PREFACE

Natural waters are the ultimate recipients of much of the chemical wastes generated by man’s industrial, agricultural and domestic activities. Most of the Indian rivers and freshwater streams are seriously polluted by industrial wastes or effluents which come along with waste waters of different industries such as petrochemicals, fertilizer factories, oil refineries, tanneries, distilleries etc. The waste waters of these industries and mills include metals (cadmium, copper, zinc, lead, mercury, and chromium, etc.) and detergents (petroleum, acids etc). All the chemicals of industrial wastes are toxic to animals and may cause death or sublethal pathology to the respiratory systems in both invertebrate and vertebrate aquatic animals.

Increasing industrialization leads to continuous addition of pollutants in the environment. The indiscriminate use of metal compounds in industries has increased tremendously. Among the environmental contaminants the heavy metals have been recognized as strong biological poisons because of their persistent nature and cumulative action. Heavy metals have a unique property of accumulation, over a period of time, along a food chain and a very high levels can be accumulated in organisms from very low concentrations in
water and sediment. Since past two decades a considerable attention has been given on the heavy metal stress on aquatic animals because of the global concern over extensive dumping of waste materials into aquatic environment.

According to Gautam and Lall (1989) aquatic environment has become the nodal point of not only serving as the receptacle for the industrial wastes but also an area of intensive research for evaluating the short and long term health and genetic hazards to humans and the deleterious changes in the ecological milieu affecting other flora and fauna.

The fresh water ecosystem occupies a very small area in comparison to marine ecosystem. Now-a-days degradation of these freshwater resources, due to water pollution has become a serious problem for the entire world.

The effect of heavy metals on fresh water ecosystem has become a global problem. These metals in that are persistant and hence once released into the environment remain in the biota for prolonged period. The heavy metals have been recognized as serious pollutants of aquatic ecosystem with deleterious effects on associated organisms which ultimately affect the ecological balance.
Heavy metals due to their bio-accumulative and non-biodegradable properties constitute a core group of aquatic pollutants. These metal particulates can be classified into essential and non-essential depending on their role in biological systems and requirement. Lead, mercury and cadmium are non-essential while, iron, copper, manganese, chromium and zinc are essential elements. They are required in traces by all forms of life but when present in excess, are highly toxic. Many workers reported that heavy metals in higher concentrations effect various metabolic processes of aquatic animals (Benoit, 1976 and Mahipal Singh, 1995).

Aquatic animals inhabiting waters contaminated by industrial effluents are adversely affected by heavy metals. The particulates of heavy metals concentrate in the tissues of aquatic biota and enter human beings through food chain causing potential health hazards sometimes even lethal (Ui,. 1972).

A great deal of research investigation is undertaken on aquatic invertebrate fauna with respect to heavy metal effects. In the aquatic environment especially the invertebrates appear to have a particularly high capability for concentrating metals alongwith other foreign materials found in the environment. Metals tendency to be bioaccumulated, may be perhaps be one of the most important biological properties (Vinogradov,
The bioaccumulation of metals varies from metal to metal and differ among various organisms. The entry of metals in the body of organisms is by various means. Some of the metals are bioaccumulated through the food chain. The secondary consumers have the more concentrations of metals in their body, but the highest being occur in the invertebrates (Vernberg and Vernberg, 1974). The ability of organisms to concentrate low levels of dissolved, undesirable substances e.g. lead, mercury, cadmium etc. and their transmission through the biological food chain is a matter of concern. There is a lack of information regarding the complete mechanisms of their transmission and concentrations and their subsequent biological effects on organisms.

Amongst aquatic invertebrate forms the molluscs in India are playing a vital role in aquatic biological study. Apart from marine environment, the freshwater molluscs are abundant in inland waters.

Gastropods not only attract the attention as pests, but like oysters, mussels and octopuses, they may be of commercial value (Cadart, 1955 and Brandt, 1968). There are edible gastropods, eaten as food in the Mediterranean Region. Molluscs are also used in scientific research such as in the study of drug action using molluscan hearts, hormones, enzymes and antitoxins especially in relation to immunological haematology. Their shells has served as a model for the study of the process of
calcification of bones. Furthermore, molluses are suitable biological agents to determine the degree of pollution particularly chemicals in the coastal waters, lakes, rivers and on land as bioindicators.

The freshwater gastropod members of the family *Lymnaeidae* consisted of freshwater snails, has received much attention in the field of medical malacologia, because its representatives are the vectors of various trematode larval forms causing diseases to human beings and his domestic animals around the world. The *Lymnaea acuminata* found distributed and are in abundance throughout the year in the Kham River near Aurangabad (M.S.), India, is selected and the metal chromium is chosen, owing to its importance as a highly toxic industrial pollutant often entering the aquatic ecosystem through drainage run off. Hence the present thesis was undertaken to study the effect of chromium on freshwater snail *L. acuminata*. The thesis is entitled “Effect of hexavalent chromium on the freshwater snail, *Lymnaea*, from Aurangabad, Maharashtra State.” The thesis comprises of following five chapters:

The first chapter deals with the general information of metal chromium as a toxicant. Its different forms, occurrence, general properties, uses and hazardous effects are included in this chapter.
The second chapter comprises of toxicity evaluation of hexavalent chromium to the snail *Lymnaea*, after exposure to 24, 48, 72 and 96 hours time periods. LC10 and LC50 values calculated for respective time periods and its toxic effects are discussed and included in this chapter.

The third chapter includes effect of chromium on the respiratory metabolism of the snail. The snails were exposed to 1/10\textsuperscript{th} concentration of LC\textsubscript{50} value for 24 and 96 hours was used as an experimental medium. The amount of oxygen consumed was measured after 1, 2, 4, 8, 12, 24, 48, 72 and 96 hours of exposure to hexavalent chromium. To estimate the amount of oxygen in water samples, standard Winkler’s Technique (Welsh and Smith, 1960) was used. The rate of oxygen consumption is measured and the results are expressed in terms of ml O2/liter/hr/gm body weight of the snail.

The fourth chapter includes the effect of chromium on changes in the various biochemical metabolites viz. total proteins, glycogen and total lipids in various body components like, foot, mantle, hepatopancreas, gonad and other accessory sexual glands such as albumen and prostate gland. Snails were exposed to 1/10\textsuperscript{th} concentration of LC\textsubscript{50} value of chromium for 24 and 96 hours exposure period. After every exposure period viz., 24, 48, 72 and 96 hrs. and after 5, 7 and 10 days all the three
metabolites were estimated. The results are expressed in mg/100 mg dry weight basis.

The histopathological lesions caused by chromium to different tissues of the snail viz. foot, mantle, hepatopancreas, gonad and neuroendocrine system of *Lymnaea* is included in fifth and last chapter.

General summary and conclusions is followed by bibliography at the end of the thesis.