JASEM ISSN 1119-8362

Full-text Available Online at www.bioline.org.br/ja

J. Appl. Sci. Environ. Manage. December, 2007
Vol. 11(4) 91 - 94

Physico-chemical analysis of water sources in ubeji community and their histological impact on organs of albino mice.

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ABSTRACT: Petroleum activities serve to be one of the many sources of pollution in the environment. This study investigated various water sources of water around the Warri refinery and petrochemical company petroleum refining company. Water sources used for this study include stream, tap and well water. Some standard physiochemical parameters and heavy metals were analyzed in this water Samples. Mice were exposed orally to various water samples, 28 days after which the liver, spleen and kidney were surgically removed for histopathological analysis. The pH ranged between 4.66 and 6.85 in all samples, heavy metals like Fe, Pb, Cd, Cu and Ni were also determined with most values falling within WHO and FEPA standards. However, Fe level in tap water (2.32mg/l) was higher than the WHO and FEPA desirable limit for drinking of 0.1mg/l and 0.05mg/l respectively. Nickel level in river and discharge point (0.14mg/l and 0.16mg/l respectively) were also higher than the WHO limit (0.05mg/l) for water bodies. The histopathology of the kidney of albino mice exposed to all samples showed moderate and mild congestion of interstitial blood vessels, the liver showed moderate congestion of interstitial blood vessel of renal cortex and necrosis of hepatocytes in mice exposed to DP and WWII, the others showed no significant lesion. Spleen of albino mice exposed to all samples showed no significant lesion and all organs of albino mice exposed to DW also showed no significant lesion. From the histopathology investigation, it is shown that petroleum effluents in water samples have negative impact on organs of albino mice and this therefore serves as a signal of warning to the human populace. Petroleum refinery effluents should therefore be treated properly before discharge into the environment. @ JASEM

The petroleum industry remains one of the most important sector in the world, However its activities leave behind it trails of numerous environmental impact on the host community. These activities ranges from exploitation, exploration, refining and distribution of their products. It is therefore of paramount importance to continually carry out assessment of these environment and evaluate the possible health implications. The Ubeji Community is situated beside the Warri refinery and petrochemical company (WRPC). This company is located in the Niger - delta of Nigeria. Effluent from the WRPC are deposited into the Ubeji stream, this stream flows into the Crawford creek which flows into the Warri river. The physiochemical status of various water sources in Ubeji were carried out and their histopathological effect evaluated. The sampling points are designated, DP = Point of discharge, RW =30m upstream away from DP, TW = Tap water, WWI = Drinking well water (random samples), WWII = Non – drinking well water (random samples) and DW = De-ionized water.

AIMS

- Determining the physicochemical status of water sources in this area
- Determine if the wells and bore – hole samples (ground water) are fit for drinking.

by comparing results with standards
Determining the effect of these samples on liver, kidney and spleen of (Albino mice).

MATERIALS AND METHODS:

The following physiochemical parameters were measured; pH was determined by electrometric method, Total Hardness-EDTA titrimetric method (APHA/AWWA/WPCF, 1995), Conductivity – conductivity meter LF95, Phosphate – Spectrophotometric method,(absorbance at 696nm), Sulphate – Turbimetric method, Nitrate – spectrophotometric method measuring absorbance of NO_3 at 230nm (APHA/AWWA/WPCF, 1995), all samples for heavy metals were treated with 5ml of HNO_3 for preservation and Atomic Absorption spectrometer (AAS) was used for analysis. The test organisms used were adult Albino mice (male) of age 6 -9 weeks. The mice were distributed into six cages (five in each cage) and left to acclimatize for seven days at room temperature in the laboratory before commencement of the experiment. Mice were fed once a day with mice pellets. Water samples were introduced orally for a period of 28 days after acclimatization. After a 28 days exposure to the various water samples, mice were killed by cervical dislocation. They were then dissected and their liver, spleen and kidney were harvested and preserved in 10% formalin. These organs were further processed by modified Luna's method (Luna, 1968)

RESULTS AND DISCUSSION

The following parameters were within the maximum limits for drinking water and freshwater when compared with standards; Temperature, pH, TDS,

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Conductivity, alkalinity, Total hardness, Sulphate, Nitrate, Phosphate, Calcium, Total hydrocarbon, oil and grease. Heavy metals like copper, lead and nickel in some samples were higher when compared with the maximum limit of standards used in this study. The oil and grease values for river and discharge point samples of 3.19mg/l and 2.60mg/l respectively were low compared to 3.8mg/l – 21.9mg/l and 42mg/l recorded by Chukwwogbu in Warri river during rainy season. This is may be due to low production capacity of the WRPC as at the period of sampling. The copper level for discharge point was 0.24mg/l and it was more than the WHO maximum limit of 0.05mg/l for freshwater bodies. Chukwogbu, 1989 obtained the level of copper in Warri river to be average of 0.028mg/l while Atuma *et al*, 1986 obtained the copper level in 1984, to be 0.025mg/l – 1mg/l. The level of lead in river and discharge point was higher than the FEPA limit for freshwater. This arises from the tetraethyl lead used as an antiknock additive in gasoline compounding. The values are similar to those obtained by Chukwogbu, 1989 and Atuma et al, 1986 for Warri river. The level of iron in tap water was higher than the WHO and FEPA limits. This may be because of the iron content of the pipes. The level in river and discharge point was lower than the FEPA and WHO desirable limit for freshwater bodies. The level of nickel in well (0.007mg/l) and tap water (0.01mg/l) is acceptable since nickel is non – toxic to man, except for some individuals who are sensitive to nickel (WHO, 1984). The river and discharge point of 0.14mg/l and 0.17mg/l respectively were higher than the U.S. and EPA and WHO limit for water bodies. The presence of nickel in the discharge point and river is due to the use of nickel catalysts in the fluid catalytic unit (Chukwogbu and Akhonkhai, 1989). These results could be comparable to results obtained by them in 1989 of 0.06mg/l – 2.6mg/l for refinery effluent.

Various studies have shown that heavy metals present in effluents discharged into the river tend to settle in the bottom settlements in the vicinity of the discharge point, Chukwogbu and Akhonkhai,1989. Although there have been low production capacity in the N.N.P.C refinery Warri, results of analysis showed some of the heavy metals to be relatively high. A summary of the physiochemical result is shown in table I and II.

Table I: physiochemical results of DP and RW compared with standards

	DP	RW	WHO limit for freshwater	EPA limit for freshwater	FEPA limit for freshwater
pH	6.71	6.85			6.5 – 8.5
Temp.(^{0}C)	27.5	26			35
Cond(μ/ohms)	256	265			
Alk(mg/l)	92.6	84.6			
Ca^+(mg/l)	62	56			
TH(mg/l)	36	33			
Po-(mg/l)	3.33	2.08			
So-(mg/l)	43.2	41.5			
THC(mg/l)	7.83	3.01			
O/G(mg/l)	2.32	3.41			10
TDS(mg/l)	364	352			
Cu^+(mg/l)	0.01	0.24	0.05		1.0
Pb(mg/l)	0.12	0.17	0.01		0.05
Fe^+(mg/l)	0.89	0.19	0.01		1.5
Cd(mg/l)	0.52	0.61	1.0		
Ni(mg/l)	0.14	0.17	0.05		

DP = Point of discharge,
RW =30m upstream away from DP,
WHO = World health organization
EPA = Environmental protection agency
DPR = Department of petroleum resources
FEPA = Federal Environmental protection agency

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Table II: physiochemical results of WI, WII and TW compared with standards

	TW	WI (mean value)	WII (mean value)	WHO limit for Drinking water
pH	4.66	6.08	5.96	6.5 – 9.5
Temp.(0c)	22	24.1	23.8	-
Cond(/ohms)	69.3	96.9	106	-
Alk(mg/l)	34.2	43.7	44.2	-
Ca+(mg/l)	5	26.3	24.4	-
TH(mg/l)	8	37.5	36.7	500mg/l
Po-(mg/l)	0.01	2.75	1.05	-
So-(mg/l)	1.3	2.36	2.67	<250
THC(mg/l)	7.93	2.93	2.27	-
O/G(mg/l)	0.03	0.15	0.15	-
TDS(mg/l)	55.2	59	54.1	1000
Cu+(mg/l)	0.04	0.01	ND	0.1 or 2-3 *
Pb(mg/l)	0.01	0.01	0.01	0.1
Fe+(mg/l)	2.32	0.02	0.04	0.1 or 1
Cd(mg/l)	0	0.02	ND	0.01
Ni(mg/l)	1.04	ND	0.003	0.02

TW = Tap water, * for adult/day
WWI = Drinking well water (random samples),
WWII = Non – drinking well water (random samples)
WHO = World health organization
EPA = Environmental protection agency
DPR = Department of petroleum resources
FEPA = Federal Environmental protection agency

The histology of the liver, kidney and spleen of albino mice exposed to water from discharge point (DP), river water (RW),tap water(TW), drinking well (WWI) and non – drinking well (WWII), which were harvested 28th day is shown in table II, The histology of the liver, idney and spleen of albino mice exposed to deionized water (control) which were harvested 28th day is shown in table III.

Table III: Histopathology of Albino mice exposed to water from DP, RW, TW, WWI, WWII and DW

Organs	DP	RW	TW	WWI	WWII	Deionized water (Control)
Liver	Moderate congestion of interstitial blood vessel of renal cortex	No significant lesion	No significant lesion	No significant lesion	Mild diffuse vacuolation of hepatocytes within parenchyma, few foci of necrosis of hepatocytes	No significant lesion
Kidney	Moderate congestion of interstitial blood vessel of glomerular capillary of kidney	Moderate diffuse congestion of interstitial blood vessel through out parenchyma of kidney	Mild congestion of interstitial blood vessels of renal cortex	Mild congestion of glomerular and interstitial vessels of cortex	Mild congestion of glomerular capillaries in the renal cortex	No significant lesion
Spleen	No significant lesion	No significant lesion	No significant lesion	No significant lesion	No significant lesion	No significant lesion

The results showed that the kidney was the most affected showing mild and moderate congestion of interstitial blood vessels and glomerular in all samples except those exposed to deionized water in (control).The congestion of blood vessels develop when there is an introduction of a toxic substance into the kidney as reported by Clarke and Clarke (1976). However, no congestion in kidney of mice exposed to deionized water indicating no introduction of toxic substance. Findings by Baronia et al (1991) showed that when albino mice were exposed to carbaryl – a petroleum product, histopathological and accumulation studies on their liver and kidney proved the toxicity of carbaryl on the vital organs of albino mice. Cadmium has been reported to readily absorb in the gut and is then fixed by the tissues, the highest

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concentrations being found in the kidneys and liver (Forney et al, 1995).

From this investigation, it is shown that petroleum effluents have negative impact on water and this is significant to human health when consumed. Although, it is difficult to determine the impact in humans directly, we can however draw conclusions when other laboratory mammal show negative indications; such therefore serves as a signal of warning to the human populace. It
is therefore suggested that the refineries adhere to remediation policies and ensure that their effluent is properly treated before discharge into the environment.

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