days** | **30 days** | **36 days** |
| **(A)**Control | 8260 (± 0.012)* | 8290 (±0.016)* | 7910 (±0.014)* | | | |
| **(B)** (0.304 ppm $As_2O_3$) | 34870 (± 0.08)* (-76.31)• | 42840 (± 0.011)* (-80.64) | 50210 (± 0.02)* (- 84.25) | | | |
| **(C)** (0.304ppm $As_2O_3$+coriander extract 5 ml/lit) | 16960 (±0.001)* (-51.29)• [+51.44]Δ | 33740 (±0.02)* (-75.42)• [+21.24]Δ | 41940 (±0.012)* (-81.13)• [+16.47]Δ | | | |
| After 21 days exposure to 0.317ppm $As_2O_3$ **(D)** WithNormal water | | | | 19120 (±0.07)* (-56.79)• [+61.91]□ | 14120 (±0.024)* (-41.28)• [+71.87]□ | 10120 (±0.013)* (- 21.83)• [+79.84]□ |
| **(E)** Cured with coriander extract 5ml/lit | | | | 8170 (±0.01)* (-1.089)• [+83.72]□ | 4270 (±0.002)* (-48.49)• [+91.49] □ | 2110 (±0.0289)* (-73.32)• [+95.79]□ |

Each value represents a mean of three observations ± standard deviation, The values in () Brackets indicate percent change over with respective days controlvalue. Second ( ) brackets indicate compared with respect to B.Values in [ ] brackets compared with respective 18 days of 'B'.

**Graphical representation of table:-** Oxygen consumption after chronic exposure

Scale – X-axistime of exposure

Y-axis Arsenic content in ppm




## Discussion

Heavy metals have more density than five times water. They are non-biodegradable and persist in the environment for several years. Inhibition of enzyme activates by heavy metal is either due to the direct binding with enzyme protein or due to damage of cell organelles or by toxic effect produced. The specific amoebocyte and digestive vesicles engulf metals outside the cell membrane then move back into the tissue carrying their particulate burden. Similarly bioaccumulation of heavy metals such as magnesium, iron, zinc and copper concentration in different body parts and shell of *C.melo* from Cuddalore coast[10]. The level of accumulation of heavy metals such as mercury, cadmium, lead, zinc, copper and arsenic in soft tissues of 15 species of benthic invertebrates from Zhejiang coastal waters, East China[3]. The concentration of iron in different soft tissues and byssus and also studied the potential role of the byssus as an excretion route for iron in *P. viridis*[13]. Cadmium is widely distributed at low level in the environment and most foods have an inherently low level of Cd which has been shown to bind to the protein and accumulate significantly in higher level FDA 2011. The accumulation of metal in different species is the function of their respective membrane permeability and enzyme system. The ratio between bioaccumulation and exposure concentration with periods of exposure has been shown by various investigators. The accumulation of several metals is due to the low capacity of these mollusks for discriminating among metals, which are similar in some characteristics such as ionic radius [6][5]. Heavy or toxic metals are metals with a density at least

five times greater than that of water. They are stable elements (meaning they cannot be metabolized by the body) and bio-accumulative are passed up the food chain to humans. These include mercury, lead, nickel, arsenic, and cadmium, aluminium, platinum and copper. Heavy metals besides micronutrients have no function in the body and can be highly toxic. Studies confirm that heavy metals can directly influence behavior of living organism including man. Two obvious methods exist for expressing the heavy metal component of living organisms. Absolute may be assessed by considering the organisms, metal contents i.e. body burden and the metal component may be expressed as a function of the weight of individual organism. Bioaccumulationof heavy metals, chromium, copper, lead and zinc in vitro by using using water lettuce *Pistia stratiotes* Engl. (Araceae)[1].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[9]. 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, [8].The pond snail (*Lymnea stagnalis* L.), which is one of the most common snails of freshwater habitats in central Europe, have a good indicator potential, since more information about the features of heavy metal accumulation, toxic pollution tolerance and impact of metals on the physiology of the genus *Lymnaea* are known, [4].the coriander has been proven to chelate toxic metals from our bodies in a relatively short period of time combined with the benefits of the other ingredients. This recipe (cilantro pesto)is a powerful tissue cleanser. Two teaspoons of this pesto daily for three weeks is purportedly enough to increase the urinary excretion of mercury, lead and aluminum, thus effectively removing these toxic metals from our bodies.

University of Oslo from, Norway, studied antioxidant activity in extract from coriander and conclude that, the leaves and seeds from coriander have concentration-dependent inhibitory activity towards 15-LO and radical scavenging properties. However, the effects are more potent in extracts from leaves than in seeds from coriander and seem that compounds of medium polarity are most potent, even if their total antioxidant contribution in the plant is small[12]. He also shows a co-relation between total phenolic content and antioxidant effect, thus a screening of phenolic content in coriander extracts will probably indicates the presence of compounds with antioxidant activity Various phytochemical components especially polyphenols, flavonoid, phenolic acids etc. are responsible for the free radical scavenging and antioxidant activity of the plants. Polyphenols possess

many biological affects, mainly attributed to their antioxidant activities in scavenging free radicals, inhibition of perodixation and chelation of transition metals [7].

Coriander contains active phenolic acid compounds, including Caffic and Chlorogenic acid. The flavonoids include quercetion, keampferol, rhamnetin and apigenin. Most of these compounds are known to inhibit free radicals generated in the cellular system, when they are obtained through the diet [11].Antioxidant activity coriander to food will increase the antioxidant content and may have potential as a natural antioxidant and thus inhibit unwanted oxidation processes.

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