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Advances in Applied Science Research, 2010, 1 (1): 9-13

# Microbiological Investigation of Selected Organs of *Clarias gariepinus* Exposed to Wastewaters from a Detergent Industry

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## ABSTRACT

*The microbiological investigation of selected organs of Clarias gariepinus exposed to effluents from a soap and detergent industry, in Ilorin was carried out. The microbiological analyses of the selected organs (gills, and skin) showed that the index of the microbial load is in order of* $10^{6,}$ *indicating that the effluent is highly populated with fungi and bacteria. The results showed that the metal components of the industrial effluents bioaccumulated in the organs of fish, this phenomenon was thought to have brought about the enhanced growth of microorganisms in the organs. The probability of being exposed to non point pollution was considered. Notable microorganisms in the organs of the fish include the following; Proteus vulgaris, Bacillus Sp, Streptococcus faecium, Eschericia coli.*

**Keywords ;** Organs, Bioaccumulation, Microbial load, Pollution.

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## INTRODUCTION

The addition of harmful substances to the environment, making it undesirable or unfit for life is referred to as pollution. Pollution occurs as a result of anthropogenic activities which concentrate the emissions and discharges in areas where people live and work[1]. When pollutants reach a particular ecosystem, they disturb its delicate balance and threaten the health and existence of living organisms including man [2].

Industrial effluents may be considered as one of the most common water pollutants, some of which may be regarded as non-degradable. Many industries lack effluent treatment plants, and thus discharge untreated or partially treated effluents into natural water bodies [1, 3]. Effluents discharged into surface water have adverse effects; such that the discharges may kill aquatic organisms as a result of reduction in dissolved oxygen content of the receiving water [4]. The self purification processes in the water become overstretched and both the physical and chemical quality of surface water become generally impaired [1].

*Clarias gariepinus* is common in Africa especially in Nigeria. It belongs to the family Clariidae of the order siluriform and super order Ostariophysii. *Clarias gariepinus* possess gill fans and epibranchia organs, for efficient and obligate air breathing.

Generally, fish have ability to bioaccumulate metals in their bodies [5]. *C. gariepinus* bioaccumulates the highest amount of metals in its gills followed by liver skin and muscle [6].

Considering the richness of fish organs in nutrient particularly, the study of the impact of bioaccumulation of industrial effluents on microbial population in the organs of fish is important. Egboka reported that majority of water borne pathogenic microorganisms enter water courses as a result of feacal contamination [7]. Adewoye and Lateef also reported that industrial effluents discharged into water body facilitated dense growth of microorganisms in the river, this affects inhabiting organisms such as fish[8].

Accumulation of microbes inside water meant for fishing for human consumption could cause diseases such as cholera, typhoid fever, skin diseases among others[1]. Moreover, *Edwardsiella ictaluri,* gram negative red bacteria is a typical example of microorganisms that survive in catfish and pond bottom mud [9].

## MATERIALS AND METHODS

The industrial effluent used for the toxicity test was collected from soap and detergent industry in Ilorin, Kwara State.

The test organisms, *Clarias gariepinus* of table size were collected from Fishery Division, Ministry of Agriculture, Ilorin, Kwara State.

### Acclimatization

The test organisms were acclimatized for 14 days in large containers by not giving them food to ensure their adaptation to the new environment.

### Procedure for toxicity test

The method of Bioassay used was renewal test. Both lethal and sub lethal test was carried out and the control. After carrying out the test, the mortalities from the two tests were kept in a freezer before analyses.

### Microbiological analyses

The skin, gills and muscles of the test organisms were subjected to microbiological analyses. Aseptically, the skin of the fish sample from each concentration were scraped, homogenized and serially diluted. Two dilutions were chosen and plated out using nutrient agar and potatoes dextrose agar. For the nutrient agar, the plates were incubated at $37^0$C for 24 hours while for potato dextrose agar (PDA), the plates were incubated at room temperature for 48 hours. The process was repeated for the gills. Control experiments were also carried out.

The distinct colonies observed were aseptically subculture and transferred into the slants; the different isolates obtained were then characterized for identification.

## RESULTS

Exposure of *Clarias gariepinus* to industrial effluent in this research work revealed the effects of the industrial wastes on microbial load in the skin and gills of the fish.

Microbial load for bacteria was in order of $10^6$ while microbial load in control was in order of $10^2$. Table 1; show that the concentration of industrial effluent has no much effect on the abundance of bacteria load in fish organs (gill, muscle and skin). There was no significant difference in the bacteria load of the organs of *C. gariepinus* as the concentration of the industrial effluent increases.

Microbial load for fungi was in order of $10^6$ while microbial load in the control was in order of $10^2$ (Table 2). There was no significant difference in the population of fungi in the gills, skin and muscle of *C. gariepinus* as the concentration of the industrial effluent increases.

**Table 1: Microbial load for Bacterial cfu/ml**

| Concentration | Gills Samples | Skin Samples | Muscle Samples |
|---|---|---|---|
| Control | $1.2x10^2$ | $2.0x10^2$ | $1.2x10^2$ |
| 0.005 | $6.2x10^6$ | $6.2x10^6$ | $6.0x10^6$ |
| 0.010 | $6.5x10^6$ | $6.0x10^6$ | $5.2x10^6$ |
| 0.020 | $2.7x10^6$ | $2.6x10^6$ | $2.5x10^6$ |
| 0.025 | $8.6x10^6$ | $8.0x10^6$ | $4.8x10^6$ |

*Each value is a mean of two readings*

**Table 2: Microbial load for Fungi cfu/ml**

| Concentration | Gills Samples | Skin Samples | Muscle Samples |
|---|---|---|---|
| Control | $1.2x10^3$ | $1.5x10^2$ | $1.2x10^2$ |
| 0.005 | $5.3x10^6$ | $4.8x10^6$ | $4.0x10^6$ |
| 0.010 | $7.8x10^6$ | $7.0x10^6$ | $6.8x10^6$ |
| 0.020 | $9.4x10^6$ | $6.5x10^6$ | $4.8x10^6$ |
| 0.025 | $1.2x10^6$ | $2.0x10^6$ | $1.0x10^6$ |

*Each value is a mean of two readings*

**Table 3: Biochemical characterization of the isolates of the Gills**

| Samples Code | Probable Identification |
|---|---|
| $FgN_1$ | *Serratia marcescens* |
| $FgN_2$ | *Streptococcus Sp* |
| $FgN_3$ | *Proteus rulgaricus* |
| $FSN_1$ | *Bacillus Sp* |
| $FSN_2$ | *Streptococcus* |

*F = Fish, S =Skin, g = gill, N = Nutrient agar*

Table 3 and 4 shows probable isolates of bacteria and fungi respectively as found in the skin, gills and muscle of *C. gariepinus* exposed to industrial effluents.

**Table 4: Biochemical characterization of the isolate from the skin (fungi)**

| Samples Code | Probable Identification |
|---|---|
| $FgP_1$ | *Saccharomyces cerevisiae* |
| $FgP_2$ | *Rhodosporium Sp.* |
| $FgP_3$ | *Saccharomyces cerevisiae* |
| $FSP_1$ | *Alternaria Sp.* |
| $FSP_2$ | *Aspergillus niger* |

*Key: F – Fish, g – gill, S –Skin, P = Potato dextrose agar*

## DISCUSSION

Considering the results obtained in this study, it is evident that the microbial load and the status of the microorganisms isolated from the selected organs of the test organism shows a level of contamination which indicates that the presence of effluent in any water body would make it highly populated with different species of microorganisms making fish and other organisms susceptible to diseases. This conforms to the findings of [8] that industrial effluents discharged into water body facilitates dense growth of microorganisms in the river.

Out of the three selected organs analyzed, the gills and the skin had higher microbial load than the muscles which indicated that the test organisms bioaccumulated high concentration of industrial effluents in their gills and skin than in the muscles. This observation is in agreement with the findings[6] that *C. gariepinus* generally bioaccumulates highest concentration of metals in its gills followed by liver, skin and muscle.

The microbial loads recorded in the three organs (gills skin and muscles) varied. The results obtained from this work shows that the increase in the concentration of the industrial effluent has no significant effect on the abundance of microorganisms in the fish organs. Therefore, the microbial loads in these organs cannot be directly attributed to the concentration of the accumulated pollutants. On the contrary, Adewoye and Lateef reported that the variation recorded in the abundance of microbes across the particular sites of Oyun stream, could be attributed to the variation in the concentration of the deposited pollutants[8]. A report according to Saida and Veljo showed that the fluctuation of the abundance of bacteria could be as a result of the presence and density of main producers of organic matter in water[10].

The abundance of bacteria and fungi in the organs of the test organisms indicates that the organs were also exposed to non-point pollution. For instance, some of these organs are rich in certain nutrients which enhanced the growth of microorganisms. Feacal contamination in water is usually demonstrated by the detection of specific bacteria that are present in very large numbers in intestines [7]. Hence, it can be concluded that the organs are exposed to both point and non-point pollution, which can alter the natural balance of populations within the ecosystem, by selectively encouraging the development of those aerobic microorganism which can degrade all or some of the added materials [11].

This study however, revealed the potentials of exposure of fish to detergent effluents or the seepage of the effluents into water bodies which constitute a change in the water quality while the fish organs serve as reservoirs which encourage the growth of microorganisms especially the pathogenic ones that are injurious to man health. Hence the consumption of fishes from waters polluted with detergent effluents must be discouraged because of their deleterious effects on man's health.

## ACKNOWLEDGMENT

The authors would like to thank the Ministry of Agriculture, Fishery Division, Ogbomoso, Nigeria and Central Research Laboratory, Ladoke Akintola University of Technology, Ogbomoso Nigeria for providing *Clarias gariepinus* species and facilities respectively for this study.

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