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A Study on Oxygen Consumption in a Freshwater Fish *Channa punctatus* Exposed to Automobiles Effluent Water From Car Servicing Centers Of Nanded City.

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ABSTRACT

The fish Channa punctatus exposed to lethal concentrations of automobiles effluent at 96 hr LC $_{50}$ 1139 ml. Total oxygen consumption of fish to the effect of automobiles effluent was 2.68, 3.10, 1.84 and 1.01 ml CC of O_2/animal/hr. during 24, 48, 72 and 96 hours respectively in treated group. In control total oxygen consumption was 2.99 ml CC of O_2/animal/hr. which indicate initially increasing demand of oxygen is required in treated fishes but later on in 72 and 96 hrs. decreasing trend was observed in the experiment these results are compare with control group. Hence oxygen consumption rate was observed in experimental group suddenly increase in initial period of exposure and decreasing trend in 72 and 96 hours in treated group.

Keywords: O2 uptake; *Channa punctatus*; automobiles effluent.

INTRODUCTION

Aquatic pollution has become a global problem in recent years. Extensive industrialization has measurably influenced the quality of water lakes, ponds and rivers all over the world. Dharmalata and Namitha Joshi (2002), reported that the respiration is a vital phenomenon of the life and the rate of oxygen consumption in turn controls the metabolic activities and changes in respiratory rates have been used as the indicator of the stress in pollutant exposed organisms. Increasing human population and establishment of industries have resulted in the discharge of untreated industrial effluent and sewage wastes, containing heavy metals and their compounds, into the aquatic bodies. Unlike other types of contaminants, heavy metals cannot be eliminated from the environment and heavy metal pollutants are greatest concern because they cause deterioration of life sustaining quality of water and cause damages to both aquatic fauna and flora.

Considering the impact of automobiles effluent on metabolic rates of aquatic animals and since the fishes have been the most popular test organisms and their importance in food web of aquatic ecosystem.

According to the Prosser and Brown, (1977) the respiratory potential or oxygen consumption of an animal is the important physiological parameters to assess the toxic stress, because it is a valuable indicator of energy expenditure in particular and metabolism in general. Oxygen consumption also be useful to assess the physiological state of an organism, helps in evaluating the susceptibility or resistance potentiality and also useful to correlate the behaviour of the animal, which ultimately serve as predictors of functional disruptions of population. Respiration is one of the most important physiological parameters on which many of the vital functions like growth and reproduction of fishes depend (Holden 1973), which in turn has a direct bearing on the productivity of freshwater ecosystems in terms of fish production.

A variation in respiration rate is an indicator of stress and is frequently used to evaluate the changes in metabolism under environmental deterioration (Chebbi and David, 2010). Numbers of workers reported that pesticides are indicated to cause respiratory distress or even failure by affecting respiratory centers of the brain or the tissue involved in breathing. Numerous studies such as *Cirrhinus mrigala* (Mushigeri and David, 2003), *Labeo rohita* (Patil and David, 2008), *Oreochromis mossambicus* (Logaswamy and Remia, 2009), *Ctenopharyngodon idella* (Tilak and Swarna Kumari, 2009); *Oreochromis niloticus* (Barbieri and Ferriera, 2010) and *Cyprinus carpio* (Singh *et al.*, 2010) reported either increase or decrease their respiration rate in response to variety of pesticides. Hence in the present investigation undertaken to evaluate effect of automobiles effluent on the oxygen consumption rate on the freshwater fish *Channa punctatus.*

MATERIALS AND METHODS

The fresh water fish *channa punctatus*, measuring from 12 to 14gm were collected from Godavri River Nanded. Fishes were treated with 0.1% potassium permagnet to avoid the dermal infection. Then fishes were acclimatized to laboratory condition for about 8 days prior to the experimentation. Fishes were divided in to two batches “A” and “B”. Batch “A” was maintained as control and “B” batch fishes were exposed to lethal concentration of automobiles effluent water from car servicing centers from Nanded. The test fish *Channa punctatus* were exposed to lethal concentration of automobiles effluent water and the rate of oxygen consumption of fishes estimated up to 96 hr. Estimation were also made for 0 hr as control group of fishes. Oxygen contents for control and exposed fishes were measured by standard Winkle’s method as modified and described by (Strickland and Parsons,1965), the oxygen consumption experiments were conducted using respiratory chamber of 320 ml capacity with an air tight rubber stopper with glass which served as an outlet the rubber stopper could be removed to place the animal in chamber.

The oxygen consumption was determined in fishes from lethal to control groups water was drown from aquarium of control fish in to wrinkle’s chambered and care was taken to made it air tight, free from leakage of water. Initial water sample was collected from narrow rubber tube in to reagent bottle of 250 ml capacity. The weighted fishes were now place in wrinkle’s chamber and stopper tightly. Final water sample was collected in similar way as initial water sample after every one hour and amount of dissolved oxygen

content of water sample collected at 0, 24, 48, 72 and 96 hr was determined by wrinkle's method. The medium was replaced every day to keep it fresh and to maintained concentration constant throughout experimental period. The respiratory chambered also contain the same medium in which the animals were being exposed minimum 6 observations were made for each cases and the values were expressed to mean standard values.

RESULTS AND DISCUSSION

The freshwater fish *Channa punctaus* observed the changes in the rate of oxygen consumption when exposed to the lethal concentration of automobiles effluent i.e. 96 hours LC_{50} 1139 ml for 24, 48, 72 and 96 hours.

In present investigation total oxygen consumption of fish to the effect of automobiles effluent was 2.68, 3.10, 1.84 and 1.01 ml CC of O_2/animal/hr. during 24, 48, 72 and 96 hours respectively in treated group. In control total oxygen consumption was 2.99 ml CC of O_2/animal/hr. which indicate initially increasing demand of oxygen is required in treated fishes but later on in 72 and 96 hrs. decreasing trend was observed in the experiment these results are compare with control group.

The rate of oxygen consumption was 0.01276, 0.01476, 0.0087, and 0.0048 ml CC of O_2/animal/hr. wet. wt. of fish during 24, 48, 72 and 96 hours respectively. There was increased rate of oxygen in 48 hours but later on reduced rate of oxygen consumption in 72 and 96 hours these results are compared with control group. In control group rate of oxygen consumption was 0.01423 ml CC of O_2/animal/hr. wet.wt.in fish. Hence oxygen consumption rate was observed in

Table no. - 1 Effect of Automobiles effluent water (Car servicing centers from Nanded) on Total Oxygen Consumption and Rate of Oxygen Consumption in *Channa punctatus.*

Sr. No.	Oxygen Consumption	Control	Experimental Readings			
			24hrs	48hrs	72hrs	96hrs
1	Total Oxygen Consumption in CC of O_2 /Animal/hr.	2.99 ± 0.34	2.68 ± 0.20	3.10 ± 0.72	1.84 ± 0.10	1.01 ± 0.16
2	Rate of Oxygen consumption in CC of O_2/gm/hr. Wet Weight	0.01423 ± 0.004	0.01276 ± 0.002	0.01476 ± 0.003	0.0087 ± 0.002	0.0048 ± 0.003

[Values are mean ± SD of six replicates,*p<0.05, **p<0.01, *** p>0.01, significant when students' test was applied between control and experimental groups.]

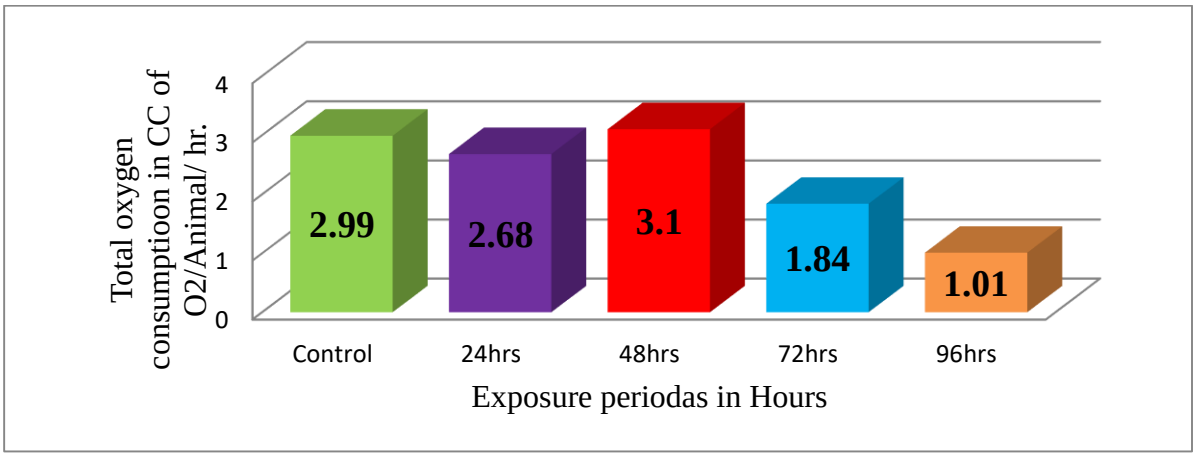

Fig No.1 - Effect of automobiles effluent on Total Oxygen Consumption of *Channa punctatus*.

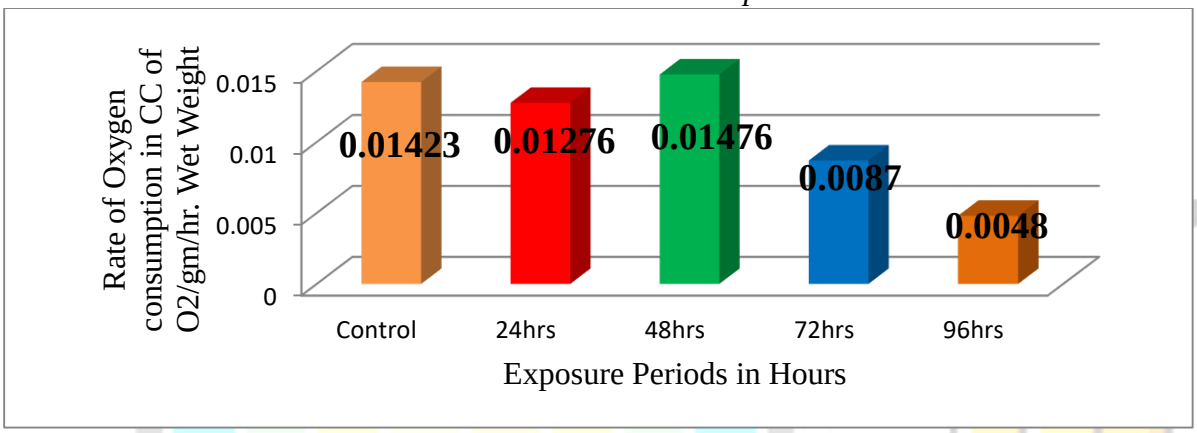

Fig no. –2 Effect of Automobiles effluent on Rate of Oxygen Consumption of *Channa Punctatus*.

experimental group suddenly increase in initial period of exposure and decreasing trend in 72 and 96 hours in treated group. All the values are represented in table no.1 and graphically represented in figure no.1and 2.

In the present investigation, the oxygen consumption was gradually decreasing with increasing exposure periods. Number of workers reported that the rate of oxygen consumption was observed in the sublethal concentration of heavy metal at different exposure periods. Dharmalata and Namitha Joshi (2002) reported that the rate of oxygen consumption in turn controls the metabolic activities and changes in respiratory rates have been used as the indicator of the stress in pollutant exposed organisms. Similar observation made by the number of workers. Susan, *et. al*. (2010) working on sublethal concentrations of fenvalerate technical grade and 20% active ingredient EC among *Labeo rohita*, *Catla catla* and *Cirrhinus mrigala* on oxygen consumption and reported that there was significant increase in oxygen consumption as compared to the controls in *Labeo rohita* and *Catla catla*, the respiratory rate being higher throughout the experimental period. On the contrary, in toxicant exposed *Cirrhinus mrigala*, oxygen consumption decreased than that of controls. From the above workers the changes in oxygen consumption is a sign of stress, which is commonly used to evaluate the changes in metabolism under environmental deterioration. In the present investigation, It is clearly evident from the studies that the automobiles effluent water affected on oxygen consumption rate of *Channa puntactus* under sublethal concentrations.

Dube and Hosetti (2010) studied on behavior surveillance and oxygen consumption in the freshwater fish *Labeo rohita* (Hamilton) exposed to sodium cyanide observed that the oxygen consumption rate in 1/3rd (11.62% and -4.52%) and 1/5th (9.11% and -2.82%) sublethal concentrations. They reported that the fish under sublethal concentration were found to be under stress but not fatal. Sandhya M. Sonawane (2015) studied on the toxicity effects of heavy metals (copper sulphate, mercuric chloride and cadmium chloride) on oxygen consumption of *Lamellidens marginalis* and reported that the after acute and chronic treatment it was found that there was a decrease in oxygen consumption. She stated that it was affected most by $HgCl_2$ and was followed by $CuSO_4$ and $CdCl_2$.

Jipsa, J.R., *et. al.* (2014)studies on the impact of a Cypermethrin insecticide on oxygen consumption of a fish *Tilapia mossambica* and observed that the oxygen consumption of control fish at 48 hours, 72 hours and 92 hours also showed marked changes and that of treated during 24, 48, 72 and 96 hours of exposure showed 0.446, 0.094, 0.194 and 0.197 ml/gm/hr respectively. Manoharan and Subbaiah (1982) observed 10 to 16.6% drop in respiratory rate of Endosulfan treated fish *Barbus stigma.*

In the present investigation the oxygen consumption of fish exposed to automobiles effluent water for 24, 48, 72 and 96 h of median lethal concentration was 2.68, 3.10, 1.84 and 1.01 (mg O2/ L/ 1hr) respectively. Oxygen consumption increased in the initial 24 h of exposure to automobiles effluent concentrations. The oxygen uptake in *Channa punctatus* for 24, 48, 72 and 96 h was 0.01276, 0.01476, 0.0087 and 0.0048 (ml/kg/ 1hr) the O_2 up take increased in the initial 24 h of exposure to automobiles effluent concentration. However, an average O_2 consumption in different time intervals of automobiles effluent exposure was significantly different from the control 2.99 (mg/L). The decrease in O_2 consumption in *Channa punctatus* exposed to automobiles effluent indicates the onset of acute hypoxia under automobiles effluent stress because of the drop in metabolic rate in fishes. Similar results were reported by Qaisur Rahman and Shamim Akhter Choudhary (2013) observed that the normal respiratory activity (oxygen consumption) was significantly affected due to the depression in the metabolic rate at the end of the exposure periods i.e. 24, 48, 72 and 96 hours on *Channa gaucha* respectively and they stated that the drop in the oxygen consumption rate in *C.gachua* exposed to zinc cyanide can also be attributed to clogging of gills by mucous.

Lokhande M.V. (2017) while working on oxygen consumption of *Rasbora daniconius* exposed to dimethoate and reported that the oxygen consumption of fish clearly shows that the rate of consumption increases in the control group in throughout the study period at different exposure. In the lethal and sublethal concentration the rates of oxygen consumption is increases in the 48 and 72 hours and suddenly falls down in 72 hours and slightly decrease in 96 hours. In the present investigation comparing the results it shows that for 24 hr rate of oxygen consumption decreased by 0.31 CCO_2/animal/hr., for 48 hr increases -0.11 CCO_2/animal/hr. and 72 decreases 1.84 CCO_2/animal/hr. and 96 hr also decreases 1.98 CCO_2/animal/hr. respectively. In the present investigation the fish is exposed to the automobiles effluent the oxygen consumption rate is increases at initial hours and decreases in 72 and 96 hours when it compare to the control. Fish under sublethal concentration were found to be under stress but not fatal. B.R Chavan and M.P Bhilave

(2007) worked on impact of heavy metals on fresh water fish *Cirrhinus mrigala* in relation to oxygen consumption and observed that in control group of fishes the rate of oxygen consumption fluctuated between 0.151 to 0.194 mg/l/h/g weight of body during 0 to 96 h. He stated that there was steadily increase in the rate of oxygen consumption in fishes exposed to cadmium and lead in LC_0 and LC_{50} groups from 0 to 96 h. Variation in oxygen consumption (70.39 to 80.50%, -4.45 to 21.35%) was observed in both lethal and sublethal concentrations of malathion respectively observed by Vineetkumar K. Patil and M. David (2008). They stated that the alterations in oxygen consumption may be due to respiratory distress as a consequence of impairment in oxidative metabolism. Fish in sublethal concentration were found under stress, but that was not fatal. B.K. Hassan (2011) Studied on the effect of copper and cadmium on oxygen consumption of the juvenile common carp, *Cyprinus carpio* (L.) and recorded the values for 24 hr of exposure, ranging from 0.243 at 0.1 ppm to 0.137 mgO2/g/h at 0.4 ppm for the copper, and from 0.381 at 0.1ppm to 0.323 mgO2/g/h at 0.4 ppm for cadmium, compared with the control 0.454 mgO2/g/h. He stated that there was a decrease in the oxygen consumption rate of *C. carpio* with increasing concentration of each metal copper and cadmium. In the present investigation also reported oxygen consumption rate initially increased at 48 hours but decrease in 72 and 96 hours during exposure to automobiles effluent.

Rachana Kumari and Shahi R. N. P. (2014) reported that the fish exposed to lethal concentration (92.00 mg/l) showed a gradual decrease in ventilation rate as the decline was significantly decreased at 24 hr onward with maximum decline ($P<0.01$) up to 27.1% at 240hr of exposure, whereas, the fish exposed to sublethal concentrations (39.45 & 13.10 mg/l) a significant increase was observed at 96 & 240hr of exposure respectively, followed by a decline ($P<0.01$ & <0.05) up to 27.40 & 12.94% respectively at 96 hr of exposure when compared with that of their normal values while working on the effect of cobalt chloride on the *Cirrhinus mrigala.* Neelima, P. (2016) reported that the sub-lethal concentrations of cypermethrin 25% EC, it was observed that experimental fish *Cyprinus carpio* showed an increased tendency in oxygen consumption during the initial time of exposures i.e. 2 to 4 hours and a gradual decrease was observed during the subsequent study period. They stated that fish showed gradual decrease in oxygen consumption from the starting period of exposure to till the end of the experiment. Dhamgaye, H.B. (2020) reported that the rate of oxygen consumption of Masheer (fry) examined under two sublethal concentrations (6.46 ugL-1, and 12.92 ugL-1) of fipronil at 7 days intervals for 28 days. They stated that the measurements of oxygen consumption rate can be useful indicators of stress.

Dhairyashil V. Ahirrao And Ashwini B. Pawar (2019) working on different concentration of detergent on the *Channa Punctatus* with 50 ppm, 100 ppm, 150 ppm, 200 ppm of detergent for a time period of 1 hour, the dissolved oxygen content showed a decreasing trend ranging from 9.48 mg/l, 9.23 mg/l, 8.89 mg/l and 8.12 mg/l. They stated that the decreased rate of oxygen consumption in the fish *Channa punctatus* that may be due to direct effect of detergent. N. Jothinarendiran (2012) working on the oxygen consumption of fish *Channa punctatus* exposed to the dimethoate concentrations of 0.15ppm, 0.2ppm, 0.3ppm and 0.6ppm were obtained to be 0.522±0.03, 0.507±0.02, 0.352±0.04 and 0.282±0.03ml/g/hr respectively during 24,

hours of treatment. He stated that the maximum oxygen consumption was observed at 0.15ppm whereas the minimum content was recorded at 0.6ppm. Muthukumaravel, K (2021) working on the rates of oxygen consumption in *Chanos chanos* in control were 0.632, 0.641 and 0.638 mL O2/g/h at 10, 20 and 30 days, respectively. The fish exposed to sublethal concentrations, on the other hand, were recorded with relatively low rates of oxygen consumption including 0.580, 0.542 and 0.481mLO2/g/hat 10, 20 and 30days, respectively. They stated that the oxygen consumption rate was decrease gradually with increasing exposure periods. A maximum decline of about 24.61% in the rate of respiration in comparison to controls was noticed 30 days after exposure. S. Thanga Malathi and V. Anuradha (2020) studied on the oxygen consumption on the fish *Channa punctauts* and *Oreochromis niloticus* exposure of lithium toxicity and observed the consumption rate of *Channa punctatus* 3.31, 2.50, 1.94 and 2.00 O2 mL/g/hr. at 24, 48, 72 and 96 hours respectively and *Oreochromis niloticus* were 2.48, 2.03, 1.41 and 0.85 mL/g/hr. at 24, 48, 72 and 96 hours respectively. The similar results are recorded in the present investigation the effect of automobiles effluent on the total oxygen consumption of freshwater fish *Channna punctatus* were 2.68, 3.10, 1.84, 1.01 CC of O_2/ animal/hr. and rate of oxygen consumption were 0.01276, 0.01476, 0.0087 and 0.0048 CC O_2/gm/hr. Wet weight rate of consumption at 24, 48, 72 and 96 hours.

C. Sruthisree *et.al* (2015) the range of the oxygen consumption rate of *P . hypohthalamus* exposed to 1/10th (0.03345- 0.06434 mg/ l/gm/hr) and 1/5th (0.0363-0.06407 mg/l/gm/hr) to the concentration of LC_{50} compared to control (0.06308 – 0.06066 mg/l/gm/hr). The average percentage of oxygen consumed by fish on different concentration (7.16 ppm) and (14.32 ppm) was 102.80% and 102.37 % lower than that of control respectively

CONCLUSION

The rate of oxygen consumption for control and exposed fish were determined by standard winkers' method. It was found that automobiles effluent induce a noticeable alteration in oxygen consumption of fish, *Channa punctatus* on exposed to lethal concentration of automobiles effluent compare with control group of fish. In lethal concentration total oxygen consumption rate for 24 hr decreased for 48 hr it was increased and for 72 and 96 hr again decreased. The values recorded at 24 hr for lethal concentration of automobiles effluent were 2.68 CCO_2/animal/hr. and for 48 hr it was 3.10 CCO_2/animal/hr. and for 72 hrs. 1.84 CCO_2/animal/hr. and 96 hr it was 1.01 CCO_2/animal/hr. respectively and for control group for 2.99 CCO_2/animal/hr. The present results are clearly indicated that the automobiles effluent affects on the total oxygen consumption on the freshwater fish *Channa punctatus* in 24 hours rate of oxygen consumption is decreased, in 48 hours slightly increased and in 72 and 96 hours decreased. Finally, it is concluded that the automobiles effluent affects the respiratory metabolism of fish because the intimate contact between the gills and automobiles effluent contaminated water might have affected the respiratory area and may be the decreased oxygen consumption on automobiles effluent resulting in hypoxic conditions while its severity may lead to death of the fish.

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