ISSN 2348-313X (Print)
International Journal of Life Sciences Research ISSN 2348-3148 (online)
Vol. 7, Issue 2, pp: (351-356), Month: April - June 2019, Available at: www.researchpublish.com

Acute Toxicity of Potassium Dichromate on Behavioral Response and Morphological Aspects of Clarias batrachus (Linn)

Fozia Ali*, A.K.Biswas**, V.K.Kakaria***

*Department of Zoology Regional Institute of Education (N.C.E.R.T) Shyamla Hills, Bhopal M.P, India (462013)

** Indian Institute of Soil Science (I.C.A.R), Nabibagh, Berasia Road, Bhopal .M.P, India. (462038)

***Department of Zoology Regional Institute of Education (N.C.E.R.T) Shyamla Hills, Bhopal M.P, India.

E-mail Address: *fozialimsr@gmail.com*

Abstract: **In the present investigation acute toxicity of potassium dichromate on Clarias batrachus (Linn) were observed. The fishes were exposed to 10.5, 12.5, 13.2 and 25.7 ppm of potassium dichromate for 96h duration. 96h Lc50 value for potassium dichromate was 13.2 ppm which was calculated by Probit analysis method. The physicochemical parameters of tap water used for experiment were also recorded pH 7.0-7.5, DO 8.5-10.0 mg/l, Total hardness 125.9 mg/l, Temperature 28.5-30.90c and Salinity 25.8-27.5psu.The morphological changes like mucus secretion from body surface, discoloration of skin, swelling on barbels, lesions on skin, muscular bleeding, and hemorrhage in fins were observed. Behavioral changes like unbalanced swimming, vertical and downward swimming, restlessness, loss of equilibrium and balance in water, jumping and jerking and difficulty in getting oxygen were also observed during the whole study. Therefore fish population exposed to chromium in natural lotic water bodies by different sources gets depleted.**

Keywords: **Behavioral changes, Clarias batrachus, Lc50, Morphological changes, Potassium dichromate.**

1. INTRODUCTION

All the pollutants pose direct threat to icthyofauna because aquatic environment receives all toxic substances including heavy metals. Heavy metals are toxic and not mobilized by the body but are accumulated in the soft tissue of body. The heavy metal pollution now becomes the world wide global problem due to enormous increase of pollutants from agricultural runoff, domestic sewage, and industrial effluents. Srinivasa et al (2007) reported aquatic environment receives heavy metals by dumping of municipal and domestic wastes, industrial effluents, and urban runoff, and agricultural runoff, atmospheric deposited and mining activities. The biotic and abiotic components of aquatic environment gets destructed results in to reduction in species richness mostly icthyofauna by heavy metals because the heavy metals have the property of biomagnification. Censi et al., (2006) also reported that metals have the property of bioaccumulation within the aquatic ecosystem. Fishes are used to evaluate the health of Aquatic environment. Aquatic pollution can be identified by the study of behavior, physiology and histology of fishes. Ozmen et al (2004), Begum et al (2005), Fernadez et al (2008), Ozturk et al (2008),

Pote et al (2008) and Parveen et al (2008) reported heavy metals in rivers, sediment, lakes and fish. The commercial and edible species of fishes have been investigated.different fish species have different sensitivity toword cadmium and iron as the concentration of these metals in the surrounding water. Suresh et al (1993), cinier et al (1999), Abdullah et al (2003). Heavy metal toxicity fishes like Salmonids are sensitive to high cadmium levels, carp and catla catla accumulate cad Suedel et al, (1997) ,Javed, (2005) reported that heavy metals are absorbed by fish directly from contaminated water or indirectly from feeding on living biota of contaminated water body. It has aslo reported that swimming behavior,

maturation period feeding behavior were reduced by heavy metal toxicity in fishes. Shrivastav and Shrivastav (1998) and Atif et al,.(2005). Hexavalent chromium may exist in aquatic medium as water soluble compounds and may persist in water and is well known carcinogenic and mutagenic metal. In the present study the effecrt of potasiumdichromate on the fresh water fish Clarias batrachus (Linn) has been carried out on its behavior and morphology and toxicity of lethal concentration of potassium dichromate at 96h duration.

2. MATERIAL AND METHODS

Fishes were collected from local fish market and were transported to Patra fish seed farm then were kept in cemented tanks for acclimatization. KMNO4 was used as a disinfectant fishes were dipped in to this solution before put them in to tanks. During acclimatization feeding and aeration were provided to fishes and periodic inspection was conducted in order to remove the dead and injured fishes. After acclimatization of one month fishes were transfer to glass aquarium of 60L capacity and then were divided in to 5 groups one serves as a control group and the remaining as treated groups ten fishes were kept in each aquarium. The water quality parameters of water like Salinity DO, Temp, Total hardness and pH were also analyzed during the whole experiment. Feeding was stopped before 24h prior to exposure. Stock solution of potassium dichromate (Merk) was prepared according to methods of APHA (1998) and fishes were exposed to 10.5, 12.2, 13.2 and 25.7 ppm respectively. After exposure Fishes were removed from glass aquarium their no was recorded as per the amount of concentration and Lc50 value was calculated by Finny (1971) Probit Analysis method. Morphological and behavioral changes were also recorded during the whole experiment.

3. RESULTS

The LC50 value for Clarias batrachus was 13.2 mg/l of potassium dichromate as shown in tab (1). The physicochemical parameters were also recorded as shown in tab (2).The fishes show different mortalities, morphological and behavioral changes at different concentrations of dose at different intervals of duration. During first trial fishes becomes highly reactive and try to escape from glass aquarium as amount of dose was increased rapid upward and downward moments occurs in fishes. Complete loss of balance and difficulty in respiration and finally restlessness, motionless and sit on bottom of aquarium as shown in tab (4). Simultaneously the abdominal and barbel oedema occurs more mucus secretion, eradication of epithelial cells like white long streaks. Epithelial lesions, discoloration of skin, fins and barbless gets haemaragic and mouth region and muscular regions were bloody as shown in tab (3) and tab (5).at the end of completion of experiment dead fishes were removed and were dissected to see the effect on internal organs the discoloration of liver and kidney were observed. The gill clumping was also recorded.

Lc50 value for potassium dichromate Tab (1)

POTASIUM DICHROMATE Lc50 13.2mg/l				
Duration	24h	48h	72h	96h
Concentration mg/l	10.5	12.5	13.2	25.7

Physicochemical parameters of water during the experiment. Tab (2)

Parameters	Control aquarium	Exposed 24h	Exposed 48h	Exposed 72h	Exposed 96h
Salinity	23.8-30.9	24.0-25.8	29.1-30.0	25.5-26-9	27.9-30.8
Ph	7.0-7.5	7.0-7.5	7.0-7.0	7.0-6.5	6.5-6.0
Do	8.5-10.0	10.0-9.0	7.5-8.1	8.0-8.5	7.0-7.4
Total hardness	125.9-129.2	121.8-123.0	125.0-123.9	121.8-125.9	128.0-129.1
Tempt °C	28.5-30.90	27.9-27.8	29.0-30.5	27.0-30.0	28.2-30.5

ISSN 2348-313X (Print)
International Journal of Life Sciences Research ISSN 2348-3148 (online)
Vol. 7, Issue 2, pp: (351-356), Month: April - June 2019, Available at: www.researchpublish.com

Morphological changes in clarias batrachus Tab (3)

Morphological changes	Duration				
	24h	48h	72h	96h	Control
Swelling on barbless	_	++	+++	++++	-
Swelling on abdominal region	-	++	+++	++++	-
Change in skin color	-	++	+++	++++	-
Lesions on skin	+	+	+++	++++	-
Fin Hemorrhage	_	_	+++	++++	-
Mucus secretion	+	++	+++	++++	-
Eradication of epidermis of integument	_	++	+++	++++	-
Gill clumping	_	_	+++	++++	-
Bleeding near mouth region and muscular region	_	_	+++	++++	-

Symbol - = normal change + = abnormal++ = moderate+++ = mild++++ = maximum changes

Behavioural changes in Clarias batrachus Tab (4)

Behavioral changes	Duration				
	24h	48h	72h	96h	Control
Jerking and jumping	+	++	+++	++++	-
Motionless and restlessness	+	++	+++	++++	-
Schooling	-	+	+++	++++	-
Loss of equilibrium	-	-	+++	++++	-
Upward and downward swimming	+	+	+++	++++	-
Blinking of eyes	-	+	+++	++++	-
Difficulty in respiration	_	-	++	++++	-
flat at bottom	_	_	++	++++	-
Increase in Opercular moment	_	_	++	++++	-

Symbol - = normal changes+ = abnormal++ = moderate+++ = mild++++ = maximum changes.

ISSN 2348-313X (Print)
International Journal of Life Sciences Research ISSN 2348-3148 (online)
Vol. 7, Issue 2, pp: (351-356), Month: April - June 2019, Available at: www.researchpublish.com

Tab (5) morphological changes in Clarias batrachus (Linn)

Mucous secretion

Haemaroge in fin region

Discoloration of skin and bloody barbles

Epidermal corrosion

4. DISCUSSION

Mackie (1989); Oyeno (1998); Khyakre et al (2001) reported toxicity of different heavy metals on different test animals. Singh and Goswami (2010) reported that the fish is the most useful tool to study the heavy metal pollution in water. Gill et al (1985). Veena et al (1997), Liopoulou-G et al (2001) reported in Barbus conchinus, Eutropus maculatus and Salmo garadiari the 96Lc50 values were 0.181, 0.13 and 0.51 ppm of mercury. 96lc50 value of lead for Salvalunis inlius was 4.1and 3.36ppm (Holcombe et al (1976).96 h Lc50 value of hexavalent chromium and cadmium for juvenile milk fish was 22.45 and 38.9 mg/l (Darmayati, Y. And D. Hindarti, (1940).In the present investigation the percentage mortality were observed and the average 96h Lc50 value of potassium dichromate for Clarias barachus was 13.2 ppm. so this data indicates that chromium is highly toxic element in aquatic environment and causes drastic effects on icthyofauna during this acute toxicity test the Clarias batrachus shows abnormality in behavior and morphology. Achinson et al (1996) studied behaviour of aquatic animals were changed due to heavy metal toxicity. Behavioral changes denotes a higher organisation level of biomarker than any cosidered so for(walker et al .,2003).The behavior changes like loss of equilibrium and erratic swimming are correlated to central nervous system of fishes. Any change in behavior occurs by the impact of potasium dichromate on different parts of nervous system by the involvement of efferent and motor nerve fibers. In case of C.mirgala and L.rohita similar signs were observed by Deva prakasa Raju (2000); Prashant and Neelgund (2008). Hypothalamus that controls the respiratory cycle alters a lot results in to difficulty in taking oxygen. Operculur moments were increased due to impact of dose on gill region by secreting more mucus. Hence ventalation rate increases enormously in exposed fishes. Decrease in oxygen uptake in Puntius ticto to Endosulfan were also recorded (Magre and Patil (2000). Muniyan et al (1999) and David et al (2002) reported gaseous exchange was disturbed by accumulation of mucus around gills. The hyper activity of fishes was observed that is correlated with acetylcholine esterase enzyme function that blocks the transmission of nerve impulse by chromium toxicity. The hindrance of nerve transmission by altering the enzyme acetyl choline esterase on lethal exposure of cyanide and pesticides on different fishes were also observed (Deva Prakash Raju (2000); Prashant (2003).Discoloration of skin takes place by the impact of chromium on Tyrosine's enzyme of Chromatophore cells especially melanophores as that converts amino acid tyrosine in to melanin pigment but due to toxic effect of chromium on the enzyme the color of fish was not regulated. Other

epidermal cells like goblet and club cells were also damaged. Mucus glands were also damaged by chromium toxicity that result in to enormous secretion of mucus around whole fish body.

5. CONCLUSION

The Chromium as a micronutrient plays an important role in the metabolic process of fishes but due to its higher concentration by different pollution sources in water it becomes toxic to aquatic animals like fishes. The present work showed that it has drastic impact on the behavior and morphology of Clarias batrachus (Linn). The changes in behavior and morphological lesions were directly related to increase in concentration of chromium. So further investigation is thus necessary to formulate water quality in order to protect abundance and distribution of icthyofauna.

REFERENCES

[1] Abdullah, S., M. Javed and A.Iram, 2003. Bio-accumulation of iron in Catla Catla from river Ravi. Indus J .Plant Sci.,2;54-8.

[2] APHA, AWWA, WEF.1998.Standard methods for the examination of water and waste water.20th Edn. American Public Health Association, Washington, DC.

[3] Atchison GJ, Sandheinrich MB and Bryan MD (1996).Effect of Environmental Stressors on Interspecific interactions on Aquatic animals. In Newman,M.C and Jagoe, C.H(eds).Quantitative Ecotoxicology:AHierarchial Approch.Chelsea,MI:Lewis.

[4] Atif, F., Parvez, S., Pandey, S., Ali, M., Kaur, M., Rehman, H., khan H.A. and Raisudin, S.(2005) modulatory effect of cadmium exposure on Deltamethrine-induced oxidative stress in channa punctatus Bloch. Archives of Environmental Contamination and Toxicology 49:371-377.

[5] Begum,A., Amin, M.d.N., Kaneco, S., and Ohta, K., (2005) selected elemental composition of the muscle tissue of three species of fish,Tilapia nilotica, Cirrhina mrigala and Clarias Batrachus,from the fresh water Dhanmondi Lake in Bangladesh.Fod Chemistry, 93: 439-443.

[6] Cinier, C.C., M. Petit-Ramel, R. Faure, O. Garin and Y.Bouvet, 1999.Kinetics of cadmium accumulation and elimination in carp (cyprinus carpio) tissues.J.Comp. Bio chem .Physiol., 122:345-52.

[7] Darmayati, Y. And D. Hindarti, 1994. Acute toxicity of cadmium and hexavalent chromium to tropical fish milkfish (Chanos chanos). In the proceedings IOC-WESTRAC Third International Scientific Symposium, pp:245-250.

[8] David M.SB Mushigeri and MS Prasahanth..2002. Toxicity of Fenvalerate to the fresh water fish, Labeo rohita.Geobias, 29(1): 25-27

[9] Deva Parkasa Raju,B. 2000.Fenvelarate induced changes in protein metabolism of fresh water fish,Tilapia mossambica. Ph. D Thesis S.K. University.Anantapur, A.P.India. Finney,DT.1971.probit analysis.3rd ed. Cambridge University Press. London.

[10] Fernandes, C., Fontainhas-Fernades, A., Cabral, D., Salgado, M.A., (2008) Heavy metals un water, sediment and tissues of Liza saliens from esmoriz-paramos lagoon, Portugal. Environ.Monit.Assess 136:267-275

[11] Gill,T.S. and J.C. plant, 1985.Mercury induced blood anomalies in the fresh water toleost, Barbus conchonius. Water, air and soil pollution, 24:165-171.

[12] Javed Md.(2005) Heavy contamination of freshwater fish and Bed sediments in the river Stretch and Related Tributaries .Pakistan Journal of Biological Sciences 8(10)1337-1341.

[13] Kock, G., M. Triendl and R.Hofer , 1996. Seasonal patterns of metal acummulation in Arctic char (salvelinus alpinus) from an oligotrophic Alpine Lake related to tempeture. Canadian J.Fisheries and Aquatic Sci., 53: 780-786.

[14] Khangarot BS and Ray PK (1989) correlation between heavy metal acute toxicity values in Daphina magna and fish, Bulletin of Environmental contamination and toxicology, 38:722-726.

[15] Liopoulou- Georgudaki, J. And N .Kotsanis, 2001. Toxic effects of cadmium and mercury in rainbow trout (Oncorhynchus mykiss) :A short term bioassay .Bulletin of Environmental Contamination and toxical.,66: 77-85.

[16] Muniyan, M. And Veeragahavan, k.1999.Accute toxicity of ethofenprox to the fresh water fish, Oreochromis mossambicus (perers).J. E.nviron. Biol., 20(1): 153-155.

[17] Mackie GL 1989 .Tolerance of five Benthic invertebrates to hydrogen lons and metals (Cd, Pb, Al) Archives of Environmental contamination and Toxicology, 18:1-2.

[18] Ozmen,H.,Kulachc,F.,Cukuroval,A and Dogru.M.,(2004). Concentrations of heavy metals and radioactivity in surface water and sediment of Hazar lake(Elazang, Turkey) Chemosphere,55:401-408.

[19] Ozturk .M.,Ozozen,G.,Minareci,O.,and Minareci,E.,(2008). Determination of heavy metals in fishes,water and sediment from the Demirkopru Dam Lake(Turky).Journal of Applied Biological Science.,2(3):99-104.

[20] Oyewo EO (1998).industrial sources and distribution of heavy metals in Lagos Lagoon and their Biological effects on Estuarine animals. Ph.D.Thesis Department of Marine Science, University of Lagos, 274pp.

[21] Prasahnth MS. 2003.Cypermenthin induced physiological, biochemical and histrophalofical changes in fresh water fish, Cirrhinus mrigala.Ph.D., Thesis Karnataka \university, Dharwad.India

[22] Prashanth MS. And SE.2008. Free cyanide- induced biochemical changes in Nitrogen metabolism of the indian major carp, Cirhinus mrigala .journal of the basic and clinical physiology and Pharmacology, 18 (4):277-287.

[23] Parveena, S.M.,Radojavic,M.,abdullah, M.H.,Aris,A.Z.,(2008).Application of sediment quality guidelines in the assessment of mangrove surface sediment in Mengkabong lagoon, sabah, Malaysia iran.J. Environ.Health. Sci.Eng.,5(1);35-42.

[24] Pote.J..Haller,L.,Kagalou,L.,Loizeau,J.L.Bravo.A.G.Sastre.V., and Wildi.,W.,(2008). Effects of a sewage treatement plant outlet pipe extension on the distribution of contaminants in the sedimentes of the Bay of Vidy,Lake Geneva,Switzerland Bioresource Technology.,99:7122-7131.

[25] Sirinivasa, R., M. Bhavesh, D. Sunil, J. Manish and k. Leena et al., Bioacummulation of heavy metals in some commercial fishes and crabs of gulf of cambay, India Curr.Sci., 92:1489-1491

[26] Singh, R.K. and Goswami,N.D.(2010) changes in Bimodal oxygen uptake due to Furadan intoxication in facultative Air breathing fish.Clarias batricus (Linn) life Science Bulletin 7(1):127-128.

[27] Shrivastav.S.K.and Shrivastav A.K. (1998). Annual changes in serum calcium and inorganic phosphate levels and corelation with gonadal status of fresh water murrel,Channa punctatus(Bloch).Brazillian Journal Of Medical and Biological Research 31:1069-1073.

[28] Suedel,B.C.,Rodgers,Jr.J.H.,Deaver and E.(1997). Experimental that may affect toxicity of cadmium to fresh water organisms.Environmental Contamination and Toxicology.

[29] Veena, K.B., C.K. Radhakrisahanan and J.Chacko, 1997. Heavy metal induced biochemical effects in an estuarine teleost. Indian. J. Marine Sci.,26: 74-78.

[30] Walker CH,Hopkins S.P.Sibly RM and Peakall D.B(2003).Principles of Ecotoxicology, 2nd edition.Taylor and Francis group.Fetter Lane,London.