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Acute toxicity of different industrial effluents to selected species of carps

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Abstract

The effects of sugar mills, sewage water and textile mills effluents were studied on the selected fish species of carp. The fingerlings of *Labeo rohita, Catla catla* and *Cirrhinus mrigala* (8-9 g each) were procured from Fish Seed Hatchery, Satyana Road Faisalabad, Pakistan, and were transported to Reasrch Laberatory Department of Zoology, Government College University Faisalabad. The fingerlings were acclimatized for fifteen days. The fingerlings of carp were fed @ 3-4% of body weight daily. The experiment was conducted in triplicate. The fingerlings were divided into three experimental groups (different concentrations of textile mill, sewage and sugar mill effluents) and one control group (thirty of each fish species). Glass aquaria were continuously aerated with air pump. The physicochemical parameters i.e. water temperature, dissolved oxygen and pH was monitored during experiment duration. Acute toxicity for 96 hours was determined for each effluent. In case of textile industrial effluents LC_{50} values for *Catla catla was* 149.14 ml/l, *Labeo rohita was* 160.97 ml/l and for *Cirrhinus mrigala was* 155.40 ml/l. In case of sugar mill effluents, the LC_{50} values determined were 560ml/l, 747ml/l, and 673 ml/l for *Catla catla,* Labeo *rohita and Cirrhinus mrigala*, respectively. Whereas in case of sewage water, the LC_{50} values determined were 224.24 ml/l 232.89 ml/l, and 227.94 ml/l for*Catla catla, Labeo rohita* and *Cirrhinus mrigala, respectively*. It was observed the *catla catla* was the most sensitive fish specie.

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Introduction

The aquatic system is the eventual source for almost all commercial residues and water quality gets critically affected via those residual products (Talapatra *et al.*, 2006). These pollution no longer just disturb the physicochemical characteristics of the water resources however additionally have an impact on the food chain in aquatic system, causing physiological and cytogenetic aberrations within the aquatic fauna (Barbosa *et al.*, 2009).

These industrial effluents cause drastic results on aquatic life particularly fish. A diversity of fish species provides a key supply of protein in the food plan. Fish offer an incredible source of material for examine of the toxic waste in water samples as they are aquatic vertebrate, which could metabolize, planned and bioaccumulate water pollutants (Azmat *et al.*, 2012).

The pollution in aquatic sources due to heavy metals released from different industries, home and other anthropogenic actions has become a matter of challenge over the past few decades (Waqar *et al.*, 2013).

Municipal and industrial toxicants, such as metals pose critical chance to many fish species and are stated to be cytotoxic, mutagenic and carcinogenic (More *et al.*, 2003). those poisonous effluents have an effect on fish morphology, boom, feeding, biochemical method, body structure, replica (Kerambrun *et al.*, 2011; Kuz'mina, 2011; Yousafzai and Shakoori, 2011). Profound discharge of unprocessed water into the rivers of Pakistan is improperly affecting the clean water fisheries (Jabeen and Javed, 2012) and the local fish species are on the limit of extension within the rivers of Pakistan (Rauf *et al.*, 2009).

The present study aimed to assess the impacts of effluents of the different industries (Sugar, Textile mill effluents and sewage water) for the evaluation of acute toxicity in selected species of carp so that culturing of that specie for food could be conducted under existing aquatic system.

Materials and methods

Fingerlings of *Catla catla*, *Cirrhina mrigala* and *Labeo rohita* measuring about 8.93 ± 0.05 g, 8.90 ± 0.04 g and 8.90 ± 0.09 g, respectively and standard length 3.3 ± 0.03 inch, 3.3 ± 0.04 inch and 3.2 ± 0.09 inch, were procured from Fish Seed Hatchery, Satyana Road Faisalabad, Pakistan, and were transported to Research Laboratory Department of Zoology, Government College University Faisalabad. For removal of dermal infection fish were washed with 0.1% KMNO4 solution. Fingerlings were acclimated in tap water for 15 days; during the period they were fed twice a day @ 3-4% body weight.

The experiment was conducted in triplicate. The fingerlings were divided into three experimental groups (different concentrations of textile mill, sewage and sugar mill effluents) and one control group (thirty of each fish species). Glass aquaria were continuously aerated with air pump. The physicochemical parameters i.e. water temperature, dissolved oxygen and pH was monitored during experiment duration. Nine aquariums (in triplicate) were arranged with the exposure of 5%, 10%, 20%, of textile industrial effluents, 50%, 75% and 80% of sewage water samples and sugar mill effluents 85%, 70%, and 30% were used to find out LC_{50} for 96 hours duration.

Statistical analysis

Probit analysis of a statistical package (Grafpad software) was used to determine LC_{50} values for 96 hours. ANOVA was used to compare the LC_{50} values of textile effluent, sewage water and sugar mill effluent.

Results

The *Catla catla, Cirrhinus mrigala* and *Labeo rohita* were exposed to different concentrations of Textile industrial effluents, sugar mill effluents and Sewage water for the evaluation of acute toxicity for 96 hours duration. In case of textile industrial effluents LC_{50} values for *Catla catla was* 149.14 ml/l, *Labeo rohita was* 160.97 ml/l and for *Cirrhinus mrigala was* 155.40 ml/l. The different concentrations of textile

industrial effluents showed significantly difference among different fish species. The *Labeo rohita and catla catla* showed highly significant difference P < 0.00 and P< 0.0 and *Cirrhinus mrigala showed significant difference P*< 0.05 in textile industrial effluents (Table 1).

Table 1. The 96 hours LC_{50}Values for Textile Industrial effluent exposed selected carp species.

Fish Species	Number	X^2	DF	LC_{50} ml/l	P
Labeo rohita	30	8.751	3	160.96	0.00**
Catla catla	30	10.897	3	149.13	0.01**
Cirrhinus mrigala	30	7.4870	3	150.40	0.05*

*= Significant **= highly significant NS= Non Significant DF= degree of Freedom Level of Significance (P<0.05).

In case of sugar mill effluents, the LC_{50} values determined for *Catla catla,* Labeo *rohita a*nd for *Cirrhinus mrigala* were 560, 747 and 673 ml/l, respectively. The different concentrations of sugar mill effluents showed non significant difference among different fish species. The *Labeo rohita, catla catla* and *Cirrhinus mrigala showed non significant difference P*> 0.05 in different concentrations of sugar mill effluents (Table 2).

Table 2. The 96 hours LC_{50}Values for sugar mill effluent exposed selected carp species.

Fish Species	Number	X^2	DF	LC_{50} ml/l	P
Labeo rohita	30	0.9675	3	747	0.809^{NS}
Catla catla	30	0.4190	3	560	0.936^{NS}
Cirrhinus mrigala	30	0.5645	3	673	0.904^{NS}

NS= Non Significant DF= degree of Freedom Level of Significance=(P<0.05).

Whereas in case of sewage water, the LC_{50} values determined for *Catla catla*, *Labeo rohita* and *Cirrhinus mrigala* were 224.24, 232.89 and 227.94 ml/l, respectively. The different concentrations of sewage water showed significantly difference among different fish species. The *Labeo rohita and Cirrhinus mrigala both* showed highly significant difference P < 0.00 and *catla catla showed significant difference P*< 0.05 in sewage water (Table 3).

Table 3. The 96 hours LC_{50}Values for sugar mill effluent exposed selected carp species.

Fish Species	Number	X^2	Df	LC_{50} ml/l	P
Labeo rohita	30	8.97716	3	232.89	0.03*
Catla catla	30	10.1850	3	224.23	0.01**
Cirrhinus mrigala	30	10.7859	3	227.93	0.01**

*= Significant **= highly significant NS= Non Significant DF= degree of Freedom Level of Significance (P<0.05).

Discussion

In present study, acute toxicity of textile mill effluent, sewage water and sugar mill effluents was assessed. The 96hrs LC_{50} values of textile mill effluents to Catla, Rohu and Mrigala fingerlings were 149.13, 160.96 and 150.40 ml/l, respectively. These findings are in line with the findings of Sreelikshmy *et al.* (2016) who studied acute toxicity of industrial effluent on cat fish and reported that mills effluents, controversially, is most basic and fundamental participants of pollutants in aquatic environment and affects the aquatic organisms in preference fishes specially. These

findings are also supported by the findings of Ogundiran *et al.* (2010) who reported that effluents can be easily absorbed by gills or intestinal epithelium producing histological and biochemical alterations in the organs of animals due to potential toxicity of industrial effluents.

The LC_{50} values of sugar mill effluent to Catla, Rohu and Mrigala fingerlings were 560, 747 and 673 ml/l, respectively. These finding are in line with the findings of Samuel *et al.* (2014) who conducted survey on threatened impacts of industries on surrounding water, air and soil especially suger mill. They reported presence of heavy metals in the effluent of sugar mill quantitatively and which have the potential to pollute the aquatic environment.

The LC_{50} values of sewage water to fresh water fish Catla, Rohu and Mrigala fingerlings were 224.23, 232.89 and 227.93 ml/l, respectively. These findings are also in accordance with the findings of Jawahir *et al.* (2015) who worked on acute toxicity determination in Indian major carps. The present study findings are also in line with findings of Kousar and Javed (2014) who also determined acute toxicity in four fish species (*Labeo rohita, Ctenopharyngodon idella, Cirrhinus mrigala* and *Catla catla* and they reported that lethal concentrations (LC50) in specific time duration (96h) of metals for these different four fish species varies significantly. In the present study *catla catla* was appeared most sensitive in sewage water effluents and these findings are in line with the findings of Kousar and Javed (2014) who reported that out of the *Labeo rohita, Ctenopharyngodon idella, Cirrhinus mrigala* and *Catla catla,* the fingerlings of Catla were sensitive to tested effluent and Rohita was least sensitive. As the toxicity of industries effluents compare it was as textile > sewage > sugar mill.

Conclusion

The textile industrial effluents appeared most toxic to the fingerlings of major carps than sewage water and sugar mill effluents. The *catla catla* showed more sensitivity whereas the *cirrhinus mrigala* showed least sensitivity. If the present effluent disposal rate in aquatic bodies is not monitored, lives of aquatic organisms in rivers are in serious threat.

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