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RESEARCH ARTICLE

EFFECT OF HEAVY METAL ZINC CHLORIDE ON RED BLOOD CELLS OF AQUATIC LIFE.

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Abstract

A wide range of pollutants, either physical-chemical-biological and radiological have been observed in the aquatic biota due to urbanization – industrialization and new technological development. Heavy metals are traced in some areas in sufficient concentration and physico-chemical forms that might create pollution problems. The present study is based on the impact of Zinc chloride on marine organisms. The fish *Labeo rohita* is subjected to analytical grade Zinc chloride in fresh water at different concentration of 40, 50, 60 ppm and its effect on Red Blood Cells was noted. The adverse effect of heavy metals was noted on reticuloendothedial system and haematopoisis.

Introduction:-

Heavy metals have a great negative impact on the marine organisms. This effect ranges from behavioral and ecological to physiological changes which in turn reflect on economically, nutritionally and culturally important fish species. Heavy metals are soft but highly toxic as they compete for binding with essential metals[1, 4, 6, 7] and consequently they interfere with sulphydryl groups that play an important role for normal function of enzymes and structural proteins. Due to industrialization, the number of factories and population has increased rapidly. The contamination of freshwaters with a wide range of pollutants has become a matter of concern over the last few decades[3, 5, 9]. The natural aquatic system has been extensively contaminated with heavy metals released from domestic, industrial and other man-made activities[8].

Zinc is necessary for the growth of life on earth. It helps in metabolic and physiological activities in living creatures. This is in contrary to the damage caused by trace presence of Cobalt, Copper, Chromium, Cadmium, Mercury and Lead in the human body system. However its higher concentrations are toxic for any living entity. The main source of zinc contamination in the water bodies is by the release of untreated effluents from paints, fungicide, insecticide and metal production units. This effluent concentration is as high as 160 ppm, contrary to just 5 ppm of permissible limits. Zinc causes muscular degeneration in edible fish and many health related complications in humans. The scenario in Asian countries including India is more alarming due to lack of awareness of pollution related hazards caused by uncontrolled sewage disposal into water bodies from cities and industrial zones. Government authorities were actually not concerned in this matter for years together after independence also. When these effects became draconian, the government constituted pollution control boards in each Indian state having full authority in conjunction with state electricity boards and local bodies to restrict or even entirely stop the production of units that are responsible for causing atmospheric and hydrosphere pollution by curtailing their electric supply and the effluent line to be blocked. In India, ground water, lakes and rivers have been severely affected by such indiscriminate release of sewage and industrial effluents for years together. Waters have been rendered useless for any domestic use, leaving apart the basic necessity of drinking. These waters emit foul odour, are turbid and coloured with

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microbial contamination; containing very high Total Dissolved Solids (TDS). Due to this, such water cannot be used for washing clothes and other cleaning purposes. Cases of animals which died on drinking this water are common. There is no question of survival of aquatic life in any form in such waters. Salinity of the land surrounding these polluted water bodies has increased tremendously, rendering such land unfit for agricultural activities. This has led to the breakdown of the social system. Farmers and the whole chain of people involved in this farming activity, like the traders and workers at market yards, transporters, and the retail sellers have been left without income as they have lost their source of livelihood and are under tremendous financial debt. In India, large communities rely on activities related to the fishing trade. It is not only the fisherman who is directly and adversely affected by the depleting and deteriorating quality of fish, but here also the whole chain involved in this trade is affected, and their conditions are no different to that of the farmers. Chances of microbial growth in such polluted waters is both quick and high, as the pollutants play the role of catalyst and help the organisms to thrive in the medium. The organisms that are commonly found in such waters are: *Salmonella typhi, Salmonella parayphi, Echerichia coli, Vibrio cholera.* Viruses that cause Hepatitis-A, Diarrhea, Dysentery, and Polio are also present in such environments. Other common diseases that affect the humans and animals by the contact of such polluted waters are: Sabies, Trachoma, Guinea worm, Schistosomiasis, Sleeping sickness and Hookworms. Polluted waters also help in the growth of mosquito larvae, leading to high and repeated incidence of a number of sicknesses like Malaria and Chikungunia[10].

Methodology:-

a) Processing of the fresh water fingerlings major carp *Labeo rohita* for study:-

Live and healthy fresh water fingerlings major carp *Labeo rohita* of both sexes were collected from the local fish farms. The fingerlings were transported in polythene bag containing O_2 saturated water and brought to the aquarium of the size of 4' x 2' x 2' nearly 125 to 160 fingerlings of *Labeo rohita* and were kept as stock. Aquarium containing normal fresh water, commercial fish food was given twice a day. Dissolved Oxygen level and pH of water was maintained in the laboratory. Experiments were commenced after acclimatizing the fishes to the lab condition for a period ranging from 15 to 20 days. Different concentration of Zinc was made by dissolving appropriate amount of analytical grade Zinc chloride in the fresh water. Live and healthy fresh water fingerlings exposed to different concentration of Zinc chloride. After exposing to different concentration for different duration 2–3 fingerlings were removed and sacrifice for blood smear study. The thin blood smears were prepared for observing the cellular alterations in the blood cells. The smears were stained with Leishmann's stain and the observations were noted in a tabular form.

b) Preparation of heavy metal samples of Zinc Chloride and processing of fingerlings:-

Different concentrations of Zinc Chloride were made by dissolving appropriate amount of its analytical grade in fresh water. These sets of different concentration of Zinc chloride (40, 50, 60 ppm) were prepared for treatment. The fish were divided into different group of 3 individuals each in separate polythene boxes. Commercially available fish food was provided twice a day and water medium with Zinc chloride was changed every alternate day.

c) Preparation of Blood Smear:-

Live and healthy fresh water fish subjected to different concentration of Zinc chloride (40, 50, 60 ppm). The blood smear was prepared for observation. After an interval of 15 days fish were removed from each of container and the blood was drawn from the dorsal aorta or from pressing of gills. A drop of blood was taken on a glass slide and a thin smear was made. It was allowed to dry at room temperature. The slide was then stained with Leishmann's stain for 10 minutes. Then it was washed with distilled water and allowed to dry at room temperature and studied under light microscope.

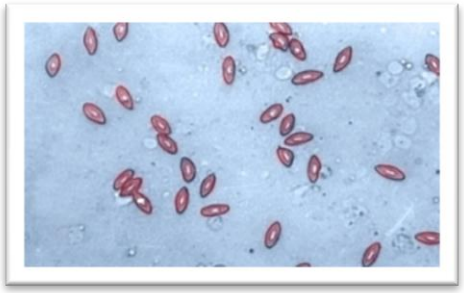
Result of Hematological Studies on Fish *Labeo rohita*:-

Table :- Effect of Zinc chloride on the normal blood cells of *Labeo rohita* subjected to various concentrations

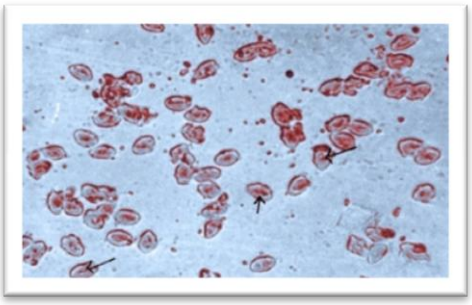
Concentration of Zinc Chloride	Effect on RBC after Exposure for		
	15 days	30 days	45 days
40 ppm	Nucleus is enlarged and damaged.	Nucleus reduced in size and shifts in position	Cell membrane is wrinkled and damaged.
50 ppm	Nucleus is enlarged and damaged.	Cell membrane is wrinkled and vacullation observed.	Nucleus shifts in position and the cell membrane is damaged.
60 ppm	Cell membrane is damaged	Nucleus enlarged and	Nucleus enlarged and shifts in

	and nucleus enlarged.	vacullation observed.	position.

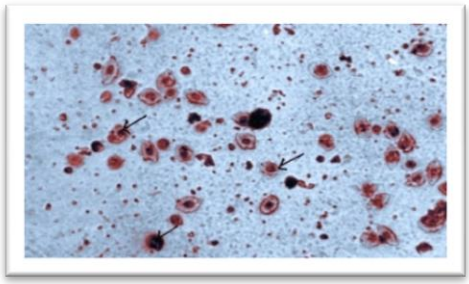
Normal bloods smear of fish *Labeo rohita*.



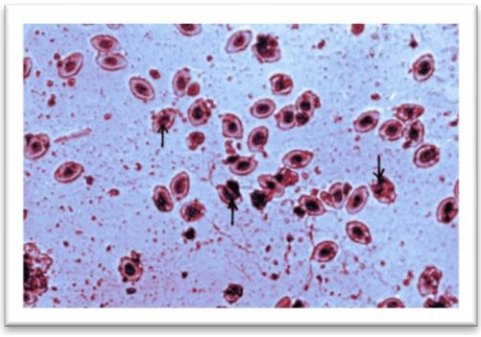
Fish *Labeo rohita* showing the nucleus of RBC_S was reduced in size and loses its central position and damaged



Fish *Labeo rohita* showing the cell membrane of RBCs was wrinkled and damaged



Fish *Labeo rohita* showing the nucleus of RBCs was enlarged and vacullation



Discussion of Results:-

Concentration of Zinc Chloride selected was higher than that of Copper Chloride and Cadmium Chloride. Effects of Zinc Chloride were observed in short and long duration exposure. 40 ppm short duration exposure has shown enlarged and damaged nucleus in same concentration longer exposure leads to reduction of size of nucleus and wrinkled cell membrane due to plasmolysis effect at longer duration. 50 ppm short duration exposure has shown the

nucleus and damaged and in same concentration longer exposure leads to the cell membrane wrinkled and vacullation observed, the nucleus shift in position and the cell membrane damaged. 60 ppm short duration exposure has shown the cell membrane damaged and nucleus enlarged in same concentration longer exposure leads to the nucleus enlarged and vacullation observed, the nucleus enlarged and shifts in position.

Conclusion:-

These types of condition like wrinkled cell membrane, damaged nucleus or enlarged nucleus, vacullation lead either to death of cell in long run or are responsible for anemic condition of animals. Anemic conditions and less iron content have been reported by several workers in fish, bird and mammal following exposure to pollutants. It is also reported by[2] that RBCs count was declined by higher concentration of endosulfan subjected to fish. It has also been postulated that the reduction of RBCs count might be due to inhibition of RBCs production and destruction of RBCs by pollutant[2].

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