

# Studies on Toxicity of Detergents in *Clarias batrachus* (Linnaeus)

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## Abstract

In this study, fish were exposed to the LC<sub>50</sub> value of two sample detergents. Fishes are collected from Gumla, Jharkhand, and acclimatized for 15 days. During the experiment dry prawn powder is fed to fishes and water is properly aerated and changed after every 24 hrs interval. The average length was 15 to 20 cm and the average weight was 90 to 100 gm. Fishes were exposed to 11 plastic tubs of different concentrations of detergent sample 1 and sample 2 for 96 hours. Each tub was stocked with 6 fish and three replicates were conducted. Physicochemical characteristics like DO, hardness, and chloride are noted and the mortality rate was daily recorded. Results observed the lethal concentration for LC<sub>50</sub> for 96 hrs was 70 mg/L for sample 1 detergent and 200 mg/L respectively. Hence concluded the sample 1 detergent is more toxic than sample 2.

**Keywords:** LC 50, 96 hours, *Clarias batrachus* (Linnaeus).

## Introduction

Pollution is the releasing of substances into the environment by mankind in quantities that damage either health or resources [1]. There are several chemicals and substances them some are toxic. These are released into the environment and enter the biological system of the organism further they interfere in the biochemical processes and may lead to fetal.

The mode of toxicity of pollutants to fish has been studied since 1920. Fishes are biomarkers of pollution state because of their habitat, availability, temperature regimes, food availability, contaminants, and varying physicochemical factors. Detergents are one of the well-known pollutants that cause disorders in aquatic ecosystems with detrimental effects on associated organisms. Toxicological study depends on the exposure period

such as acute and chronic toxicity. The use of the term acute toxicology relates to single exposure but sometimes it is considered as a multiple exposure during a short period, [2]. The period set for multiple exposure to be defined as acute is not clearly defined but restricted to 24 hrs is most generally acceptable but the studies on fishes are extended up to 96 hrs.

Most of the acute study is designed to determine the median lethal concentration (LC<sub>50</sub>) of the toxicants for specified exposure time. It has been derived as a statically derived expression of a single dose of toxicants that can be expected to kill 50% of the test animals and the median tolerance limit (TLM) which is 50% of test organisms survive. The exposure period of the test is 24 - 96 hrs. Acute toxicity test uses index animals that are more sensitive towards the ecosystem. The toxicity of toxicants irrespective of their nature is influenced by several factors in bioassay and has an inherent capacity to reflect with many folds influence in the biota, where health hazard is of prime concern. Therefore, human health which is the primary importance is the danger of the influence of toxicants such as pesticides, detergents, and heavy metal toxicants through aquatic medium.

According to Cairns [3], a bioassay is merely a concentration-response evaluation that is living organisms used to determine their response to a toxicant, exposure may be beneficial or toxic. It has a graded series of concentrations of toxicant under adequately controlled conditions in which the increased concentration is accompanied by increased response. The response may be crude brutal or more subtle such as changes in growth rate, cell division, behaviour, respiration, etc. Without such a test it is difficult to decide about the concentrations that are essential to the life for the beneficial materials or the detrimental to life for the toxic substances.

## Methodology

Tests were conducted in laboratory conditions, for which fishes were collected from District Gumla,

Jharkhand and treated with 1% potassium permanganate for a disinfectant and acclimatized in a glass aquarium in laboratory condition for 15 days as per the guideline as described in APHA, 1995. Fishes fed with dry prawn powder. Fishes were checked for any pathological disease, changes in colour, and avoidance of food. The average size of fish was 15-20 cm and the average weight was 90-100 gm. During the experiment crowding was avoided, Behavior, Temperature, pH, Dissolved Oxygen, and Free Carbon dioxide, were frequently checked and water was changed after the regular interval of 24 hrs.

During the exposure period of acute toxicity 6 fishes were kept in plastic tubs with dechlorinated water and detergents to find out the LC<sub>50</sub> value for 96 hrs simultaneously a control set without concentration was run for comparison and three replicates were conducted. Fishes were exposed to different concentrations of detergent sample 1 (100, 90, 80, 70, 60, 50, 40, 30, 20, 10, 0.5 mg/L) and sample 2 (300, 275, 250, 225, 200, 175, 150, 125, 100 mg/L).

## Results and Discussion

**Bioassay test:** Detergent sample 1 and sample 2 was taken on a freshwater fish, *Clarias batrachus*. The LC<sub>50</sub> value 96 hrs or a lethal concentration of detergent sample 1 was 70 mg/L and sample 2 was 200 mg/L. The sublethal concentration of detergent sample 1 was 17.5 mg/L, 35.5 mg/L, and 52.5 mg/L while the sublethal concentration of detergent sample 2 is 50 mg/L, 100 mg/L, 150 mg/L (The data is explained in Table 1 and 2).

**Litchfield and Wilcoxon [5] graphical method:** The 96 hours LC<sub>50</sub> value for detergent sample 1 70 mg/L. The 96 hours LC<sub>50</sub> value for detergent sample 2 200 mg/L. (The data is explained in Graphs No. 1 and 2).

Nowadays day detergents are one of the major environmental pollutants and have an adverse effect on organisms. Nayak and Madhyastha [6] determined the LC<sub>50</sub> Value of 'Point' detergent to *Rasbora daniconius*

(Ham) for 96 hrs and were 160 mg/L. Palanichamy and Murugan, [7] studied the 96 hours LC<sub>50</sub> for 'Surf', 'Besto', and 'Key' detergents which were 12.734, 77.624, and 32.292 ppm respectively to *Rasbora elonga*.

Metabolism of *Rainbow trout* fish exposed to Diocetyl Sodium Sulfosuccinate (DSS) detergent, the LC<sub>50</sub> for 96 hrs was 28 mg/L reported by Mark et. al. [8].

**Table 1: Shows acute toxicity of detergent sample-1 to a freshwater fish, *Clarias batrachus* (Linnaeus)**

Sr. No.	Concentration mg/L	% of concentration	No. of fishes exposed	Mortality reported after time Intervals of								% of mortality for exposure to 96 hrs	
				0-1 (hrs)	1-4 (hrs)	4-8 (hrs)	8-12 (hrs)	12-24 (hrs)	24-48 (hrs)	48-72 (hrs)	72-96 (hrs)		
1	Control	Control	6	-	-	-	-	-	-	-	-	-	0
2	10	0.010	6	-	-	-	-	-	-	-	-	-	0
3	20	0.020	6	-	-	-	-	-	-	-	-	1	16.67
4	30	0.030	6	-	-	-	-	-	-	-	-	1	16.67
5	40	0.040	6	-	-	-	-	-	-	-	-	1	16.67
6	50	0.050	6	-	-	-	-	-	-	-	-	2	33.33
7	60	0.060	6	-	-	-	-	-	-	-	1	1	33.33
8	70	<b>0.070</b>	6	-	-	-	-	-	1	1	1	1	<b>50</b>
9	80	0.080	6	-	-	-	-	-	1	1	1	2	66.68
10	90	0.090	6	-	-	-	-	1	1	1	1	2	83.35
11	100	0.100	6	-	-	-	-	1	1	2	2	2	100

**Table 2: Shows acute toxicity of detergent sample-1 to a freshwater fish, *Clarias batrachus* (Linnaeus),**

Sr. No.	Concentration mg/L	% of concentration	No. of fishes exposed	Mortality reported after time Intervals of								% of mortality for exposure to 96 hrs	
				0-1 (hrs)	1-4 (hrs)	4-8 (hrs)	8-12 (hrs)	12-24 (hrs)	24-48 (hrs)	48-72 (hrs)	72-96 (hrs)		
1	Control	Control	6	-	-	-	-	-	-	-	-	-	0
2	100	0.0100	6	-	-	-	-	-	-	-	-	-	0
3	125	0.0125	6	-	-	-	-	-	-	-	-	1	16.67
4	150	0.0150	6	-	-	-	-	-	-	-	-	1	16.67
5	175	0.0175	6	-	-	-	-	-	-	-	1	1	33.34
6	200	<b>0.0200</b>	6	-	-	-	-	-	-	-	1	2	<b>50</b>
7	225	0.0225	6	-	-	-	-	-	1	1	1	2	66.68
8	250	0.0250	6	-	-	-	-	1	1	1	1	1	66.68
9	275	0.0275	6	-	-	-	-	1	1	1	1	2	83.35
10	300	0.0300	6	-	-	-	1	1	1	1	1	2	100

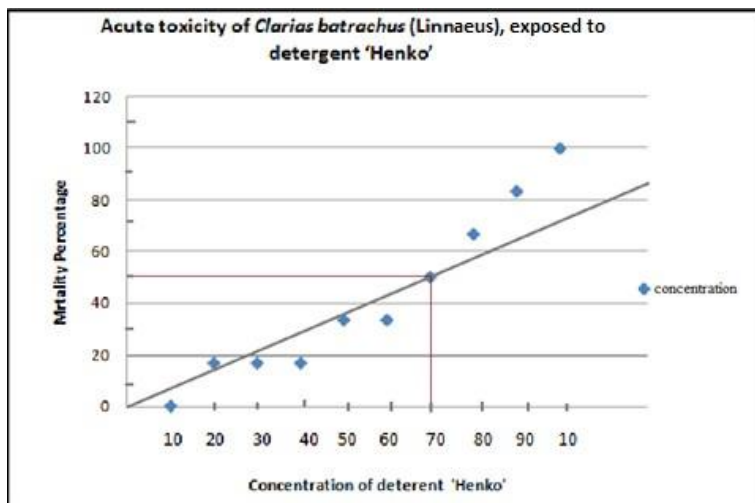


Fig. 1: Shows acute toxicity of detergent sample-1 to a freshwater fish, *Clarias batrachus* (Linnaeus),

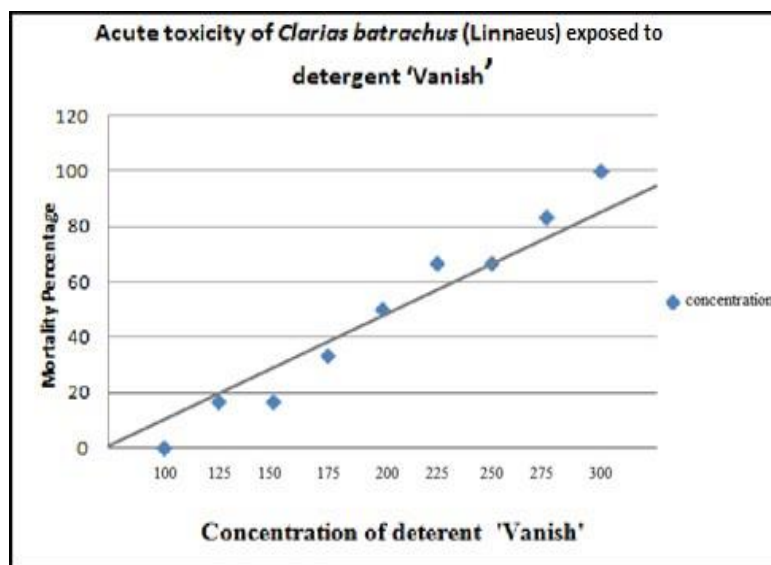


Fig. 2: Shows acute toxicity of detergent sample-2 to a freshwater fish, *Clarias batrachus* (Linnaeus)

Samson, *et. al.* [9] observed the LC<sub>50</sub> values of 'Ariel' detergent and it was 35 ppm for 48 hrs to freshwater teleost, *Oreochromis mossambicus*. Paul *et. al.* [10] studied the LC<sub>50</sub> value of the detergent 'Wheel' for 96 hrs on a fish, *O. mossambicus* and it was 66.1 mg/L. Median lethal concentration was 76.5, 69.2, 66.1, and 60.3 mg/L for 24 - 96 hrs. Palanichamy *et. al.* [11] studied static bioassay and revealed the LC<sub>50</sub> of detergent 'Surf' to fish, *Cyprinus carpio* which was 21.73, 16.51, 13.68, and

10.78 ppm for 24, 48, 72, and 96 hrs exposures respectively. The safe concentration of surf in the fish was computed as 1.64 ppm.

Ali *et. al.* [12], investigated marine risk assessment using Linear Alkylbenzene Sulfonate (LABS) in the North Sea and reported 4.1- 4.3 mg/L to marine organisms. Anunobi *et. al.* [13] observed the effect of the detergent 'Elephant Blue' on Nile, Tilapia *Oreochromis niloticus* (L),

the LC<sub>50</sub> value for 96 hrs was determined and it was 9.77 mg/L. Chandanshive and Kamble [14] observed 96 hrs LC<sub>50</sub> of the household detergent Ist and it was 28.5 mg/L and detergent IInd 41.75 mg/L in fish, *Garra mullya*. Manoj Kumar, et. al. [15] studied lethal concentration (LC<sub>50</sub>) of LAS for different exposure periods (24, 48, 72, and 96 hrs) by using software, Trimmed Spearman-Karber method. The LC<sub>50</sub> values for different exposure periods (24, 48, 72 and 96 hrs) were 0.48, 0.28, 0.18 and 0.03 mg/L respectively.

Ratnakar and Kulkarni [16] exposed a freshwater mussel, *L. marginalis* to a detergent 'Henko' and evaluated the LC<sub>50</sub> value for 96 hrs and it was 25 mg/L. Chandanshive [17] studied the acute toxicity tests of two detergents of *Mystus montanus* using static bioassays for 96 hours among them the LC<sub>50</sub> value of Det-I was 20.0 mg/L and the LC<sub>50</sub> value of Det-II was 23.5 mg/L. Topale et. al. [18], discussed the effect of the detergent 'Tide' on the mortality of *Paratelphusa jarquemontii* (Rathbun) and observed mortality at 6 gm/L.

## Conclusion

The present study shows that detergent sample 1 and sample 2 are toxic to *Clarias batrachus*. Mortality in sample 1 was 16.67% at 20 mg/L, 50% mortality at 70 mg/L, and 100% mortality at 100mg/L. Whereas in sample 2 it was 20% in 120 mg/L, 50% in 200 mg/L, and 100% in 300 mg/L. It was also observed that detergent sample 1 was more toxic than sample 2. It was observed that the detergents were toxic to the fish. The mortality occurred because of damage to gill lamellae due to coagulation and precipitation of mucus secreted by the epithelium of exposed fish.

**Conflicts of interest:** The author stated that no conflicts of interest.

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