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Research Article

EFFECT OF SURFACTANT ON EXTERNAL MORPHOLOGY AND PHYSIOLOGICAL RESPIRATION OF FRESHWATER FISH, *LABEO ROHITA*''

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ABSTRACT
Surfactants are the major components of detergent used in household as cleaning products. In present study effects of surfactants (Surf excel) on external morphology and physiological respiration (breathing rate) of freshwater fish *Labeo rohita* have been reported. For this fishes were divided into two groups. Group-I fishes were placed under the concentration of 6.63 mg/lit surfactant and Group-II fishes were placed under the concentration of 13.03 mg/ lit surfactant. One group fishes were placed in freshwater act as control group. In our experiment, fish body was worst affected by the presence of surfactant in water as swelling on the lips and on gill lamellae were recorded in fish exposed to 6.63 mg/l concentration of surfactant Further, damage of caudal fin, scars on anal fin and swelling in the eye region were also observed in fish placed under 13.3 mg/l concentration of surfactant (surf excel). Physiological respiration was also influenced by the presence of surfactant as it was recorded to be different in comparison to control group. Hence, this parameter was found to be decreased with increased duration and concentration of surfactant.

Keywords: *Morphology, Respiration, Fish*

INTRODUCTION
Population growth and industrial development are the major causes of contamination of water resources. In developing countries, pollution of water resources has become a serious problem which leads to ecological disorders and causes many physiological as well as biological changes in aquatic animals. The toxic components present in untreated wastewater discharged from textile industries affect the freshwater habitats.

This textile wastewater is rich in BOD, COD and suspended solids. In addition, it is rich in starch, bicarbonates, chlorides and metals like copper and chromium which cause mortality as well as sub lethal stress affecting the growth of aquatic organisms.

Surfactants are a diverse group of chemicals that are designed to have cleaning or solubilisation properties.

They generally consist of a polar head group (either charged or uncharged), which is well solvated in water, and a non polar hydrocarbon tail, which is not easily dissolved in water. Hence, surfactants combine hydrophobic and hydrophilic properties in one molecule.

Synthetic surfactants are economically important chemicals. They are widely used in household cleaning detergents, personal care products.

Textiles, paints, polymers, pesticide formulations, pharmaceuticals, mining. Oil recovery and pulp and paper industries. The world production of synthetic surfactants amounts to 7.2 million tons annually (Di Corcia, 1998).

Dyestuff and other chemicals like caustic soda, soda ash, hydrochloric acid and sodium hypochlorite besides exerting severe impact on the soil bio-ecosystem induce mutagenicity and carcinogenicity in human beings also. Discharge of textile wastewater into aquatic habitats lead to stress and behavioral changes in aquatic organisms, especially in fishes. Oxygen consumption is a measure of the metabolic state of the animal.

Hence, it is considered as vital parameters and indicates the physiological & metabolic alteration as the animal. It is known that the respiratory roles alter under the influence of a several biotic and abiotic

factors (Prosser, 1973) pollutant acts as physiological stress or for exposed organisms as do the environmental parameters (Newell, 1973).

As fishes live in intimate contact with the aquatic environment and sensitive to a wide variety of toxicants. The Rohu (*Labeo rohita*) is a freshwater fish of the carp family Cyprinidae that is also commonly called the Ruee, Rui or Tapra. This fish is considered to be a sacred delicacy to be eaten at all special occasions in some regions of India. Therefore, the present study was done to see the effect of Surfactant on External Morphology and Physiological Respiration of Freshwater Fish, *Labeo rohita*''

MATERIALS AND METHODS

Experimental fish were obtained from a government fish seed farm, Jhajjar Haryana (India). Prior to start of experiment fishes were acclimatized under experimental conditions in laboratory for 2 weeks.

Chemical Used: Surf excel was used here as a experimental chemical. It was weighted accurately as per requirement and dissolved in water before adding fishes in aquarium.

Experimental Design: Two experimental groups were formed which were maintained at different concentration of surfactant. Fish (Body weight (BW) 33.55 to 34.01 was randomly distributed @ 4 fish in each group.

One Act as control, fishes present in this group was stay out from surfactant stress.

Group I. Fishes were placed under the concentration of 6.63 mg/lit surfactant in water

Group II. Fishes were placed under the concentration of 13.03 mg/ lit surfactant in water

All the fishes were fed with formulated diet with feeding rate 5% BWd^{-1}. Each group of fish were exposed to their respective diet for four hours thereafter, the uneaten feed was siphoned out.

Physiological Respiration: Physiological respiration was studied by number of times gills open per minute.

RESULTS AND DISCUSSION

No adverse behavioral changes or mortality were recorded in the control experiment throughout the period of the bioassay. While the fishes treated with detergent have several abnormal behavioral responses like incessant jumping, gulping for air, frequent surface to bottom movement, restlessness condition, sudden change of direction during movement, loss of equilibrium, resting at the bottom and hence gradually onset of inactivity.

Feeding was also reduced in the fishes which were present under the influence of surfactant. Further, toxicity of detergent increased with increased the concentration.

Effect on External Morphology

100% survival was recorded in all three groups in our experiment. But the fish body was worst affected by the presence of surfactant in water as swelling on the lips and on gill lamellae were recorded in fish exposed to 6.63 mg/l concentration of surfactant (Figure 1, 2). Further, damage of caudal fin, scars on anal fin and swelling in the eye region and on gill lamellae were also observed in fish placed under 13.3 mg/l concentration of surfactant (surf excel) (Figure 3).

Effect on Physiological Respiration

The breathing rate was found to be also affected in fishes present in surfactant mixed water. When these fishes were introduced into water containing surfactant they immediately shows the discomfort and began to move rapidly and shows more faster operculum movements initially.

The fishes shows normal Physiological respiration in control group (89, 88, 93, 95 on first, second third and fourth day respectively) while the fishes of first group (6.63 mg/lit) shows their increases in oxygen consumption on first day as an average of 98 movements of gills operculum. While on rest of the days i.e. second, third and fourth day a reduced in gills operculum movements 67, 47 and 24 respectively were recorded (Table 1, Figure 4).

Further, similarly just like to first group, fishes of second group (13.3 mg /lit) also showed same trend of oxygen consumption (102, 65, 41, 21 on first, second, third and fourth day respectively) (Table 1, Figure 5).

Figure 2 and 3: Effect of Surfactant under 6.63 mg/l Concentration of Surf Excel on Fish *Labeo rohita*
1, 2: Swelling on the Lips
3: Swelling on Gill Lamellae

Figure 3: Effect of Surfactant under 13.3 mg/l Concentration of Surf Excel on Fish *Labeo rohita*
4: Damage to Caudal Fin
5: Scars on Anal Fin
6: Swelling in the Eye Region

Table 1: Respiration Rate of Fish *Labeo rohita* under Normal, 6.63mg/l, 13.3 mg/l Concentration of Surf Excel

Conc. in mg/l	1st day (Fish Breath/5min)	2nd Day (Fish Breath/5min)	3rd Day (Fish Breath/5min)	4th Day (Fish Breath/5min)
Control	89	88	93	95
6.63mg/l	98	67	47	24
13.3mg/l	102	65	41	21

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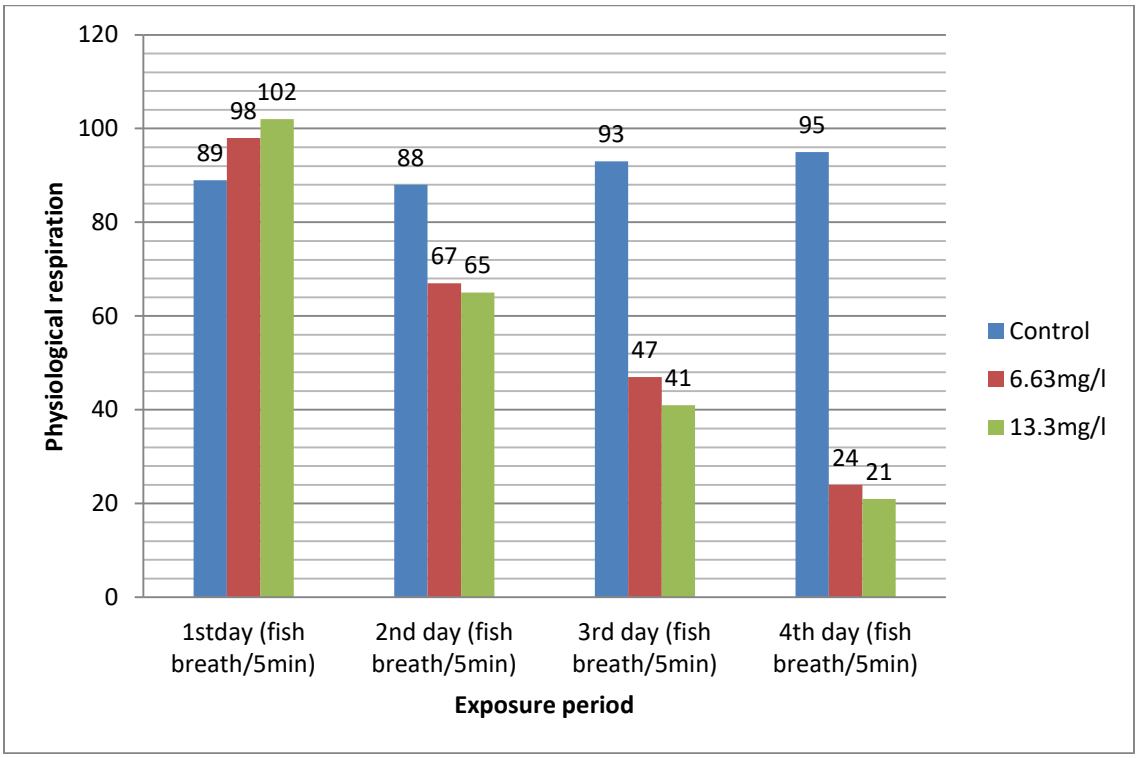

Figure 4: Effect of Surf Excel under Normal, 6.63mg/l, 13.3 mg/l Concentrations on Fish *Labeo rohita*

In *labeo rohita*, oxygen consumption was increased on first day when fishes were introduced in first and second group but after then it was decreases with increase time of exposure. This may be due to irritation of gill epithelium, penetration of the pollutants at subcellular level and hence damage of the gill tissue.
Only a few accounts have described the effects of detergent effluent on the behavior of fish. The chemical receptor of *Letalurus natalis* (lesueur) was reportedly damaged by detergents (Bardach *et al*., 1965). Foster *et al*., (1966) documented that sub lethal concentration of detergents prevented feeding activities in flag fishes, *Jodanella floridea* burst of erratic swimming and gradual onset of inactivity in Rainbow trout. Further, with wide spread use of synthetic detergents for household purpose, it is inevitable that these compounds would find their way into rivers and ponds, the effect of detergents on tissue of different fishes have been studied by Abel (1974) and Bromage and Fuchs (1976). Gills a primary site of osmoregulation, as well as respiration, may be highly vulnerable to lesions because they are in immediate contact with aquatic toxicants. The most prominent manifestation of the acute toxicological effect of detergents is on the gill tissue of the fish. Destruction of the gill epithelium is regarded as a consequence of the reduction of surface tension by the presence of surfactants (Bock, 1965). Schooling patterns of fish have been reviewed by Partridge (1982). Detergent causes impairment of chemoreceptor organs (Bardach *et al.*, 1965). Operculum movement and schooling pattern was measured as an index for behavioral toxicity in control and detergent exposed fish fingerlings. Many of the reports available are related to the effects of surfactants during exposure period of 15 min to 30 days. Respiration was largely affected in the presence of surfactants. The detergent exposure was found to induce conditions similar to hypoxia. Thus, alterations in water quality would easily interfere with their functions the consequences being a breakdown in the communication among the fish and between the fish and environment.

Conclusion

This study has proved credibly that detergent effluents are deleterious to natural population of fish. The confirmed haphazard discharge of these effluents can not only be traced to lack of proper awareness on wastes disposal but also to inadequate functioning of environmental monitoring groups.

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