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ASSESSMENT OF TEXTILE EFFLUENTS QUALITY USING FISH

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ABSTRACT
Assessment of toxicity of treated textile effluents from one of the Textile industry in Kano (Nigeria) was made by acute toxicity test using fish for 96 hours. Analysis of physicochemical parameters revealed that the effluent quality conformed to the statutory limits set by Environmental Regulatory Agency. There was not much variation in the weight of the fish exposed to different treated textile effluent concentrations. There was no significant variation in the length of the fish exposed to different treated effluent concentration.
There were no deaths of fish after 96 hours. It is recommended that regular laboratory bioassay is necessary for effluent quality assessment.

Keywords: Effluent, Fish, Textile, Toxicity

INTRODUCTION
Textile industries consume large quantities of water and produces large volumes of wastewater from different steps in dyeing and finishing processes. Business and industry play a crucial role in the socio-economic development of a country. However, industrial development is the main cause of depletion of natural resources and degradation of the environment[1]. Industries generate wastes, which can be damaging to water, air, land resources and quality of life [2]. The issues of industrial pollution and control are gaining importance in Nigeria today. Kano as the second most industrialised city in Nigeria, is witnessing unprecedented levels of environmental degradation. Contaminated air, soil and water from industries are associated with heavy disease burden[3] and this could be part of the reasons for the current shorter life expectancy in the country[4], when compared to the developed nations. Some heavy metals contained in these effluents are known to be carcinogenic [5].
In advanced countries, environmental monitoring agencies are more effective and environmental laws are strictly enforced. General environmental quality of water resources is done on a regular basis [6],[7],[8],[9]. As a result, any abnormal changes in the environment or water quality can easily be detected and appropriate action taken before any outbreak of epidemics. The case is quite the opposite in many developing countries, and environmental laws where they exist are rarely observed.

MATERIALS AND METHODS
The effect of textile effluent on aquatic life was investigated with acute toxicity test described by [10] using

fish. Effluent concentration of 20, 40, 60, 80 and 100% including control (diluted water containing no effluent) were prepared in 12 plastic containers. The pH and electrical conductivity of the solution were taken using pH meter and conductivity meter respectively. The fishes were introduced into the prepared solutions of different concentrations. Each container was labelled appropriately according to its concentration test. Effluent was changed daily because oxidation may degrade or remove the toxicants and also the volatile components in the pollutants may escape [10].

Observation on mortality was made at the following intervals of time after the exposure of the fish: 15 minutes, 30 minutes, 1 hour, 2 hours, 4 hours, 8 hours, 14 hours, 24 hours, 30 hours, and 48 hours

Fish was considered dead when there was no response to gentle prodding. Any dead fish was removed immediately from the test tank.

Chemical Analysis of Treated effluent

The chemical analysis of treated effluent was done using standard analytical methods of water analysis [11], [12] [13].

Determination of pH and Conductivity

pH and electrical conductivity were determined at the time of sampling in the field. The pH of the sample was measured with a pH meter that had been calibrated with buffer solutions and conductivity was measured with a conductivity meter calibrated with potassium chloride solution.

Determination of Dissolved Oxygen

Dissolved oxygen (DO_2) was determined by Winkler's titration. This was carried out as described by [14]. Manganous chloride and Winkler's reagent were added to the sample immediately after collection of the sample. On coming to the laboratory, the precipitate of manganese hydroxide resulting
from the earlier addition of manganese chloride solution and Winkler's reagent on the field was dissolved by addition of 2.0ml concentrated dihydrogen tetraoxosulphate (VI) acid in the sample. The sample was then thoroughly mixed and 100ml transferred from the sample bottle into a conical flask. This was immediately titrated against standard (0.0125M) sodium hyposulphite solution until only a faint yellow colour remained. Then a few drops of freshly prepared starch solution was added and the sample further treated drop wise against sodium thiosulphate solution until the blue colour disappeared. Each 1.0ml of thiosulphate used was titrimetrically equivalent to 1.0mg O_2 /ml [15].

Determination of Heavy Metals

Heavy metals (Cr, Cu, Zn, Pb, and Cd) were determined by digesting a known volume of effluent sample with analytical grade HNO_3. The digested effluent was filtered into 20ml standard flask made up to the mark with distilled de-ionised water, and stored in a refridgerated nitric acid pre-washed polyethylene bottle prior to chemical analysis. The effluent extracts were analysed for metals with HACH Spectrophotometer. Each sample was analysed in triplicate and average of the results taken. General laboratory quality assurance measures were always observed to prevent sample

contamination and instrumental errors. The water used throughout the experiment was doubly distilled in an all glass distiller before it was de-ionised. Wavelength setting of spectrophotometers used was done daily by standard instrumental procedure and other equipment used was always calibrated against reference standards.

RESULTS

The results observed during the study are presented in tables 1-4 below

Average mean weight of (A) =36.31g
Average mean weight of (B) =36.15g

In replicate A, the minimum mean weight of the fish used was 35.50g, while the maximum mean weight of the fish used was 37.20g.

In replicate B, the minimum mean weight of the fish used was 35.55g. While the maximum mean weight of the fish used was 37.15g.

The average mean weight in replicates A and B were 36.31g and 36.15g.

It can be observed from the above results that there was no much variation in the weight of the fish exposed to different treated textile effluent concentrations.

Average mean length of (A) =9.67cm
Average mean length of (B) =9.62cm

In replicate A, the minimum mean length of the fish was 9.40cm and the maximum mean length was 10.10cm.

In replicate B, the minimum mean length of the fish was 9.20cm, while the maximum mean length of the fish was 10.00cm.

It can be observed from the results that there was no much variation in the length of the fish exposed to different treated effluent concentration.

Table 3 shows the results of acute toxicity test of treated textile effluents using activated carbons. There were no deaths of fish after 96 hours

DISCUSSION

The initial observation was that, when the fish is introduced into untreated textile effluent moved fast in irregular manners, but this was short lived. Thereafter they came to the surface of the test solution to gulp air.

All these indicate stress of various magnitude caused by the test solution to the fish.

Similar observation of stress imposed by effluent has been reported when fish was introduced into refinery effluent [16].

The fact that the fish in treated effluent experiment survived even after the duration of the experiment implies that all mortality can be attributed to the untreated effluent.

The quality of the treated effluent was generally satisfactory.

The results of physicochemical parameters of treated effluent conform to the federal ministry of environments limit. The result of acute toxicity test for treated effluent showed that there was no mortality in the treated effluent concentration including control for 96 hours as shown in Table 3.This was in agreement with [10] and [17] that a well treated effluent should not be toxic to fish within 96 hours.

[18] Observed that a well treated refinery effluent do not cause any mortality to test organism.

CONCLUSION

Considering the results obtained, we can conclude that the treated textile effluents have no effect on the lives of fish in Kano metropolis. We

recommend that environmental monitoring agencies should include bioassays in their monitoring programmes.

REFERENCES

[1] Abdullahi, A. (2004).Report of Committee on Waste Water Treatment Plant at Sharada, Challawa and Bompai Industrial Estate, Kano. pp 1-2.

[2] Tamburlini, G, Ehrestein, O.V. and Bertollin, R. (2002). Childrens Health and Environment: A Review of Evidence, in: Environmental Issue Report No. 129, WHO/European Environment Agency, WHO Geneva, pp 223.

[3] World Health Organisation (WHO) (2002). Water pollutants: Biological agents, Dissolved Chemicals, Non dissolved chemicals, Sediments, Heat, WHO CEHA, Amman, Jordan.

[4] World Health Organisation (WHO) (2003). The world Health Report 2003: Shaping the future, World Health Organisation, Geneva, Switzerland.

[5] Tamburlini, G, Ehrestein, O.V. and Bertollin, R. (2002). Childrens Health and Environment: A Review of Evidence, in : Environmental Issue Report No. 129, WHO/European Environment Agency, WHO Geneva, pp 223.

[6] Manahan, S.E. (1979). Environmental Chemistry. Willand Grant press London. 3rd edition. P 271-273.

[7] United States Environmental Protection Agency (USEPA) (1995). Environmental indicators of Water Quality in the United States. pp 841.

[8] United States Geological Survey (USGS) (1995). Water Used in United States.

[9] Neal,C, and Robson, A.J. (2000). A summary of River Water Quality Data Collected within the land ocean Interaction Study, Core Data foe Eastern UK Rivers Draining to the North Sea. Science of the Total Environment 251/252, 585-665.

[10] United States Environmental Protection Agency (USEPA) (1996). Environmental Indicators of Water Quality in the United States EPA 841. R-96-002

[11] Trivedi, R.K and Goyal, P.K. (1986). Chemical and biological methods for water studies. *Environmental Publication*. pp 123.

[12] APHA-AWWA-WPCF (1985). Standard methods for the examination of water and waste water. APHA-AWWA-WPCF. Washington DC.

[13] United States Environmental Protection Agency (USEPA) (1979). Handbook for Analytical Quality Control in Water and Wastewater Laboratories, EPA 600/4-79-019. USEPA Cincinnati.

[14] Huber, L. (1979). The Environmental Impact of Refinery Effluent on aquatic life (fish). *Journal of Environmental Biology*.*Vol 4*, P16

[15] Onwumere, G.B. (1986). Toxicity of treated effluent from NNPC Refinery Kaduna on *T nilotica* (L). M. Sc Thesis ABU, Zaria, unpublished.

[16] Concawe, A. (1979). The Impact of Refinery Effluent on the Environment. A Technical Report , p1-7

[17] Sprague, J.B. (1971). Measurement of Pollutant Toxicity to Fish, *Water Resources 12 (5)*, 245-265.

[18] Bennet, D. P and David, A,H (1974). Introduction to field Biology, 2nd edition, Macmillan publication company, Glasgow p 256.

Table- 1: Mean weight of fish used for treated effluent toxicity test.

Effluent concentration	Mean weight A(gram)	Mean weight B(gram)
Control 0 %	36.20	36.30
20 %	36.40	36.50
40 %	35.85	35.60
60 %	35.70	35.55
80 %	35.50	35.80
100 %	37.20	37.15
Total	217.84	216.90

Table 2 - Mean length of fish used for treated effluent toxicity test.

Effluent concentration	Mean length of A(cm)	Mean length of B (cm)
Control 0%	10.10	10.00

20 %	9.85	9.95
40 %	9.72	9.60
60 %	9.50	9.65
80 %	9.40	9.30
100 %	9.45	9.20
Total	58.02	57.70

Table 3 Result of toxicity test for textile effluents treated with activated carbons on fish after 96 hours.

Percentage concentration of effluent	Number of Dead Fishes Observed											
	0%		20%		40%		60%		80%		100%	
Time Interval/Replicate	A	B	A	B	A	B	A	B	A	B	A	B
15 minutes	-	-	-	-	-	-	-	-	-	-	-	-
30 minutes	-	-	-	-	-	-	-	-	-	-	-	-
60 minutes	-	-	-	-	-	-	-	-	-	-	-	-
2 hours	-	-	-	-	-	-	-	-	-	-	-	-
4 hours	-	-	-	-	-	-	-	-	-	-	-	-
8 hours	-	-	-	-	-	-	-	-	-	-	-	-
15 hours	-	-	-	-	-	-	-	-	-	-	-	-
24 hours	-	-	-	-	-	-	-	-	-	-	-	-
30 hours	-	-	-	-	-	-	-	-	-	-	-	-
48 hours	-	-	-	-	-	-	-	-	-	-	-	-
72 hours	-	-	-	-	-	-	-	-	-	-	-	-
96 hours	-	-	-	-	-	-	-	-	-	-	-	-

Table 4 Levels of colour, COD and heavy metal before and after treatment with activated carbon

Parameter	Raw	1g/250ml	1.5 g/250 ml	2 g/250 ml
Colour	Dark blue	Light yellow	Pale yellow	Colourless
COD	2320	458	189	25
Zn	10.5	2.1	1.2	0.25
Cu	4.2	0.5	0.5	0.1
Cr	0.15	0.03	0.02	0.01
Cd	0.042	0.02	0.01	0.002
Pd	0.42	0.03	0.02	0.01