

Toxic Effect of Nickel Sulphate on Red Blood Cells of Fish *Labeo rohita*

Alkesh I. Shah

Associate Professor & Head, Department of Zoology, B. P. Baria Science Institute, Navsari, India

ABSTRACT: Heavy metals occur naturally in traces under aquatic environments; their levels have increased due to industrial, agricultural and mining activities. So the aquatic life has become prove to the toxic effect of heavy metals. The present study has been undertaken to analyse the impact of Nickel sulphate on the Red Blood Cells of fish *Labeo rohita*. The effects reported showed wrinkled all membrane, damaged nucleus or enlarged nucleus, vacuolation leading either to death of all or for anemic condition in the animal. The fish were exposed to analytical grade Nickel sulphate at different concentrations of 40, 55, 70 ppm. and its effect on Red Blood Cells studied.

KEYWORDS: Nickel sulphate, Red Blood Cells, Aquatic environment, *Labeo rohita*.

I. INTRODUCTION

Heavy metals occur naturally in traces under aquatic environments, presently their levels have increased due to industrial, agricultural and mining activities. Resultantly the aquatic life has become prone to the toxic effect of heavy metals [1]. Among contaminants, the heavy metals are considered to be most hazardous at global level with reference to their toxicity [2]. Various toxic chemicals produced during industrial and agricultural activities contaminate aquatic ecosystems [3]. Aquatic pollution with metals is a global environment problem. Among various pollutants, heavy metal are unique in their action due to their non-biodegradability [4], prosperity of bio-magnification in food chain [5] and their effects on the ecological equilibrium of the recipient aquatic body and diversity of aquatic organisms [6, 7]. Nickel is a heavy metal element whose presence in traces is necessary for the growth of all living entities; whether motile or immotile; on the earth. When the amount exceeds the tolerance limits of that particular living being, then the resultant effect creates impediments in the growth or even leads to fatal consequences.

II. LITERATURE SURVEY

Excessive presence of nickel also plays a key role in hampering the growth of fish *Labeo rohita*. Nickel is used by industries associated with different trades. Nickel finds it use in the manufacturing of stainless steel, and its alloys; and also as a catalyst in food processing units. Nickel salts like nickel chloride, nickel sulphate and nickel nitrate are widely used in many processes. It is present in soil, air, water and all living material. It is the 24th most widely found element in the whole world. Burning of natural coal in industrial boilers, natural erosion of rocks due to strong winds, combustion of petroleum products are the causes of release of nickel salts in the atmosphere. Tobacco also contains nickel, and its smoking results in the direct addition of excessive nickel content in the body of the smoker [5]. The same concentration of nickel in drinking water is 10µg/liter. Effluents laden with nickel salts pollute the water of the rivers thus disturbing the eco system and the organisms that rely on it; animals and human population who thrive on the river water [6, 7]. These effluents are from the human settlements that thrive in cities and near industrial zones and the industries themselves who release effluents unchecked. Excess of nickel concentration in water hampers the growth of fish amounting to their survival in question. This fish when eaten by people, causes skin rashes, asthma, eye diseases, and more dangerous consequences of damage to body implants like cardiac stents and valves, and orthopedic implants like plates, rods; damage or death of living cells; carcinogenesis of living cells, that are fatal when things go out of control. The reason behind the damage or death of living cells is believed to be due to oxidative reactions known as nickel induced Lipid Peroxidation (LPO). Hence it is better to keep a watch on the release of nickel through effluents and the total content of excessive nickel in the whole of the environment; so that the above mentioned hazards are avoided [8].

International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 5, Issue 11, November 2016

Any alteration in the chemical composition of natural aquatic environment usually induces changes in the biochemical aspects of the inhabitants particularly fishes. These alterations in body metabolism due to organochlorine intoxication have been extensively studied [9, 10].

III. METHODOLOGY

a) Processing of the fresh water fingerlings major carp *Labeo rohita* for the 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 O₂ 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 Nickel was made by dissolving appropriate amount of analytical grade Nickel sulphate in the fresh water. Live and healthy fresh water fingerlings exposed to different concentration of Nickel sulphate. After exposing to different concentration for different duration 2–3 fingerlings were removed and sacrificed 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 Nickel Sulphate samples and processing of fingerlings:

Different concentration of Nickel was made by dissolving appropriate amount of analytical grade Nickel sulphate in the fresh water. These sets of different concentration of Nickel sulphate (40, 55, 70 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 Nickel sulphate was changed every alternate day.

c) Preparation of Blood Smear:

Live and healthy fresh water fish subjected to different concentration of Nickel sulphate (40, 55, 70 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 Nickel Sulphate on the normal blood cells of *Labeo rohita* subjected to various concentrations

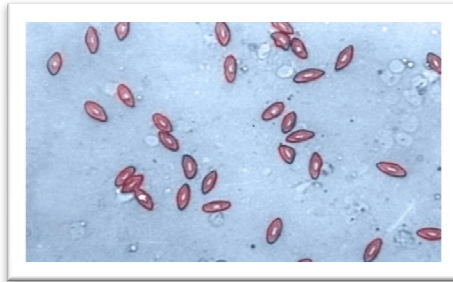
Concentration of Nickel Sulphate	Effect on RBC after Exposure for		
	15 days	30 days	45 days
40 ppm	Cell membrane is damaged.	Nucleus is enlarged and vacuolation observed.	The cell membrane damaged and vacuolation observed.
55 ppm	Nucleus shifts in position.	Cell membrane gets wrinkled and vacuolation observed.	The nucleus damaged.
70 ppm	Cell membrane is damaged and vacuolation observed.	Nucleus is enlarged and shifts in position.	Cell membrane is destroyed and nucleus is enlarged and damaged.

International Journal of Innovative Research in Science, Engineering and Technology

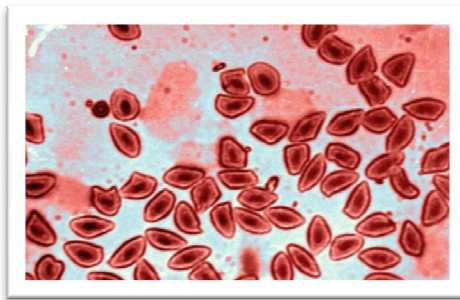
(An ISO 3297: 2007 Certified Organization)

Vol. 5, Issue 11, November 2016

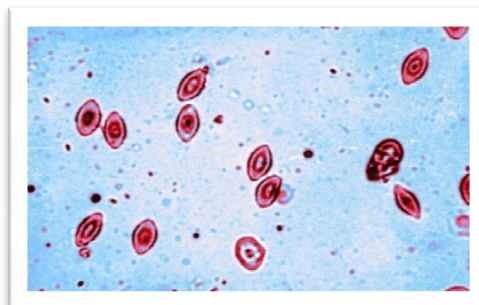
Normal blood smear of fish *Labeo rohita*.



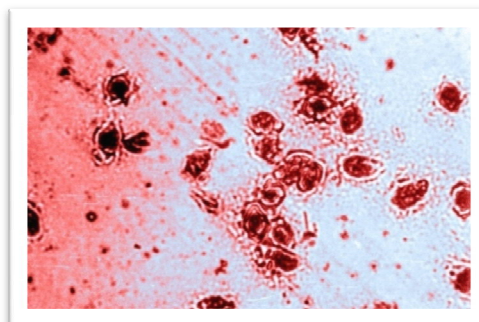
Fish *Labeo rohita* showing the cell membrane of RBCs was damaged



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



Fish *Labeo rohita* showing the nucleus of RBCs enlarged and loses its central position



International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 5, Issue 11, November 2016

III. DISCUSSION OF THE 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 vacuolation 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 vacuolation observed, the nucleus enlarged and shifts in position.

During the study of RBCs with 40 ppm concentration of Nickel sulphate exposed to fish on 15th day the cell membrane was damaged but in longer duration it was observed on 30th day the nucleus enlarged and vacuolation observed. While on 45th day the cell membrane damaged and vacuolation seen. 55 ppm of Nickel sulphate concentration lead to the nucleus shift in position even in short term exposure of 15 days [11]. While on 30th day exposure the cell membrane wrinkled and vacuolation observed and on 45th day exposure the nucleus damaged. 70 ppm concentration of Nickel sulphate lead to the cell membrane damaged and vacuolation observed on 15th day. While on 30th day exposure the nucleus enlarged and shifts in position and on 45th day the cell membrane destroyed and the nucleus enlarged and damaged.

IV. CONCLUSION

These types of condition like wrinkled cell membrane, damaged nucleus or enlarged nucleus, vacuolation 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 that RBCs count was declined by higher concentration of endosulfan subjected to fish. Thus we can conclude that heavy metals affect reticulo-endothelial system and haematopoiesis.

REFERENCES

- [1] Kalay M, Canli M. "Elimination of essential (Cu, Zn) and non-essential (Cd, Pb) metals from tissues of freshwater fish *Tilapia zill.* Turkish". J. Zool., 24: 429-436. 2000.
- [2] Vuren VJHJ, Preez HHD, Wepener V, Anendrofe A, Barnhoorn IEJK. "Lethal and sub-lethal effects of metals on the physiology of fish". An experimental approach with monitoring support. Water research commission, Pretoria. WRC. Report 608/11/99. 1999.
- [3] Isani G, Andreani G, Cocchioni F, Fedeli D, Carpena E, Falcioni G. "Cadmium accumulation and biochemical responses in *Sparus aurata* following sub lethal Cd exposure". *Ecotoxicol. Environ. Saf.* 72: 224-230. 2009.
- [4] Javed M, Abudullah S. "Studies on the acute and lethal toxicities of iron and nickel to fish". *Pakistan J. Biol. Sci.* 9: 330-335. 2006.
- [5] Khare S, Singh S. "Histopathological lesions induced by copper sulphate and lead nitrate in the gills of fresh fish *Nandus*". J. *Ecotoxicol. Environ. Monit.* 12: 105-111. 2002.
- [6] Farombi EO, Adelowo OA, Ajimoko RK. "Biomarkers of oxidative stress and heavy metal levels as indicators of environmental pollution in African Cat Fish (*Clarias gariepinus*) from Nigeria Ogun River". *Int. J. Environ. Res. Pub. Health*, 4: 158-165. 2007.
- [7] Farombi EO, Adelowo OA, Ajimoko YR. "Biomarkers of oxidative stress and heavy metal levels as indicators of environmental pollution in African Cat Fish (*Clarias gariepinus*) from Nigeria Ogun River". *Int. J. Environ. Res. Pub. Health*, 4(2): 158-165. 2007.
- [8] Polish Journal of Environment Study Vol.15, No.3(2006), 375-382.
- [9] Leonard AW, Hyne RV, Lim R, Pablo F, Van den Brink P. "Riverline endosulfan concentrations in the Namoi River, Australia: Link to cotton field runoff and microinvertebrate population densities". *Enviro. Toxicol. Chem.*, 19: 1540-1551. 2000.
- [10] Ramaneshwari K, Rao LM. "Influence of endosulfan and monocrotophos exposure in the activity of NADPH cytochrome C reductase (NCCR) of *Labeo rohita* (Ham)". J. *Environ. Bio*, 29: 183-185. 2008.
- [11] Anusha. "Effect of endosulfan on oxygen consumption, red blood cell count and food utilization of fresh water fish *Clarius dussumieri*". I J. *Env. And toxicology*, 4(1): 1-63. (pp.33-36)1994.