THE IMPACT OF URBAN RUN-OFF ON OGBOR RIVER

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ABSTRACT
Impact of urban run-off on Ogbor River in Aba metropolis has been studied. The run-off contains toxic chemical, heavy metals and suspended solids. Water samples were collected from three discharged points in the months of May to September. The results of the analysis of the samples show high-level concentration of lead, iron, cadmium, cyanide and chromium (1.7mg/l, 5.52mg/l, 1.47mg/l, 2.44mg/l and 1.31mg/I respectively). However, the water sample of the slaughter house, and the industrial effluents are free from heavy metals. In addition, the water quality of the downstream location of the river shows an appreciable reduction of the concentration of the heavy metals probably due to dispersion effect. The presence of this pollution in water is hazardous to health. Ballasted flocculation technology can be used to reduce the concentration level of these pollutants.

Key words: *Ogbor River, Urban, run-off impact*

INTRODUCTION
Before the advent of science and technology our environment, particularly water environment was wholesome. Occupational and recreational activities which include e fishing, boating, etc. take place in some Nigerian rivers and streams. In the domestic, manufacturing and agricultural sectors, water is the most essential import. Occupationally, river water could help to fashion out a fishing career for people with a view of generating revenue to improve their economic well beings.

But with the development of science and technology, various types of wastes are generated in the solid, liquid and gaseous phase. Most of the wastes, especially the solid ones, are carried to our rivers and streams through surface run-offs. It was observed that surface run-offs contributed a major pollution, comprising 90% of heavy metals (Pb, Fe, Cd, CN, Cr.), in river Galveston in USA[8]. It has been observed that heavy metals in wastewaters are extremely toxic to biological degradation of wastes [3]. At high temperature and low pH, heavy metals can cause stunted growth and death of most marine organisms. Human beings can also be affected by drinking water polluted by heavy metals and eating marine organisms bio-accumulated with heavy metals. The amount of heavy metal beyond a required limit in human system could lead to cancer, nervous disorders, lack of bladder control, etc. [6].

In Nigeria, motor mechanic workshops, metal finishing workshops, dye centers, car wash centers, etc., contribute to high grease loading, fibrous materials, inorganic salt, organic chemicals and heavy metallic loading of surface run-offs [3]. Poor quality of water may affect both soil and crops and this can lead to a decrease in crop yields and possible health hazards to the consumers of the produce [7]. Chapman and Hall (1992) also observed that the health risk is greatest when polluted water sprays directly onto crops rather than flooding

around the base of the plants. Most river banks are used for irrigation farming as the case with Ogbor River. The all-seasoned vegetable garden at its bank gets its source of water supply from the polluted river water especially during the dry season. The water is usually spread directly on the vegetables with spraying cans and powered hose.

THE STUDY AREA.

Ogbor community constitutes the study area and is situated in Aba, a commercial nerve Centre of Abia State. The people of Aba are mainly artisans, technologists, and industrialists. In Ogbor community, there are many cottage metal finishing industries, motor and motorcycle mechanic workshops, dye centers and small-sized markets. Poorly disposed wastes from these sources are conveyed by run-off to the river through a network of urban drains, thereby giving rise to the pollution of the river.

Solid and liquid waste from metal finishing industries contain acids, metal ions, cyanides, chromates, mercury, etc. and these are highly toxic and as such contribute to the pollution of water environment [2]. In the same vein, absences of toxic substances like Pb, Cn, Cr, contribute to the growth and reproduction of aquatic organisms [4]. However, presence of these toxic substance in Ogbor-river definitely affects the fish life by accumulating in their systems, causing their stunted growth and also serve as a potential pathway to human through consumption of contaminated fish. Besides, through drinking, man can also contact these toxic chemicals (heavy metals) during recreational activities such as swimming and boating. The poisoning can be possible in this respect through open wounds and intake of small quantities of water through the nose, mouth, ears and eyes.

MATERIALS AND METHODS

From the study area, samples of urban run-offs were collected from storm drains along Ikot Ekpene, Omoba and East road. The sampling periods covered the months of May through September 2002, a period of pronounced rainfall. Samples of wastewater were also collected from Nigerian Brewery and slaughter house discharge points. In addition, samples were collected from Ogbor- river at a depth of 1.5m in three different locations, which included:

a. The up-stream (US) representing waste discharge points from NBL and Slaughter house.
b. Mid-stream (MS) which receives all the run-off from the three storm drains that washes Ogbor community, and
c. The downstream CDS). The river samples were taken at two different seasons: rainy season (July) and dry season (Dec.). The intervals between sampling points are 200m for US & MS, 400m for MS & DS, and 300 for DS.

The water samples were subjected to physiochemical and microbial analysis at the Imo State Environment Protection Agency (ISEPA) using the following methods, Atomic Absorption Spectrophotometer (AAS), for Pb, Cd, Cn, and Cr, BOD_5 meter for BODs determination, portable Each DR-HL/4 laboratory kit for TDS, PH and conductivity. Total coliform bacteria enumeration was carried out using the most probable number.

RESULTS AND DISCUSSIONS

The average values of the heavy metals obtained from the storm drain samples collected along Ikot-Ekpene, Omoba, and East roads are shown in Fig. 1. The monthly values of heavy metals obtained for the three-storm drains are displayed in Fig. 3. Results of samples from the slaughter house and the

values of wastewater discharged from the Nigerian Brewery PLC are presented in Table 1 while the results from the river samples are shown in Tables 2 and 3. The results show that the values of the heavy meter, Pb, Fe, Cd, CN, Cr are almost not detectable in the discharges from NBL, but Fe of 3 11mg/l value was prominent in the slaughter house discharges. The results from the storm drains show appreciable average values of the heavy metals along lkot-Ekpene road, the values are Pb (1.36mg) mg/l. Fe (6.26mg), Cd (1.62mg), CN (1.48mg), Cr (l.07mg). In the case of Omoba road the average values are Pb (2.43mg/l), Fe (8.23mg/l), Cd (1.62mg/l), CN (3.021mg/I), while East road has the following values, Fe (9.34mg/l), Cd (1.21mg/l), CN (2.21mg/l) and Cr (1.14mg/l). And these are displayed in Fig. l The concentration levels of these parameters exceed the FEPA limitation from the monthly variations of heavy metals (Fig. 3), the month of May recorded the highest level of heavy metal concentration The concentration decreases as rainfall persists into the rainy season. The high level concentration in the· month of May can be attributed to the fact that the appreciable amount of waste accumulated at different source locations during the dry season (November-April) was washed into the river at the first arrival of heavy rains in the month of May. The waste loads of the subsequent run-off are low, meaning that there is a decrease in concentration of the heavy metals in the storm drains with time (Fig. 3).

In the case of the receiving water body the result of the heavy metals at the three sampling points (US, MS, DS) were subjected to distance variation analysis. It is observed from Fig. 2 that the values of heavy metals at the mid-stream (MS) is highest followed by downstream (DS) and lastly up-stream (US). An explanation to this, is that all the discharge points of the storm drain are located in the mid- stream. The dilution effect of the river due to mixing, explains the decrease in value of the heavy metals at the down stream (DS). At the up-steam area, concentration levels of the heavy metals is close to zero. This shows that wastewater from NBL and slaughter house which provides the bulk of pollution at the stream, contains a negligible amount of heavy metals.

The dilution effect of rainfall on the degree of contamination of Ogbor-river is glaring in the analysis carried out for the month of July (peak of rainy season) and December (peak of dry season). In comparison, the concentration levels of the heavy metals in the month of December are higher than that of July (Fig. 2). It is also pertinent to note that with a pH of 5.45, Ogbor-river is slightly acidic. This level of acidity is not environmentally healthy for some marine organisms. The low pH is lowered to 6 or less. At this low pH, situation cyanide ions forms a toxic hydrogen cyanide (HCN) with hydrogen [2]. Urban run-offs also contributed to heavy amount of total solids contamination of the river. This has led to an apparent reduction in the assimilation capacity of the river thereby creating a septic condition which gives raise to odour emissions.

SUMMARY AND CONCLUSION

Collection and analysis of samples of storm drains along Ikot-Ekpene, Omoba, and East road, NBL wastewater effluent, slaughter house discharges and the receiving Ogbor-river have been presented. Based on the result of their analysis, the following conclusion and recommendation can be made. The degree of pollution from the sources is high but that of storm drains is higher due to the presence of heavy metals in appreciable quantity. Toxicity of the heavy metals prominent in Ogbor-River is traceable to Urban run-off. Generally, the values of the heavy metals exceed FEPA/WHO limits for drinking water. Therefore the run off

contributes to a great extent the pollution of Ogbor-river.

The toxic nature of the river poses a health hazard since food substances like meats from the slaughter house and sliced cassava (tapioca) are washed in the said river before they are sold to consumers.

The all-season vegetable garden being practiced at the bank of the extreme part of Ogbo-river is sustained during the dry season by the river water. Consumer of the vegetable from the vegetable garden- irrigated Ogbor-river are likely to be exposed to health hazard [4]. Those living by the river bank who do swimming, boating and finishing recreations in the river are exposed to health hazards. At the peak of water scarcity the river is a source of drinking water. Persons so exposed are vulnerable to ailment associated with heavy metals.

These observations give rise to the sorry state of Ogbor-river that necessitates a desire to carry out a study on the impact of the surface run-off on the river.

The State Environmental Protection Agency should encourage the use of ballasted flocculation technology. This facility provides a greater floc settleability, higher hydraulic loading rates of about 80,000 to 90,000 gal/h, greater effluents clarity and excellent solid removal including the heavy metals and phosphorus, than that of the conventional primary clarifier. For instance, ballasted flocculation technology ensures 90% phosphorus and heavy metal removal [9].

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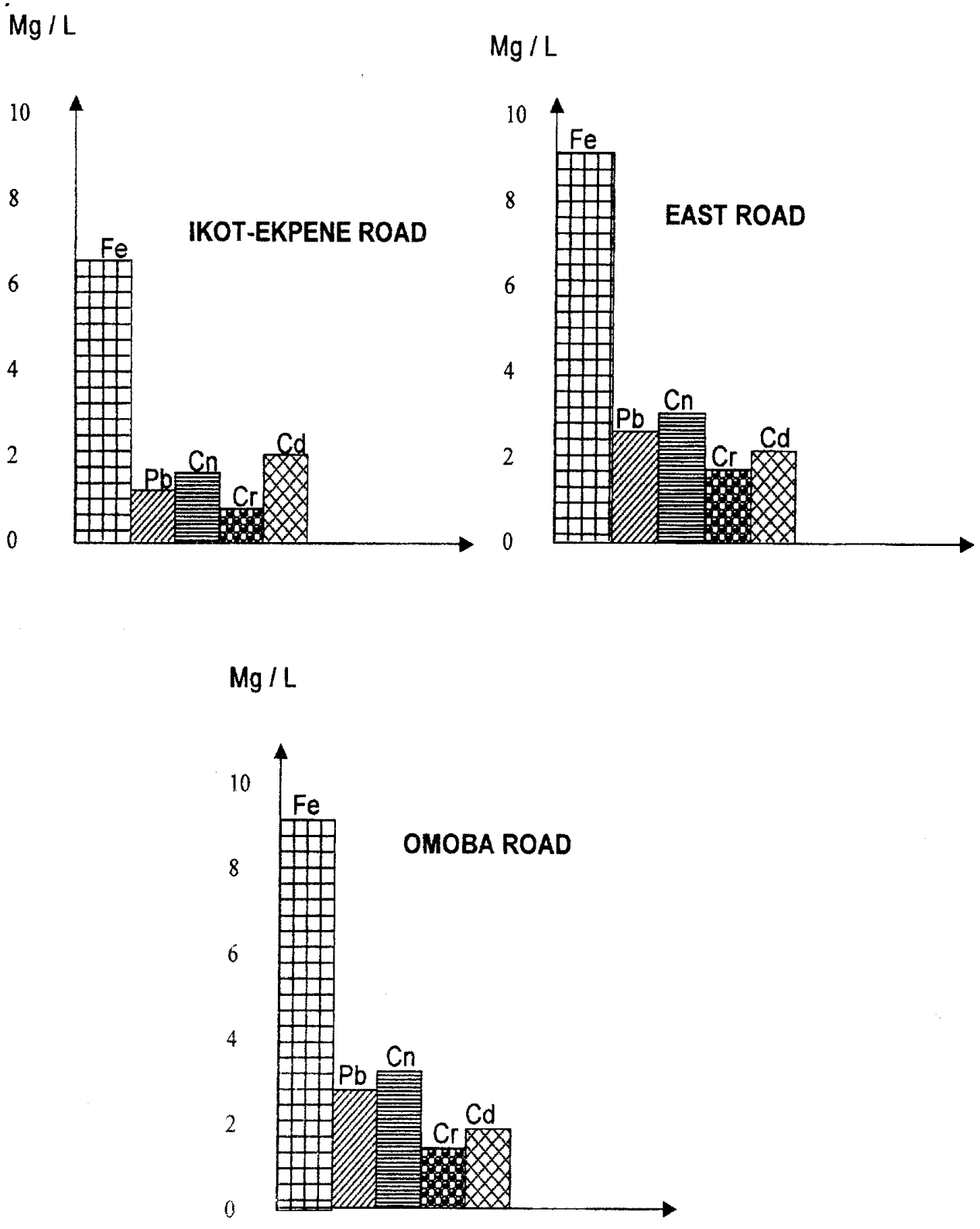

Fig 1 Shows the average values of the Heavy metals in Ikot-Ekpene, East Road and Omoba Road Storm drain between the month of May and September 2000.

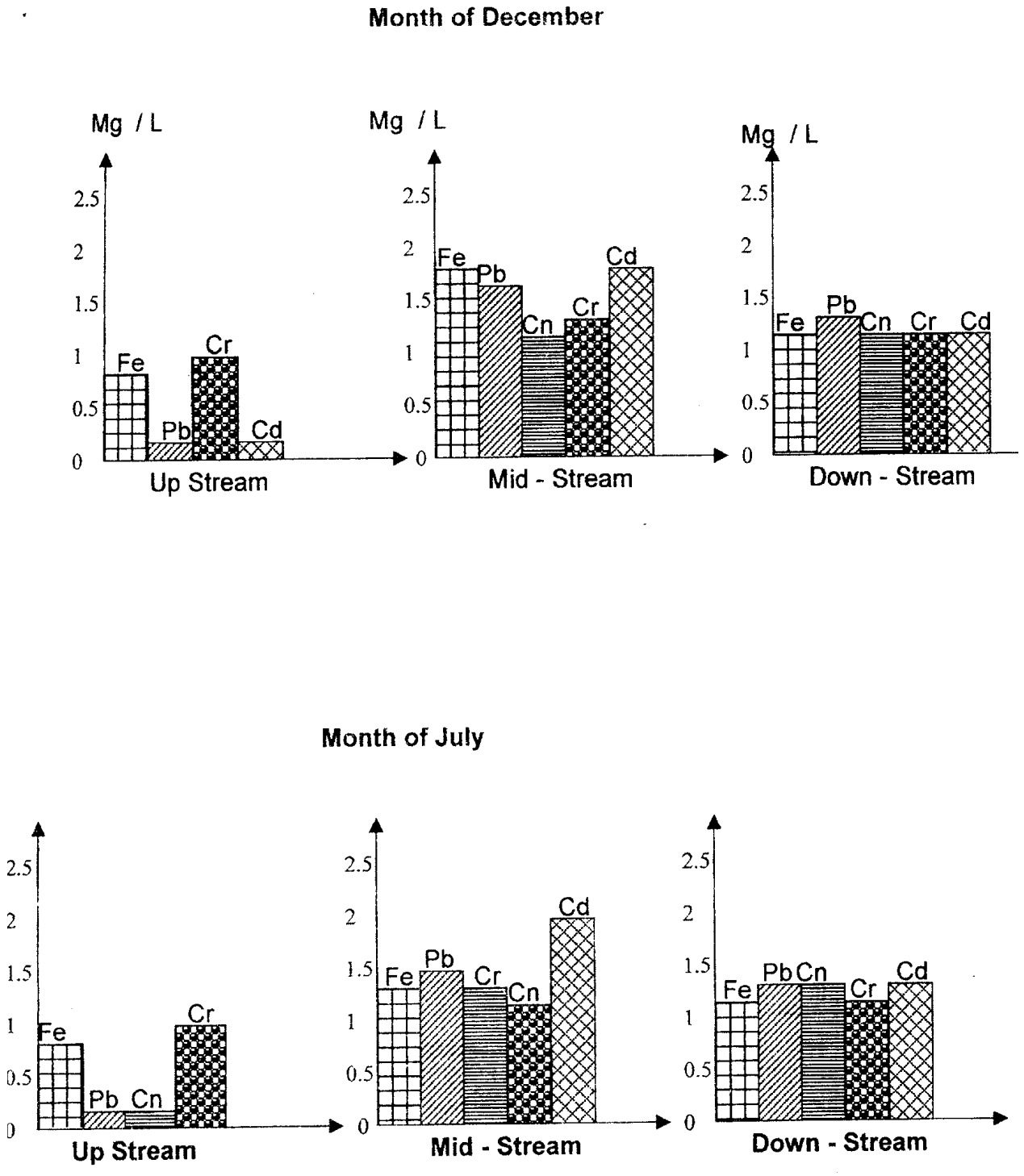

Fig 2 Pictorial representation of Heavy metal analysis of Ogbor River for the months of December and July.

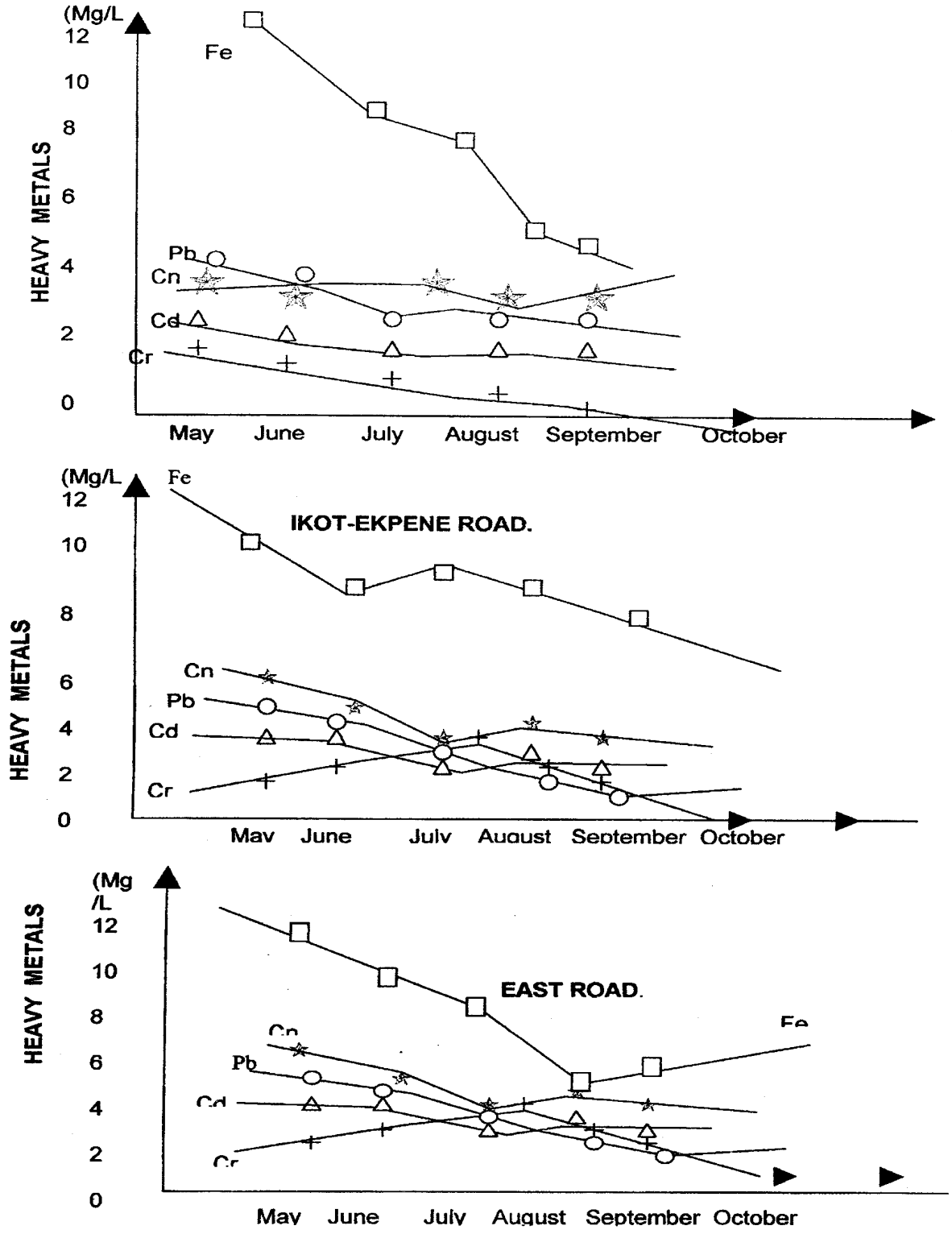

Fig 3 Temporal variation of heavy metals in Omoba, Ikot-Ekpene and East road drains.

Table 1: Results of NBL and slaughter house wastewater analyses

Parameters	NBL (mg /1)	Slaughter house (mg/i)
Temp ^{0}c	29.560	26.08
P^{h}	6	6.87
Conductivity (mg/l)	225.50	204.00
Total coliform (mg/l)	TNTC	TNTC
TDS	102.00	
SS	520.50	950
TS	627.50	
Cl^{-}	ND	498.36
DO	3.12	
BOD	1336.00	1018.03
COD	2437. 63	
Fe	ND	3.11
NO^{3}	2.08	72.11
P	.55	12.38
Pb	ND	ND
Cd	ND	ND
Oil s grease	39.70	547.91
Cn	ND	ND
Cr	ND	ND

Table 2: Characteristics of water at various discharge points of Ogbor River at the peak of rain and dry seasons.

	July			December		
	Us Mg/1	MS Mg /1	DS Mg /1	US Mg / 1	MS Ng / 1	DS Mg / 1
Colour units	6	10	8	5	6.3	5.13
Temp.	26	26.30	25.00	26	26.72	26
P^h	6.10	5.35	5.79	5.13	5.01	5.32
Cond	46.26	49.78	47.07	50.11	53.77	51.44
TDS	20.11	28.18	20.19	21.01	26.19	24.17
SS	35.00	40.37	31.57	33.04	43.17	41.38
Ts	55.11	68.56	51.76	54.04	69.37	65.01
DO	41.35	38.35	39.70	40.96	36.71	35.84
BOD	51.35	59.67	52.00	53.11	60.11	56.28
COD	25.00	28.00	25.90	27.63	32.96	29.86
Fe	0.58	1.20	1.09	0.61	1.82	1.11
No_3	1.39	1.82	1.18	1.54	2.02	1.87
K	23.00	27.01	23.77	22.83	29.13	27.95
P	22.39	22.95	22.40	23.41	25.47	23.58
Pb	0.03	1.40	1.13	0.09	1.65	1.23
Cd	ND	1.67	1.26	0.10	1.71	1.22
Oil § grease	11.95	28.24	27.34	12.37	30.28	28.15
Cn	0.12	1.29	1.26	ND	1.11	1.16
Cr	0.87	1.23	1.09	1.01	1.12	1.15
Coliform	TNTC	TNTC	TNTC	TNTC	TNTC	TNTC

Key: *ND = Not detected, TNTC =Too numerous to count.*