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Environmental Pollution: A Three-Year Retrospecive Study of Wastewater Effluent Parameters of Some Industries in Kano, Nigeria

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Abstract: ***The effects of environmental pollution associated with industrial effluents of some industrial establishments in Kano, Nigeria were examined. The physico-chemical parameters of pH, temperature, turbidity, color, odor, suspended solids, total dissolved solids, electrolytic conductivity, dissolved oxygen, biochemical oxygen demand, chemical oxygen demand, alkalinity, oil and grease, lead, sulphide, chloride, chromium, phenol, nitrate, phosphate and sulphate were examined in some major establishments involved in sack-making activities, tanning, pharmaceutical and beverage productions. The microbiological parameters examined included the coliforms and Escherichia coli. The values obtained were compared with the State and Federal Ministries of Environment standards for effluent discharge into either water bodies or soil (land). It was generally found that all the parameters of the treated effluents examined were generally below the specifications of the State Interim Primary Effluent Standards and Federal Ministry of Environment standards for quantitative industrial effluent discharge into either the land (soil) or water bodies. The implications of these pollutants on the ecosystem were discussed in line with sustainable clean environment.***

Keywords: Environment, Effluents, Treatment, Ecosystem, Pollution, Industries, Kano

1. Introduction

Environmental pollution is one of the most serious problems facing human kind today all over the world. This is because, air, water and soil that are being degraded are all important for the survival of man and other living things. In Nigeria, environmental pollution problems are numerous, resulting in long-term environmental degradation, and increase in the incidence of water-borne diseases. The increasing industrial manufacturing at large scale is now being paralleled with a corresponding challenge of waste management and disposal even in developing countries. This is to say that the hitherto clean, fresh and safe ecological setting is today exposed to the hazards of environmental pollution, which has a potential of deleterious effect to microbiota, flora and the fauna of the ecosystem as a whole. Kano, one of the three industrial zones of Nigeria, has been prone to the problems of pollution by industrial effluents (6, 7 and 5). Before 1993, many factories were observed to dispose of their wastes either at the nearby bushes or directly into the neighbouring streams or rivers such as River Salanta in south-central Kano metropolis. This was in spite of the government efforts to curve out the menace. The nefarious activity was thought to have adversely affected the vegetation including crops and animals around the river basin perhaps throughout the course of River Challawa, Wudil and Hadejia–Jama'are Rivers where such water finally drained (4, 1, and 5). Farmers had often complained of the toxic effects apart from the poignant odour of the effluents against human skin and with a potential of killing wild and domestic animals – fish, birds and rodents (1). Industries, not only mining and electroplating but including lead pipe manufacturers, tanneries and textile spinners were suspected of being responsible for discharging aqueous effluents containing relatively high levels of heavy metals such as cadmium, mercury, lead, iron, copper and chromium. If such should be the content of effluents coming from industries around Kano, then there is a fear of an adverse impact of such chemicals on the environment. This is because the ions can accumulate in the food chain and persist in the environment (9). The present paper thus examined the physico-chemical and microbiological status of the effluents discharged from some selected industries in Kano, Nigeria with the view to comparing these parameters with the existing State Interim Primary Effluent Standards and the Federal Ministry of Environment specifications for effluent discharge.

2. Materials and Methods

A survey of some industrial establishments that drain their effluents into some receiving water bodies in Kano, Nigeria was carried out for a period of three years (2006 – 2008). The establishments surveyed were located in four major industrial areas of the State. They included Bompai, Challawa, Sharada and Zaria road industrial estates. Data on the physical, chemical and microbiological characteristics of the effluents from the selected industries were obtained and compared with the State and Federal Ministries of Environment specifications (standards).

3. Results and Discussion

The data obtained from the Pollution Control Laboratory of the Kano State Ministry of Environment showed that the raw (untreated) industrial effluents examined (Tables 1-4) contained lead and chromium far above the State Interim Primary Effluents standards (SIPES) and the Federal Ministry of Environment (FME) recommendations. Lead can cause several unwanted effects, such as disruption of the biosynthesis of hemoglobin and anemia, rise in blood pressure, kidney damage, miscarriages and subtle abortions, disruption of nervous response and brain cell, declined

fertility of men through sperm damage, diminished learning abilities and behavioural disruptions of children, such as aggressive impulsive behaviour and hyperactivity (9). The presence of these heavy metals in irrigated water has been reported to retard and even prevent proliferation of crops (5). Heavy metal toxicity adversely disrupts growth and other physiological processes of plants, specifically leading to great economic and ecological trauma (8). The high levels of pollutants observed in Salanta River by (6, 7, 2) well as (2) was traced to the discharge of effluents into the river by the various industries located in and around the Sharada Industrial Estate, Kano, Nigeria. The implication of these findings is that the fish or other animals, namely birds and mammals, and crops that utilize such water may expose man to accumulation of deleterious metal ions. This can lead to serious health hazards. Previous investigators established that many corpses of fish and birds had been found around the drainage systems from similar industries (4, 1 and 5). The objectionable odour in addition to the poignant look of the area left much to be desired for curving out the menace. This can help in saving Salanta, Challawa and Wudil Rivers that finally merge with the popular River Hadejia from being severely polluted in the short run.

Table 1: Physico-chemical characteristics of effluents (all units in mg/l except where otherwise stated) from some industries in Bompai, Kano (2006 – 2007)

	2006		2007		
Parameter	Raw effluents	Treated effluents	Raw effluents	Treated effluents	*RSIPES
pH	8.20	6.50	**NT	NT	6 – 9
Color	Brownish	Colorless	Dark-brown	Colorless	Colorless
Odor	Offensive	Odorless	Offensive	Odorless	Odorless
TDS	1725	725	1585	854	***NS
SS	2050	320	1850	452	800
COD	5540	660	4954	842	2800
BOD	1979	235	1652	320	1000
O and G	213	32	385	21	50
Chromium	6.40	0.85	8.4	1.2	2.0
Sulphide	24.5	4.2	32.4	3.1	8.0
Chloride	54	20	204	62	NS

- = Recommended State Interim Primary Effluent Standard; ** = Not tested; *** = Not stated.

TDS = Total dissolved solid
SS = Suspended solid
COD = Chemical oxygen demand
BOD = Biological oxygen demand
O and G= Oil and Gas

Table 2: Physico-chemical (all units in mg/l except where otherwise stated) and microbiological characteristics of effluents from some industries around Zaria Road, Kano (2007 – 2008)

	2007		2008	
Parameter	*FMES	Treated effluents	FMES	Confluence of drainages
Temperature (°C)	20 – 33	25.6	20 – 33	20.4
pH	6 – 9	8.2	6 – 9	6.56
Turbidity (NTU)	10	0	**NS	**NT
Color	Colorless	Colorless	Colorless	Light brown
Odor	Odorless	Odorless	Odorless	Unpleasant
TDS	2000	92	2000	700
SS	15	4	NS	NT
COD	80	25	80	164
BOD	30	8	15	58
O and G	10	0	10	0
Chromium	1	0.41	1	0.02
Sulphide	0.2	0	NS	10
Chloride	NS	NT	600	8.8
EC	NS	NT	NS	1000
Lead	NS	NT	1	0
Phenol	0.2	0	0.2	0
Sulphate	500	40	500	13.2
Nitrate	20	8	20	0.44
Phosphate	NS	NT	5	1.2
Coliforms (cfu/ml)	NS	NT	400	40
Escherichia coli (cfu/ml)	NS	NT	NS	10

- = Federal Ministry of Environment Standards; ** = Not stated; ** = Not tested.

TDS = Total dissolved solid
SS = Suspended solid
COD = Chemical oxygen demand
BOD = Biological oxygen demand
O and G= Oil and Gas
EC = Electrolytic conductivity

Table 3: Physico-chemical and microbiological characteristics of effluents from some industries around Sharada, Kano (2006 – 2008)

Parameter	*2006*		*2007*		*2008*		**RSIPES*
	Raw effluent	*Treated effluent*	*Raw effluent*	*Treated effluent*	*Raw effluent*	*Treated effluent*	
TDS	6380	4320	1844	625	5949	1730	**NS
Ph	9.6	7.72	8.9	8.6	12.7	9.6	6 – 9
O and G	202	25	220	35	258	43	50
COD	6320	1520	6450	620	9250	3075	2800
BOD	2330	525	2015	194	2083	1025	1000

Chromium	9.2	2	4.8	1.2	4.9	1	2
Sulphide	23	6.5	61.3	52	72	54.5	8
Chloride	59	30	55	32	205	40	NS

- =Recommended State Interim Primary Effluent Standard

** = Not stated.
TDS = Total dissolved solid
COD = Chemical oxygen demand
BOD = Biological oxygen demand
O and G = Oil and Gas

Table 4: Physico-chemical and microbiological characteristics of effluents from some industries around Challawa, Kano (2006 – 2008)

Parameter	2006		2007		2008		*RSIPES
	Raw effluent	Treated effluent	Raw effluent	Treated effluent	Raw effluent	Treated effluent	
TDS	4558	1254	4345	1120	1150	120	**NS
pH	7.41	7.65	8.5	7.6	10.2	13.05	6 – 9
O and G	192	24	240	36	220	15	50
COD	8654	1000	6450	1250	4025	1216	2800
BOD	2885	334	3420	620	1352	420	1000
Chromium	15.6	1	13.4	1.3	3.2	0.24	2
Sulphide	85	22	73	5.3	102	0.036	8
Chloride	224	20	184	54	720	52.5	NS

* = Recommended State Interim Primary Effluent Standard;
** = Not stated.
TDS = Total dissolved solid
COD = Chemical oxygen demand
BOD = Biological oxygen demand
O and G= Oil and Gas

Conclusions and Recommendations

Generally, the physico-chemical and microbiological parameters examined for the treated effluents from some industries located at Bompai, Challawa, Sharada and Zaria road in Kano, northern Nigeria were below the specifications of the SIPES and FME. Perhaps these companies have adopted fully the standard operational guidelines necessary for efficient effluent treatment before discharge. However, it is advised that strict adherence to disposal and dispersal methods be maintained in such a manner as to prevent the accumulation of toxic concentrations. This can be a sure way for the establishment and maintenance of a stable and safe ecosystem.

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