ACUTE TOXICITY OF LINEAR ALKYLBENZENE SULPHONATE (LAS) DETERGENT TO *CLARIAS GARIEPINUS* FINGERLINGS

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Abstract
The lethal effects of Linear alkylbenzene sulphonate (LAS) detergent with trade name "ZIP" to Clarias gariepinus fingerlings was investigated using flow through and continuous aeration over a period of 96h. The LC_{50} of this toxicant was determined to be 23.99mg/L^{-1}. During the exposure period, the test fish exhibited some behavioural changes and later death. Some of the behavioural signs were loss of balance, restlessness, rapid swimming among others. Water quality measured during the experimental period showed high pH value which may be responsible for increase mortality at low concentration of the toxicant.

Key words: Lethal effect, *Clarias gariepinus,* alkylbenzene sulphonate (LAS).

Introduction

Pollution is defined as the deliberate or accidental contamination of the environment with wastes from human activities and such agents that cause pollution are called pollutants. They are substances which affect the quality of air (atmosphere), water and soil that destroys or perturbs biochemical cycles (linking people to animal and plants) and which damage the health of human (taking decades or generation to produce terminal disease).

Considerable amounts of detergent have been found to exist in the Nigerian freshwater system, where they generally affect several aquatic organisms, examples are *Oreochromis niloticus* and *Clarias gariepinus*. An understanding of the physiological response mechanisms of fish to all forms of adverse environmental pollutants and the effects of these additional stresses are to be assessed (Okwuosa and Osuaala, 1993).

The most harmful chemical substances can have an undesirable or distinctly harmful effect when taken up by an organism in sufficient amounts. No chemical is completely safe and no chemical is completely harmful (Lloyal, 1992). The factor which determines whether a chemical agent is particularly harmful or safe is the relationship between the concentration (quantity) and the duration of exposure. Poison is lethal when it causes death or sufficient to cause it by direct action and is sub – lethal when the poison is below the level that directly causes death but results in the regression of the physiological or behavioral process of the organism and its overall fitness is reduced (Okoli – Anunobi *et al*., 2002).

Fish is one of the most important non-targets organisms affected by detergent pollution. It is noted that lower levels would increase the uptake of other pollutant by the fish (Abel 1974). Effluents from industries wastes, Agricultural practices and also communal washing are common practice along several segments of rivers in Nigeria could lead to a build up of detergent level in natural waters causing oxygen depletion, reduction in water quality and damage to fishing interests.

Clarias gariepinus belong to the family Claridae and belonging to the genius Clarias. The family Clariidae has three genera and fifteen species are found in the Nigerian waters. The catfish family clariidae comprises members of genus *chanallabes clarias, Heterobranchus, Gymnallabes* and

Heteroneusites. *Clarias garipinus* is one of the most commonly cultured catfish in Nigeria. It is commonly found in open waters but it is most common in shallow marginal areas. This specie has high potential for culture because of its high fecundity rate, Omnivorous feeding habit, ability to grow and thrive well in adverse pond condition, good food conversion rate, and high palatability. Hence their importance in aquaculture.

Linear alkylbenzene sulphonate (LAS) detergent with trademark (klin) is a synthetic detergent which is widely used in so many textile industries which discharge their effluents into the aquatic environment. They are also used in washing clothes as well as for so many other domestic works. Okwuosa and Omeregie (1995) documented that synthetic detergents are toxic to fish at concentration between 0.4 and 40mg/l as obtained in Ofojekwu *et al*., (1999).

Materials and Method

Clarias gariepinus (5.0±1.2g) used as the test organisms for this experiment was collected from Jummic farm along Gidan Kwanu, Minna. The fish were transported to the Fish farm, Federal University of Technology, Minna in a portable well aerated polythene bag containing clean water. The fish were kept in indoor hatchery tank at temperature range of 25-26^{0}C for acclimatization for 2 weeks. During this period, the fish were fed with 40% protein diet in clean water.

The test concentrations of alkylbenzene sulphate detergent with trade name 'Klin' were prepared according to Donald and Philip (1987), by dissolving 100mg of the powder in 1 litre of distilled water. From the stock solution the following concentration were prepared alongside the principle of serial dilution method of Warner (1962); 10.00mg/l, 8.00mg/l, 6.00mg/l, 4.00mg/l, 2.00mg/l. Dechlorinated tap water formed the control at 0.00mg/l. Flow through system was used during the experimental period, 10 fish each were introduced into 12 glass aquaria of 33cm × 60cm × 20cm on the average, of 4mm thickness with over head tank (60cm × 50cm × 40cm) with water holding capacity of 200litres containing the different concentrations. Feeding was discontinued 24 hours before the commencement of the experiment through the experimental period. Mortality was recorded every 24 hours, though the aquaria were inspected every 3 hours for dead fish which were immediately removed. During exposure period, the temperature, dissolved oxygen, alkalinity and conductivity. Dissolved oxygen and alkalinity were monitored using the method of APHA, (1995). Conductivity was measured with conductivity meter while temperature was measure in situ with thermometer. The 96h LC_{50} was determined by graphical method.

Results and Discussions

Table 1: Mortality of *Clarias gariepinus* fingerlings exposed to different concentrations of LAS detergent for 96 hours.

Toxicant Conc (mgl^{-1})	log Conc (mgl^{-1})	Motality rate in duplicate 24hrs	48hrs	72hrs	96hrs	mean mort (%)	mean probit
10.00	1.00	1 0	1 0	0 0	0 0	10	3.72
8.00	0.90	0 2	2 0	3 0	0 0	35	3.96
6.00	0.78	3 0	0 0	0 0	0 0	15	4.61
4.00	0.60	1 0	3 0	4 0	2 1	55	5.13
2.00	0.30	0 5	3 0	0 1	2 0	55	5.13
0.00	0.00	0 0	0 0	0 0	0 0	0	-

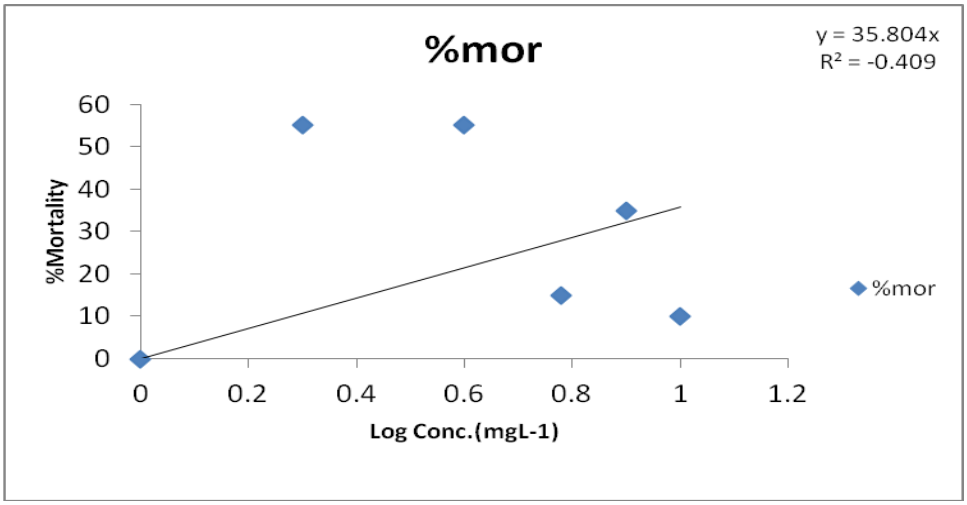

Fig 1: Graph of Clarias gariepinus exposed to different concentrations of LAS showing log concentration and mortality.

Table 2 : Mean mortality of *Clarias gariepinus* during the exposure period

ln(mgl-1)	Concentration 24hrs	48hrs	72hrs	96hrs
10	0.50	0.50	0.00	0.00
8	1.50	1.00	1.50	0.00
6	1.50	0.00	0.00	0.00
4	0.50	1.50	2.00	1.50
2	2.50	1.50	0.50	1.00
SEM	0.53333	0.4068	0.46667	0.26874
Significant	0.835	0.822	0.660	0.233

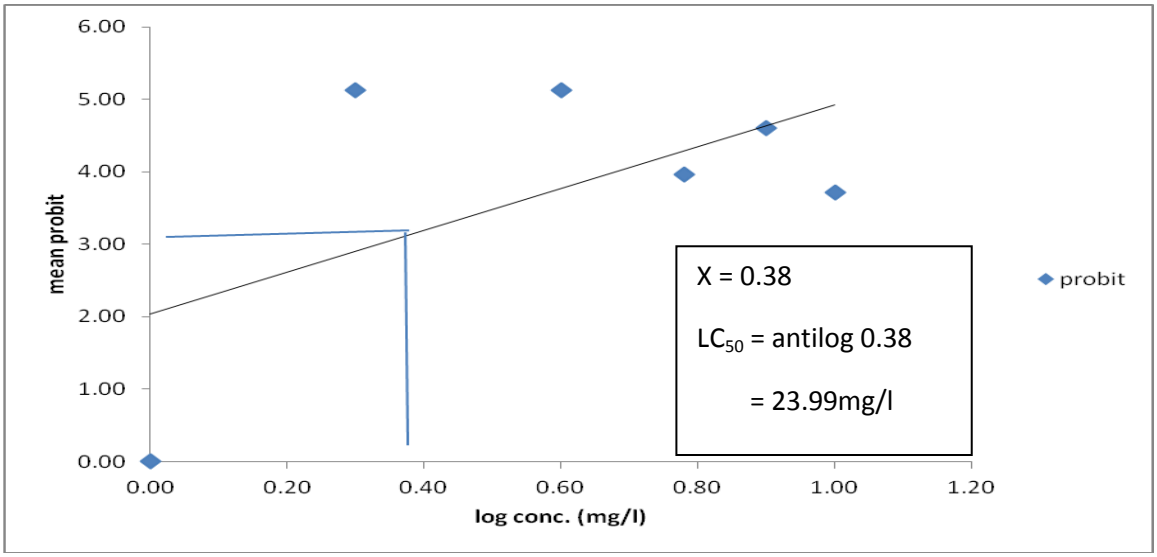

Figure 2: Determination of LC50 by graphical method Log_{10} conc. (mg/l) for *Clarias gariepinus*

Table 3: Water quality parameters recorded during the exposure of *Clarias gariepinus* fingerlings to different sublethal concentrations of linear Alkylbenzene sulphonate detergent for 96hrs

	Toxicant Concentration (mgll)				
Parameters	10.00	8.00	6.00	4.00	2.00
Disolved Oxygen (mgl^{-1})	6	6.8	8.2	6.8	4
p^H	7.40	7.40	7.40	7.40	7.40
Conductivity (μcm^{-1})	360	360	360	370	370
Temperature ($_0C$)	29.00	29.00	29.20	28.00	29.10
Alkalinity (unit)	110	180	112	114	90

Table 3 above showed the mean water quality parameters during exposure of *Clarias gariepinus* fingerlings to the detergent for 96hrs. The temperature, dissolved oxygen and conductivity concentration were observed to have remained relatively constant, whereas, the pH and alkalinity showed remarkable high concentration in table 3.

Swingle (1961) reported that the warm water fish of fresh water ecosystem are known to be most favoured by pH 6 and 8, and the acid and alkaline death points for fish are approximately pH 3 and 11 respectively.

Different behaviour patterns were exhibited by the test fish during the exposure period. Example, restlessness, rapid swimming, frequent attempts at jumping out of the tanks, rapid opercula movement, loss of balance, respiratory distress and excess mucus secretion towards the 96^{th} hour. The colour of the exposed fish became darker, the skin of the dead fish were dry and had lost their mucus lining. Haemorrhaging of the gill filaments were observed on the dead fish. These behavioural changes are indication of stress, nervous disorder and intoxication. These observations are similar to those of Omoregie *et al*.(1990); Ghatak and Konar (1991); Ufodike and Omoregie(1991); Okwuosa and Omoregie (1995); Nwanna *et al* (2003).

The lethal concentration that could kill half of the test population, LC_{50} , within the 96h test period (96h LC_{50}) obtained for the detergent was 23.99mg/L^{-1} .

The mortality rate of the test fish exposed to various concentrations of the detergent as shown in Table 1 above revealed that the mortality was high at early concentration of the detergent. This could be due to the changes in the water quality parameters as a result of the detergent. There was no mortality in the control. The value of 23.99mg/L^{-1} as the 96hr LC50 for the detergent makes this toxicant highly lethal for fish in the aquatic medium. This figure is within the range of 0.4 - 40mgL-1 reported by Abel (1974) of synthetic detergents to be acutely toxic to fish.

Conclusively, alkylbenzene sulphonate detergent is toxic to *Clarias gariepinus* fingerlings. This detergent also contributes to pollution of the water which leads to the mortality of the fish.

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