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ACUTE TOXIC EFFECT OF QUA IBOE LIGHT CRUDE OIL ON THE GILLS OF *CLARIAS GARIEPINUS* JUVENILES

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ABSTRACT: *The effect of the water soluble fraction of Qua Iboe Light crude oil on the survival of the Juveniles of African freshwater catfish (Clarias gariepinus) was investigated under laboratory conditions for 96 hours. A total of ten (10) juveniles of C. gariepinus each were grouped into twelve (12) test aquaria and held for 24, 48, 72 and 96 hours in six (6) different concentrations of Qua Iboe Light Crude oil (0, 10, 20, 30, 40 and 50mg/l) . The experiment were conducted in two batches (A and B).. No mortality was recorded in the 0-20mg/l of toxicant, 40% mortality was recorded in the 30mg/l of toxicant giving 60% survival at the end of the 96 hours of test. In the 40mg/l of toxicant 90% mortality was recorded, giving 10% of the organism surviving at the end of the 96 hours test, while in the 50mg/l of toxicant, 100% mortality was recorded leaving 0% survivor at the end of the 96 hours bioassay. The 96 hours LC_{50} for both batches was 30.12mg/l. Toxicant exposure induced behavioural changes such as abnormal and uncoordinated swimming movement. It was observed that mortality was concentration – dependent: the higher the concentration, the higher the mortality. There was no significant differences in mortalities between the two batches ($P>0.05$) leading to the conclusion that the WSF of Qua Iboe Light Crude oil in the Nigerian coastal waters may have adverse effects on aquatic fauna and flora. However, it was observed that the WSF of Qua Iboe Light Crude oil had severe impacts on the gills of the test organisms resulting in gill lamellae disintegration and erosion which may be attributed to the cause of the mortality in the test organisms.*

KEYWORDS: Acute Toxicity, Qua Iboe Light Crude Oil, *Clarias gariepinus*, Juveniles, Gills

INTRODUCTION

Pollution has become a general term for the common man because he has become accustomed to it that it may mean close nothing to him. Environmental pollution has become woven to the fabric of our modern life. However, every few years the world is shocked by reports of pollution disasters which have cause man to become active and conscious about the harmful effects of pollution. Pollution is defined as the addition or presence in the environment of one or more contaminants in such quantities and of such duration which tends to alter the physical, chemical or biological characteristic in a way that it becomes injurious to human health, animal or plant life. (Pers. Com).

Pollution from crude and refined oil is common worldwide and particularly endemic in countries whose economies are dependent on the oil industry. In Nigeria, oil industry operations are both onshore and offshore and all the oil terminals and most refineries in the country are located in the Niger Delta region and hence more than 90% oil - related activities take place in this region (Imevbore and Adeyemi, 1981). Spill incidences of various scales involving different kinds of

oils are reported to be more rampant and endemic in the coastal areas because this is the site of most oil refining and terminal operations.

The degree of hazardous effect of crude oil products is dependent on their concentration, chemical components and solubility in water. These products have been recognized as a potential environmental contaminant shortly after the beginning of twentieth century [Albers, 1995]. Researches carried out across the globe on the toxicity of Bonny Light crude oil (BLCO), Premium motor spirit (PMS), Qua Iboe Light crude oil (QILCO) and Dual purpose kerosene (DPK) on aquatic organisms have revealed their lethal, acute, short and long term effect (Baker, 1971). It has been found that as little as 0.1ppm of oil can seriously affect fish, amphibians, crustaceans and plankton. "Oils" float and coats things and has the potential to kill quickly by coating aquatic lives, interfering with gas exchange necessary for life. Sediments at the bottom on contamination has longer effect and benthic organisms become particularly susceptible (Baker, 1971).

In Nigerian waters, cases of oil spillage have been recorded between 1958 to date, releasing about 2.4 million barrels of crude oil into coastal aquatic environment. Of importance are the Exxon Mobil spills, Idoho disaster, 1998, Ogoni oil spills disasters, 1958-2005 (Udo, 2007). These pose great risk to aquatic organisms like periwinkle, which is a source of protein for the coastal dwellers in Nigeria. Doertter (1992) reports that oil spills cause substantial mortality among fish, amphibians and invertebrates. Other effects include changes in species composition, low abundance, loss of species and tainting (Windows *et a.,l* 1982).

Exposure of aquatic organisms to crude and refined oils, water soluble and water accommodated fractions of crude oil have been shown to impact on various aspects of fish physiology and sometimes leading to large scale mortality (Barron *et a.l,* 2003; Couillard *et al.,* 2005, Liu *et al.,* 2006). Haematological and histopathological changes in fish exposed to pollutants have been proposed and used as sensitive biomakers for assessing the effects of several environmental contaminants, including petroleum products (Heath, 1990; Benneth *et al.,* 1990).

Gills are generally considered a good bio indicator of the water quality and are appropriate for the assessment of environmental impact (Fernades and Mazon, 2003; Fanta *et al.,* 2003). Moreover, studies on the histopathology of different fish organs exposed to contaminants are often carried out with freshwater or brackish-water species (El-Sayed *et al.,* 1995; Spies *et al.,* 1996; Dwivedi *et al.,* 1997; Simonato *et al.,* 2008). Histopathological studies are performed to evaluate the direct effects of contaminants on fish in laboratory bioassays (Schwaiger *et al.,* 1992, 1997; Ortiz-Delgado *et al.,* 2007).

Despite the large number of spills of various scales occurring in the country particularly in the Niger Delta region, very little is known of the haematological and histopathological changes that exposed fish population may suffer under exposure to crude or refined oil (kerosene).The African catfish, *Clarias gariepinus* is the most popular and widely cultivated fish in Nigeria (Awa *et al.,* 1991). *C. gariepinus* is consumed widely in Nigeria because of its nutritive value. The vitamin content of the catfish has been the object of numerous research reports especially vitamin C (Ascorbic acid). Ascorbic acid is an indispensable and multifunctional micronutrient. It plays

important roles in improving immune function (Hardie *et al.*, 1991), improving growth (Boon-yaratpalin *et al.*, 2001), and providing good health (Khajaren and Khajaren 1997).
This study therefore, concurrently evaluates the effects of Qua Iboe Light Crude Oil, at acute lethal doses on survival, morphology and behavior and the effects on the histopathology of the gills of the test organism *C. gariepinus*.

MATERIALS AND METHODS

Collection and Transportation of Crude Oil (Qua Iboe Light)

Qua Iboe Light Crude Oil was obtained from the Oil Company (Mobil Producing Unlimited), Eket, Akwa Ibom State in airtight plastic cans and transported to the Research Laboratory of the Institude of Oceanography (IOC), University of Calabar, for subsequent use.

Collection and Transportation of Test Organism

A total of 120 healthy *Clarias gariepinus* juveniles were used for this study. The juveniles were in the range of 8 – 10cm in size. The fish were bought from the University of Calabar Fish Farm, Cross River State located within the University of Calabar at latitude $04^{0}5$, 020'N and longitude $008^{0}20$' 450' E, respectively. (Asuquo and Bassey, 1999 and Akpan *et al*., 2002), and was transported to the Research Laboratory of the Institute of Oceanography (IOC), University of Calabar, where they were acclimatized.

Acclimatization and Maintenance of Study Organisms

In the laboratory, *Clarias gariepinus* juveniles were allowed to acclimatize to laboratory conditions for 24 hours in the glass tank and aerated with air stone connected to electrically powered aquarium pumps.

PREPARATION OF TOXICANT SOLUTION

The water soluble fraction (WSF) of Qua Iboe Light Crude oil was obtained by vigorously shaking Crude Oil with flittered habitat water in a separatory funnel. The system was allowed to stand for six hours to effect complete phase separation, after which the lower aqueous layer containing the WSF was collected for the toxicity test.

Stocking of Specimens

The *Clarias gariepinus* juveniles were gently caught using a hand net in order to avoid stress, into glass tanks measuring 25 X 10 X 15cm from an acclimatized tank. The glass tank was filled with 2 liters of dechlorinated water.

Monitoring of Water Quality Parameters

Water quality parameters were monitored before start of experiment, and also specify (dialy) according to standard method (APHA, 1989). Parameters that were monitored include; Dissolved Oxygen (DO), pH, temperature (^{o}C), Nitrite (NO^{-}_{2}) and Ammonia (NH_3).

Monitoring of Specimen for Mortality
Test animals were taken as dead if failed to move their bodies. They float or sink into bottom when probed gently with a glass rod. During assessment for mortality each fish was removed from a test medum with a pair of forceps, placed in a clean empty petri dish and recorded.

Preliminary Test
The concentration ranges chosen for the preliminary test of WSF of Qua Iboe Light Crude oil on *Clarias gariepinus* juveniles were 0, 4, 8, 12, 16 and 20mg/l. Ten fish were randomly introduced into each of the reconstituted crude oil and each concentration was set in duplicate with control containing declorinated water without the addition of WSF of Qua Iboe Light Crude oil.

Definitive Test
The concentration ranges chosen for the WSF of Qua Iboe Light Crude oil for the toxicity test on *Clarias gariepinus juveniles* after the preliminary tests were 0, 10, 20, 30, 40 and 50mg/l. The duration of the experiment was 96hours. After 96 hours the LC_{50} determination was calculated using a modified method (Finney 1971, Stephan, 1977). The fish were starved in order to minimize waste production. The distress behaviour and the deaths were closely monitored and recorded from the onset of the experiment 6h, 12h, 24h, 48h, 72h and 96h, respectively. The initial water parameter and daily water parameter dissolved oxygen, temperature; pH, nitrite and ammonia were monitored using mercury – in – glass thermometer, and Lurton Do and pH meters. The battery operated meters were calibrated according to manufacturer's instructions before being used for measurement (Boyd, 1989, 1990).

Histopathology
The gills tissues isolated from the test animal were fixed in formal-saline for 48 hours. The fixed tissue was processed manually through graded ethanol, cleared in xylene, impregnated and embedded in paraffin wax. These sections were cut with a rotary microtome, stained by haematoxylin and eosin technique, examined microscopically for pathological changes.

Statistical Analysis
The number of dead organisms between control and experimental group were analyzed using ANOVA at $(P < 0.05)$ to test for Significance difference. Statistical analysis was powered by SPSS 18.0 (SPSS Inc; Chicago, USA).

RESULTS

The variations in the physico-chemical parameters of the test medium during the bioassay is shown in Table 1.The test organism (*Clarias gariepinus*) iuveniles showed pathological changes and mortalities. Sub-lethal changes observed were erratic swimming behaviour, restlessness, loss of balance, attempt at jumping out and haemorrhaged gills, respiratory difficulties and mortalities were observed in the WSF exposure groups but not in the control. The percentage mortality and survivors of *C. gariepinus* fingerlings at the end of the test period in each of the concentration are shown in Table 2 for the two batches of the experiment. In the 0mg/l of toxicant, no mortality was

recorded throughout the test period. Similar observations were made in the 10mg/l and 20mg/l of the toxicant. In the 30mg/l of toxicant, 40% mortality and 60% survivors were recorded; in the 40mg/l of the toxicant, 90% mortality and 10% survivors were recorded, while in 50mg/l of the toxicant, all test organisms were observed dead, leaving 0% survivors in both batches (Table 2). The 96 hours LC_{50} for *Clarias gariepinus* is shown in Figure 1 for both batches. The 96 hour LC_{50} is given at log concentration of 1.48 a point were 50% of the organism would be killed at the end of the 96 hours if toxicant finds its way to the habitat of the fish. The log transformation of thedifferent concentration of the toxicant is shown in Table 3 for both batches. Statistical analysis using ANOVA (SPSS 18.0) showed that there was no significant difference ($P > 0.05$) in mortality between the two batches (A and B) of the test organism. Plate 1 shows the normal distribution of gill lamella of the fish at 0mg/l of toxicant. Erosion of gill lamellae is shown in Plate 2 at 10mg/l of toxicant, while Plate 3 shows destruction of gill secondary lamellae at 20mg/l of toxicant. Plate 4 shows hyperplasic gill membrane at 30mg/l of the toxicant. In Plate 5, the gill was observed to show loss of gill membrane and hyperplasia condition.

Table 1: Physico-chemical parameters of the test medium during the 96hrs bioassay
* Initial values of the physico-chemical parameters of the test solution prior to stocking

Conc. of toxicant (mg/l)	***Initial DO value = 5.3mg/l**				***Initial temp value = 29.8°C**				***Initial pH value = 6.77**				***Initial NO^{-}_{2} values = 0.1mg/l**				***Initial NH^{-}_{3} (mg/l) = 0.0mg/L**			
	DO (mg/l)				**Temp °C**				**pH**				**NO^{-}_{2}(mg/l)**				**NH^{-}_{3}(mg/l)**			
	Time (hrs)																			
	24	**48**	**72**	**96**	**24**	**48**	**72**	**96**	**24**	**48**	**72**	**96**	**24**	**48**	**72**	**96**	**24**	**48**	**72**	**96**
0	7.4	9.4	8.6	8.8	27.6	27.3	27.5	27.2	7.31	7.12	6.25	6.25	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0
10	1.5	1.5	4.6	6.6	27.6	27.2	27.5	27.3	7.22	7.40	6.85	7.02	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0
20	1.7	1.3	2.4	5.4	27.1	27.3	27.5	27.5	6.78	7.75	7.52	6.16	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0
30	1.3	1.3	1.9	4.1	27.7	27.3	27.6	27.5	6.33	6.45	7.50	6.23	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0
40	1.9	1.2	1.5	1.3	27.7	27.4	27.5	27.5	7.13	7.48	6.58	6.28	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0
50	1.6	1.2	2.14	1.3	27.8	27.4	27.4	27.6	5.16	7.25	5.68	6.12	0.1	0.1	0.1	0.1	0.0	0.0	0.0	0.0

TABLE 2: Summary of percentage mortality of *Clarias gariepinus* juvenile in the toxicant at the end of the experiment (96 hours)

Conc. of toxicant mg/l	Batch A % mortality	Batch B % mortality
0	0	0
10	0	0
20	0	0
30	40	40
40	90	90
50	100	100

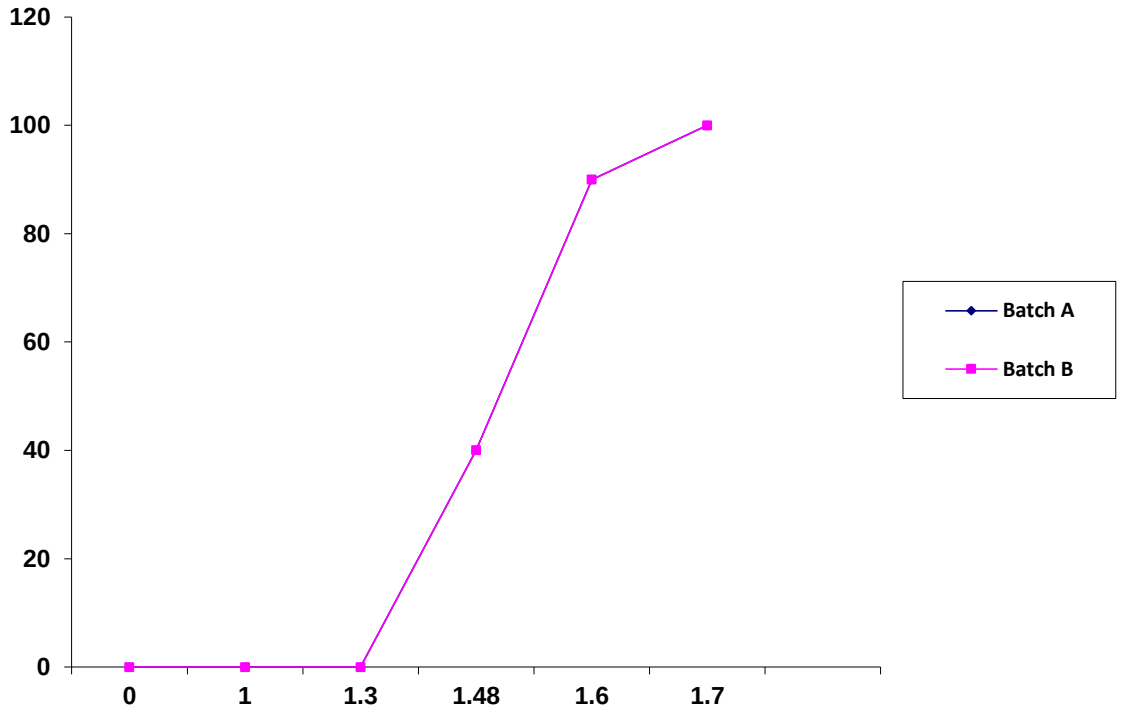
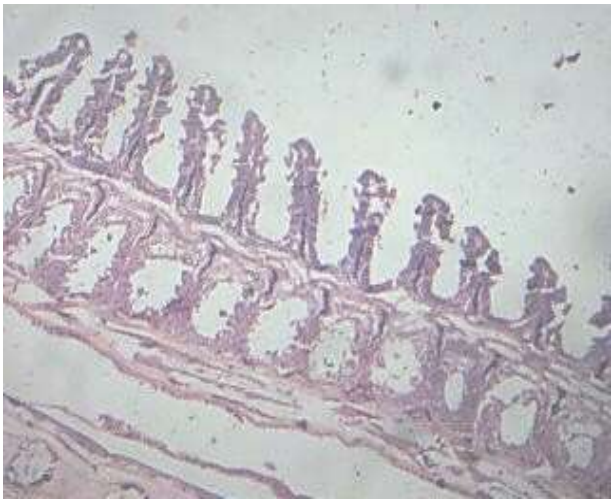


Figure 1: Log-transformation of toxicant on *Clarias gariepinus* juvenile for the determination of probit level at the end of the experiment (96 hours

TABLE 3: Log-transformation of the toxicant on *Clarias gariepinus* juvenile for the determination of probit level at the end of experiment (96 hours)

Toxicant conc. Mg/l	Log values of concentration	Batch A (% mortality)	Batch B (% mortality)
0	0	0	0
10	1	0	0
20	1.30	0	0
30	1.48	40	40
40	1.60	90	90
50	1.70	100	100



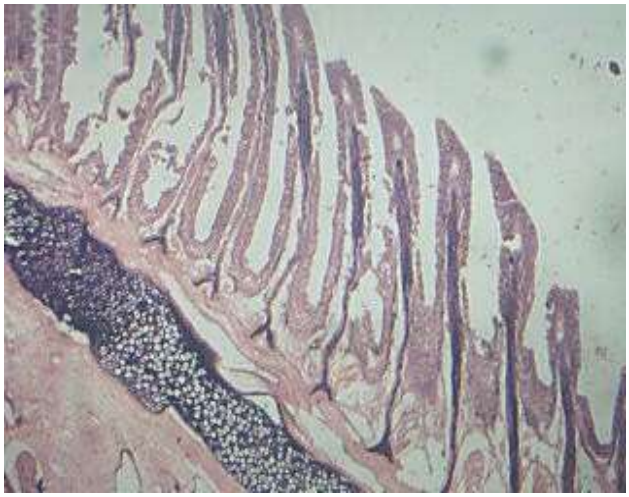
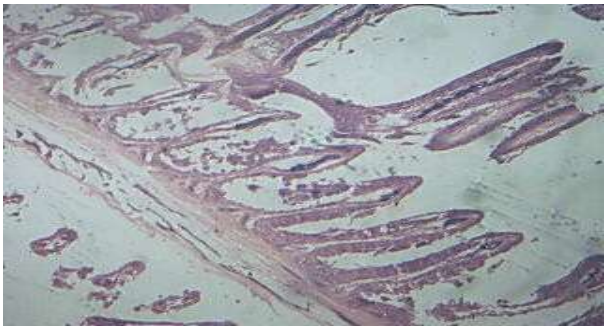


Plate 1: Normal distribution of gill lamellae in *C.gariepinus* (Control) **Plate 2:** Gill of *C.gariepinuis* showing erosion of gill lamellae at 10mg/l WSF of Crude Oil at the end of the experiment (96hrs)



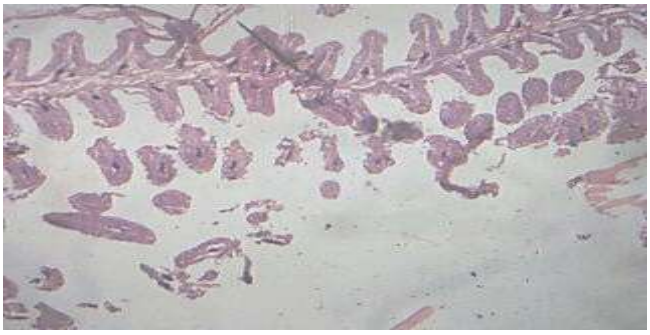


plate 3: Gill of *C. gariepinus* showing destruction of gill secondary lamellae at 20mg/l WSF of Crude Oil of Crude Oil at

Plate 4: Gill of *C. gariepinus* showing Hyperplasic gill membrane at 30mg/l WSF

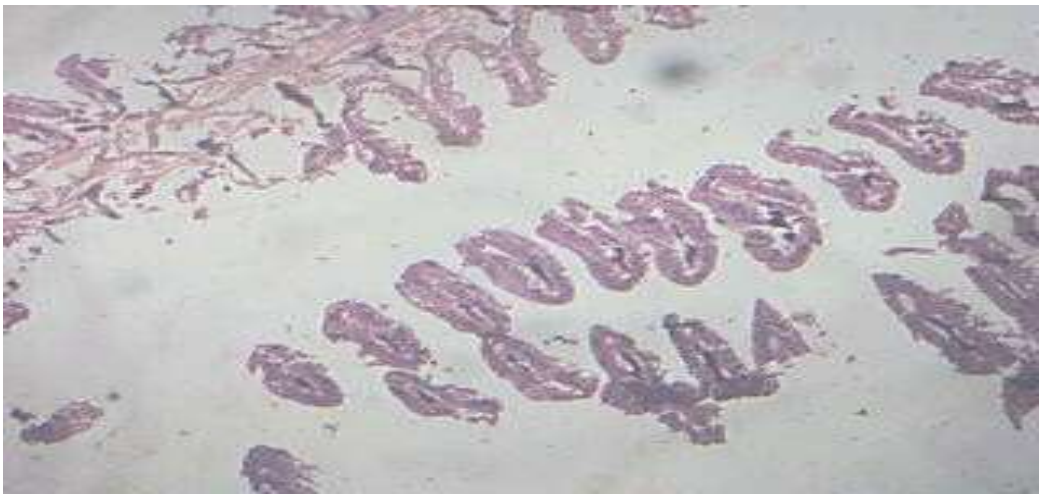


Plate 5: Gill of *C.gariepinus* showing Loss of gill membrane/ hyperplasia condition at 40mg/l WSF of Crude Oil at the end of the experiment (96hrs)

DISCUSSION

Five basic physico-chemical parameters were taken prior to the stocking of the fish species. Dissolved oxygen had a value of 5.3 mg/l, with a value of 29.8 ^{o}C recorded for temperature, 6.77 for pH, 0.1 mg/l for nitrite and 0.0 mg/l for ammonia. In aquaculture operations, standard ranges of values for these parameters are known. For dissolved oxygen a range of between 6.0 mg/l to saturation is suitable, 6.7 - 8.6 for pH, 25.0 - 30.0 ^{o}C for temperature, 0.1 mg/l for nitrite and 0.0 mg/l for ammonia (Alasbaster and Lloyd, 1980; Smith, 1982; Meade, 1989; Udo, 2007; Ajah, 2007). The ranges of the physico-chemical parameters of the experimental water were found to fall within the acceptable limits prior to the commencement of the experiment as previously reported by the author under reference.

The maintenance of the normal values of the physico-chemical parameters in the experimental water prior to the commencement of the experiment might have been as a result of absence of impurities or the toxicant and the organisms themselves (WHO, 1984; Smith and Williamson, 1985; Samabaswa and Rao, 1985; Vogel, (2000). Impurities, pollutants and toxicants are known to elevate or reduce the different physicochemical parameters in aquatic environment (WHO 1984; Gbem *et al.*, 2001; Idodo-Umeh, 2002).

During the experimental period variations in the physico-chemical parameters were generally observed in the experimental aquaria in both batches. As the concentration of the toxicant increased with time the values of the physicochemical parameters were observed to fluctuate when compared with the control. This phenomenon has been previously reported in the physico-chemical parameters of the test water media by Ayotunde *et al.*, (2011) when investigating the toxicity of *Carica papaya* on adult catfish (*Clarias gariepinus*), Ayotunde and Ofem (2005) when reporting on the acute and chronic toxicity of pawpaw (*Carica papaya*) seed powder to Nile tilapia (*Oreochromis niloticus*), Ayotunde and Ofem (2008) when studying acute and chronic toxicity of

pawpaw (*Carica papaya*) seed powder to adult Nile tilapia *Oreochromis niloticus*, Ayotunde *et al.,* (2010) when investigating toxicity of pawpaw (*Carica papaya*) seed powder to sharp-tooth catfish *Clarias gariepinus* fingerlings and effects on haematological parameters and Cagauan *et al*., (2004) when evaluating botanical pisicides on Nile tilapia, *Oreochromis niloticus* and mosquito fish *Gambusia affinis.* It is a generally acceptable scientific findings that concentration influences the elevation and / or reduction in physico-chemical parameters of test water during an experiment (Heijerick *et al.*, 2003; Ayotunde *et al.*, 2011) coupled with the fact that the organisms will also spend their time absorbing oxygen in particular for survival (Ogundiran *et al.,* 2010; Adewoye, 2010).

It may however be interesting to note that there were no observed elevation and / or reduction in nitrite and ammonia during the study period which may be attributed to the presence of heavy slime (mucus) on the skin of *C. gariepinus*. The presence of slime on surfaces have been reported to have the ability to neutralize any impact of nitrite and ammonia in solution (Kaniewska-prus, 1982; Banerjee, 1993), as was observed in the result of the present study. It is usual that for a toxicity test to be carried out on organisms, for the purpose of range finding (Ayotunde *et al*., 2011; APHA, 1989) under laboratory conditions. Though toxicity range values are usually found to be different for each toxicant and organisms (Akah *et al.*, 1997; Bossayt and Jansen, 2005), the procedure is generally acceptable in ecotoxicity experiments (APHA, 1989). No mortality was recorded in each of the 0mg/l, 4mg/l, 8mg/l, 12mg/l and 16mg/l concentration of the toxicant used but in the 20mg/l concentration of the toxicant, 10% mortality was recorded during the 96 hour of test. The varying and differential percentage mortalities observed during the preliminary test in the study show that each fish species show differential and varied percentage mortalities when exposed to a particular toxicant at a certain concentration as was previously reported (Ayotunde *et al.,* 2011; Akah *et al.,* 1997).

The percentage mortality of *C. gariepinus* in the water soluble fraction of crude oil ranged from 0-100% in both batches A and B at the end of the 96 hours of test. No mortality was recorded in the 0-20mg/l of toxicant. However, 40% was recorded in the 30mg/l concentration in each of the bathes, while 90% mortality was recorded in the 40mg/l of toxicant, and 100% mortality was recorded in the 50mg/l of toxicant. Between 0-100% mortality was reported in *Clarias gariepinus* fingerlings exposed to varying lethal concentrations of detergent effluent with 0% mortality recorded in the control tanks A and B, 30 and 30% mortalities in the 0.01mg/l, 40 and 80% mortalities of 0.02mg/l concentrations A and B, 90 and 70% mortalities in 0.03mg/l concentration A and B, 80 and 100% mortalities in the 0.04mg/l concentration A and B, 100% mortalities each in 0.05mg/l concentration A and B in Ogundiran *et al.,* (2010) report.

In the present study, percentage mortalities were concentration - dependent. The higher the concentration, the higher the percentage mortalities. Similar report was presented by Ogundiran *et al.,* (2010) when investigating toxicological impacts of detergent effluent in fingerlings of African catfish *Clarias gariepinus*, Calta *et al.,* (2004)

when studying acute toxicity of the synthetic pryrethroid deltamethrin to young minnow cap, cyprinus carpio, Ayotunde *et al.,* (2011) when investigating in the toxicity of *Carica papaya* on

adult *C. gariepinus*, Ayuba and Ofojekwu (2002) when investigating on acute toxicity of diazinion to African catfish C. *gariepinus*.
Clarias gariepinus generally are ecologically adapted to muddy environment in which temporary changes in water chemistry are more rapid and the contaminant concentration are usually higher (Koivisto, 1995; Ayotunde *et al*, 2011). This view may however not be supported by some contaminants or toxicant such as crude oil which produced 100% mortality of the fish in 96 hours. The results of this work also agrees with the work of Ayuba and Ofojekwu (2002) when investigating acute toxicity of Jimson's weed, *Datura innoxia* to the African catfish *Clarias gariepinus* fingerlings. The 96 hours LC_{50} of any toxicant is the dose or concentration which will kill 50% of the stocked organisms at the end of the experimental period of 96 hours (4 days) (Samabaswa & Rao, 1985; AKpan *et al.*, 1999; Udo *et al.*, 2006).

The 96 hour LC_{50} is known to vary from toxicant (Samabaswa and Roa, 1985; Ayotunde *et al.*, 2010) and from concentration to concentration of the toxicant (Cagauan *et al*, 2004; Ayotunde *et al.*, 2010). The 96 hours LC_{50} was 30.12mg/l representing log concentration of 1.48mg/l for both batch A and B. The 96 hours LC_{50} are known to vary with toxicant (Ogundiran *et al.*, 2010, Arimoro, 2009). Ogundiran *et al* (2010) reported 96 hours LC_{50} of 0.0166mg/l and 0.0038mg/l for batch A and B *Clarias gariepinus* fingerlings under the toxicity effect of detergent effluent. A 96 hours LC_{50} of 0.1mg/l and 0.03mg/l was reported by Adewoye *et al.*, (2010) when working on the effect of soap and detergent effluents in *Clarias gariepinus*. The varied 96 hours LC_{50} values usually obtained from different toxicants and test organisms is again reported by Ekanem *et al.*, (2011), when they reported a 96 hours LC_{50} of 5.0±1.76 and 4.0±1.76mg/l for *Macrobrachium macrobrachion* and *M. vollenhovenii*.

In this study the 96 hours LC_{50} of 30.12mg/l obtained for Batch A and B might have depended on the range of the toxicant after series of preliminary test which produced the concentration finally used for the test. The effects of the water soluble fraction of Crude Oil showed severe destruction of the gill lamellae of *Clarias gariepinus*. However, the gill lamellae of the organism in the control (0mg/l) were not affected. In the 10mg/l concentration of the toxicant it was observed to cause erosion of gill lamellae in *C. gariepinus*. In the 20mg/l concentration of the toxicant the gill lamellae of *Clarias gariepinus* were observed to have shown destruction of gill secondary lamellae while in the 30mg/l concentration of the toxicant the gill were observed to show hyperplasic effects of the WSF on the gill membrane. In the 40mg/l concentration of the toxicant the gill was observed to show loss of gill membrane and hyperplasic condition.

Gill lamellae cell disintegration has been reported by Diana *et al.*, (2007) in *Carassius auratus gibelio* when investigating biochemical and histological effects of deltamethrim on the species with different effects such as lamellae cells hypertrophy and nuclear pycnosis in the basal cells. Hypertrophic, necrotic, atrophy and dystrophy of secondary lamellae have also been reported in *Clarias gariepinus* juveniles exposed to refined petroleum oil and kerosene under laboratory conditions (Gabriel, *et al.*, 2007).

The changes in the gills of *Clarias gariepinus* exposed to the water soluble fraction of Crude Oil fall within the general responses of fish organs to environmental pollutants. Fernandes and Mazon (2003) observed that fish gills are the prime target organ of all pollutants due to their extensive

surface in contact with the external medium and the reduced distance between the external medium and gill morphology are important biomakers providing a rapid method of detection of the effect of pollutants (Banerjee, 1993; Gabriel *et al*., 2007). The general morphological changes in the gills recorded in this study have been reported in *Astyanax* sp. after 96h exposure to water soluble fraction of crude oil (Akaishi *et al.*, 2004). Gabriel *et al.*, (2007) also reported similar changes in *Clarias gariepinus* exposed to petroleum oil and kerosene, as was reported in *Oreochromis niloticus* by Wannee *et al.*, (2002).

CONCLUSION AND RECOMMENDATION

The results of the experiment indicate that Qua Iboe Light Crude oil is toxic to *Clarias gariepinus* even at low concentrations. Therefore it could be recommended that the level of this toxicant in aquatic environment should not exceed the 10% of their 96 hours LC_{50}.Based on the results of the study which showed high percentage mortalities of the fish species when exposed to the water soluble fraction of crude oil, it is very imperative that ecologically friendly methods would be put in place in discharging the effluents by oil companies refining crude oil for the production of various related products. These products are extensively used world-wide. *Clarias gariepinus* is an important aquaculture candidate in most parts of the world including Nigeria. The continuous discharge of crude oil either through tanker accidents or oil spillages to the environment as would be expected, will cause a deleterious ecological effects to both terrestrial and aquatic biota at the long term. Realising the tremendous adverse effects associated with crude oil and their wastes on humans and the environments, companies refining these products should adhere to modern techniques of waste management and disposal.

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