ISSN No:-2456-2165

Physiochemical Assessment and Artisal Activies Emanating from Abattoir Waste in Abeokuta Metropolis

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Abstract:- The physiochemical assessment of abattoir waste in Abeokuta metropolis were investigated. Waste were collected from five different abattoirs located in Abeokuta municipal. These were from points P1 to P5, in order to assess contaminants in the Abattoir in both dry and wet season. The results obtained were compared with WHO standard set limits. The temperature range were performed outside and inside the waste with 28.0^{O}C and 29.0^{O}C respectively. The mean pH in dry and wet season had 5.47, 5.58 and electrical conductivity had 0.37 µScm^{-1} and 0.75µScm^{-1} dry and wet season. The values were slightly less than the WHO standard. Pb in dry and wet season were higher than 0.015 WHO standard. The mean values of the Fe at both dry and wet season were 3.52 and 3.80 far higher than 0.03 the value of WHO standard. This evidently showed there is pollution as well as contaminants from the abattoir sites. Of all acidic parameters, P04^{2-} had 111.00mg/L and 148.55mg/L dry and wet season respectively, which is far greater than the value of 5mg/L WHO standard, S04^{2-} and cl^{2-} had 7.34mg/L, 97.14 mg/L, 130.0 mg/L, 148.27 mg/L, both seasons; respectively. These values are within the 230mg/L WHO standard. Thus, the abattoir activities within Abeokuta metropolis impact positively in the environment and good measures should be put in place to arrest the condition.

***Keywords:-** Abattoir Waste, Heavy Metals, and Abeokuta.*

I. INTRODUCTION

An abattoir is known as any premise(s) that is used for any activities connected with slaughtering of animals for human consumption. After the slaughter, the effluent consists of faeces, bones, urine and blood. These wastes constitute unwanted materials which must be disposed. The inability of the processors in these abattoirs to manage the slaughter wastes properly with accompanying dung and slurry into water ways has constituted concern for environmentalist (Adie, et al., 2007).

The various activities in the abattoir sites causes the decomposed waste to pollute the soil. Adesemoye et al (2006) reported that all these activities occurred because the operators did not strictly adhere to laid down good hygienic practices. The resultant effect led to oxygen depletion and nutrient over enrichment of the receiving water bodies.

The diverse activities therein led to accumulation of waste, making the soil to be contaminated. This is because the highly organic waste had different levels, suspended solids, liquid, and fat (Olanike, 2002). Osenwote (2010) reported that the abattoirs effluent occur as a result of these activities.

The rapid increase in world population had contributed to the ever increasing pollution of our fresh water most especially in the developing countries (FEPA, 1991); (Festino and Anbart, 1986); (Ekeke and Okonwu, 2003).

The slaughter house waste water although harmful causes the deoxygenation of rivers. These effluent also contaminate ground water (Sangodoyin and Agbawhe, 1992). The overall effect of these action in the soil causes the soil to contain heavy metals, salts in different forms within the soil and affect mobility as well as biological activities in the soil (Adelegan, 2002).

The different consumable plants and vegetables near the water bodies are contaminated due to indiscriminate dumping of wastes. The vegetables when consumed could lead to different diseases, because of the contamination from vehicular exhaust, agricultural activities from nearby farmers, and other industrial activities (Morenikeji and Raheem, 2008).

All these heavy metals in the different soils can cause great danger to human life (Oviasogie and Ofomaja, 2007). The consequential effects fo these effluents embedded in the soil where plants are grown can also cause a decrease in the immunological defenses of the man as well as fishes in the nearby water bodies.

These untreated waste water causes pollution load in the entire water body thus increasing the abattoir effluent. These and many are the different activities of abattoir operations in different crannies where abattoirs are practiced in Abeokuta metropolis.

ISSN No:-2456-2165

II. MATERIALS AND METHODS

Collection of effluent: Soil sample contaminated with abattoir waste were collected from Akinolugbade, Lafenwa, Madojutimi and Gbonogun P1-P4 areas of Abeokuta metropolis respectively and the control P5 soil was collected from the adjacent area of slaughterhouse. Both soil samples were transported to the laboratory and then air dried at a temperature of 30 to 35^{O}C. Samples were sieved through <2mm sieve. The fraction <2 mm were stored in a refrigerators at 4^{O}C and were used for further studies.

Physicochemical analysis of the waste samples: The different reagents used were of analytical standard (BDH). While the physicochemical quantities of the samples were determined via standard methods for analysis of soil according to Piper (1994) APHA-AWWA-WEF 2000.

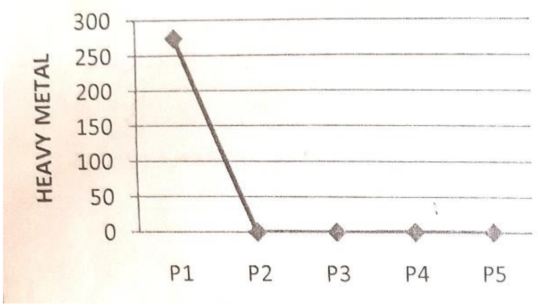
Heavy metals: The method of (Lokeshwiri and Chandrappa, 2006) was adopted in heavy metals analysis. 2g each of the samples was put into 250ml glass beaker and digested with solution of aqua regia on sand berth for 2 hours. After evaporation to dryness, the samples were dissolved with 10ml of 2% nitric acid filtered and then diluted to 50ml with distilled water. The filtrate was then used for heavy metals analysis using Atomic Absorption Spectrophotometer BUCK SCIENTIFIC MODEL Ser 423 LOANER 21G VGP at the central laboratory Multidisciplinary Centre, University of Ibadan, Nigeria. The heavy metals analyzed were Lead (Pb2+), Iron (Fe2+), Calcium (Ca2+), Magnesium (Mg), Manganese (Mn) respectively for dry and wet season samples respectively.

Chloride ion concentration was determined by argentometric method while sulphate ion was performed using the turbidometric method. Concentration of phosphate in the soil samples was determined by the molybdenum blue method while nitrate ion concentration was determined following the brucine method.

TABLE 1
PHYSICAL - RESULT FOR DRY AND WET SEASON

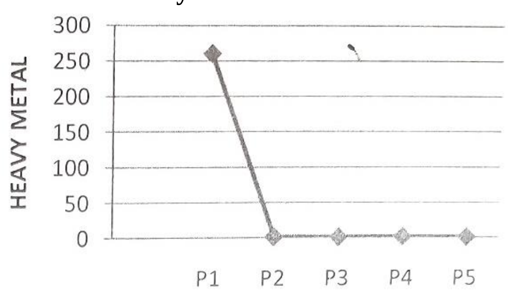
Physical	P1	P2	P3	P4	P5	WHO STANDARD
Colour (DRY SEASON)	Colourless	Colourless	Colourless	Colourless	Colourless	
Colour (WET SEASON)	Reddish	Brownish	Colourless	Colourless	Pale	
Appearance (DRY SEASON)	Reddish	Brownish	Colourless	Colourless	Pale	
Appearance (WET SEASON)	Reddish	Brownish	Colourless	Colourless	Pale	
Temperature (°C) in Sample (DRY SEASON)	28.10 29.00	28.10 29.00	27.00 29.00	27.00 29.00	26.00 28.00	35-40
Temperature(^{0}C) in simple (WET SEASON)	27.10 29.20	27.00 28.00	28.10 28.30	28.20 28.40	30.00 30.50	35-40^{0}C
pH (DRY SEASON)	6.53	5.7	4.9	4.8	5.4	6.5-8.5
pH (WET SEASON)	6.60	5.8	5.0	4.9	5.6	6.5-8
Odour (DRY SEASON)	Foul	Odourless	Odourless	Odourless	Odourless	Odourless
Odour (WET SEASON)	Foul	Odourless	Odourless	Odourless	Odourless	Odourless
Turbidity (DRY SEASON)	7.64	1.3	0.4	0.5	0.7	5 NTU mg/l
Turbidity (WET SEASON)	7.50	1.50	0.6	0.7	0.9	5NTU mg/l
Conductivity (DRY SEASON)	0.27	0.16	0.32	0.75	0.35	1.0 mscm
Conductivity (WET SEASON)	0.26	0.90	0.50	0.92	0.50	1.0mscm

Fig 1
Conductivity Variation in Dry Season



SAMPLED POINTS

Fig 2
Conductivity Variation in Wet Season



SAMPLED POINTS

Conductivity is highest in point P1 in both season and least in P2 to P5 respectively

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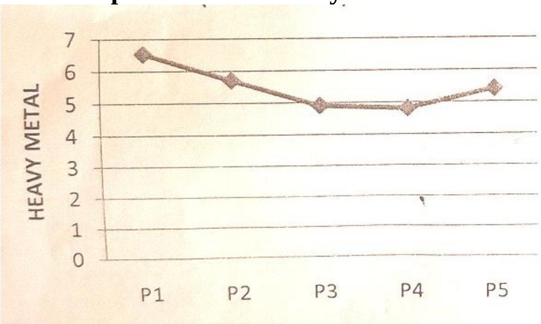
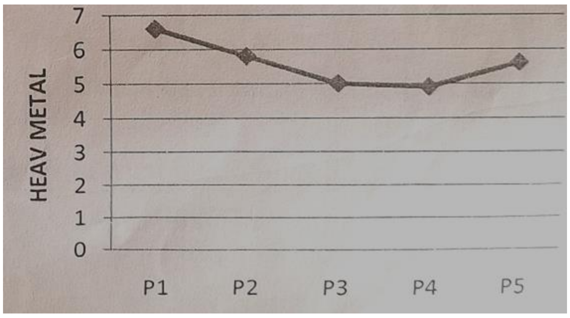
Fig 3
pH Variation in Dry Season



SAMPLED POINTS

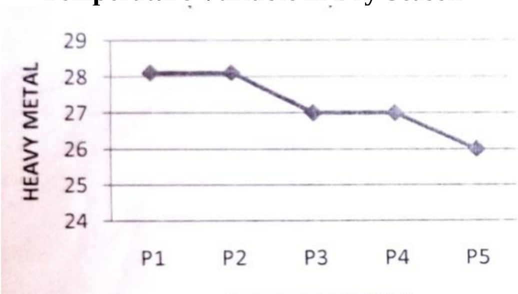
Fig 4
pH Variation in Wet Season



SAMPLED POINTS

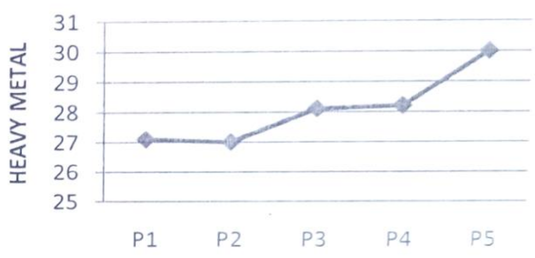
pH highest in P1 and P5 and least in P3 and P4

Fig 5
Temperature Variable in Dry Season



SAMPLED POINTS

Fig 6
Temperature Variable in Wet Season



SAMPLED POINTS

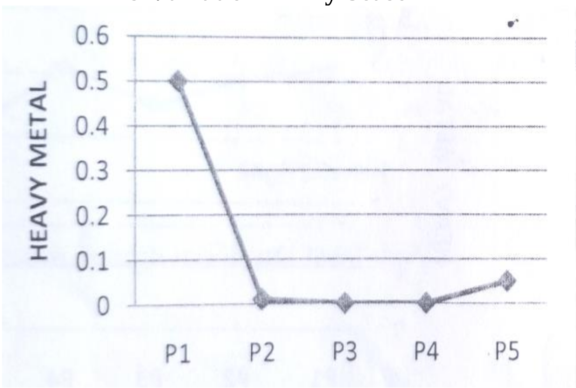
Temperature in the sample is least in P1 during wet season but high in P1 during dry season. However, temperature is highest in P5 during wet season.

TABLE 2

HEAVY METAL - RESULT FOR DRY AND WET SEASON

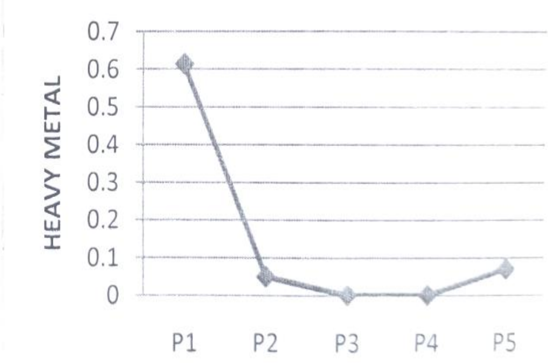
Sampling Point	P[1] Mean mg/L	P[2] Mean mg/L	P[3] Mean mg/L	P[4] Mean mg/L	P[5] Mean mg/L	WHO STANDARD
$Pb^{2\pm}$ (DRY)	0.51±0.120	0.01±0.030	0.00±0.020	0.00±0.020	0.05±0.030	0.015 mg/L
$Pb^{2\pm}$ (WET)	0.613±0.140	0.050±0.041	0.001±0.023	0.001±0.02	0.070±0.040	0.015
$Fe^{2\pm}$ (DRY)	3.68±0.074	1.89±0.042	2.81±0.042	2.49±0.067	6.753±0.604	0.03 mg/L
$Fe^{2\pm}$ (WET)	3.85±0.621	2.15±0.05	3.51±0.055	2.54±0.043	6.932±0.413	0.03
$Ca^{2\pm}$ (DRY)	3.69±0.071	3.72±0.039	3.24±0.052	3.77±0.085	2.92±0.040	200 mg/L
$Ca^{2\pm}$ (WET)	4.15±0.031	3.970±0.040	3.521±0.001	4.110±0.072	3.123±0.005	200 mg/L
Mg (DRY)	3.70±0.054	3.22±0.130	4.23±0.046	3.81±0.030	3.50±0.061	150 mg/L
Mg (WET)	3.803±0.0310	3.621±0.100	4.521±0.006	3.921±0.060	4.411±0.001	150 mg/L
Mn (DRY)	0.11±0.009	0.06±0.002	0.23±0.013	0.34±0.02	0.183±0.017	0.05 mg/L
Mn (WET)	0.214±0.070	0.082±0.031	0.414±0.012	0.042±0.003	0.164±0.042	0.05 mg/L
Coltalt (DRY)	NA	NA	NA	NA	NA	NS
Cobalt (WET)	NA	NA	NA	NA	NA	NS
Zn(DRY)	0.017±0.021	0.000±0.000	0.000±0.000	0.000±0.000	0.000±0.000	1.5 mg/L
Zn (WET)	0.274±0.062	0.000±0.000	0.001±0.000	0.301±0.000	0.001±0.000	1.5 mg/L

Fig 7
Pb Variation in Dry Season



SAMPLED POINTS

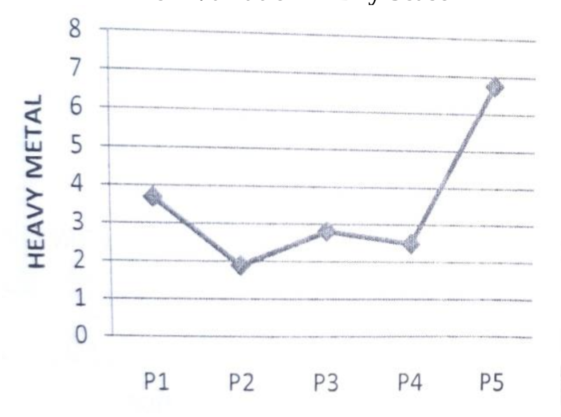
Fig 8
Pb Variation in Wet Season



SAMPLED POINTS

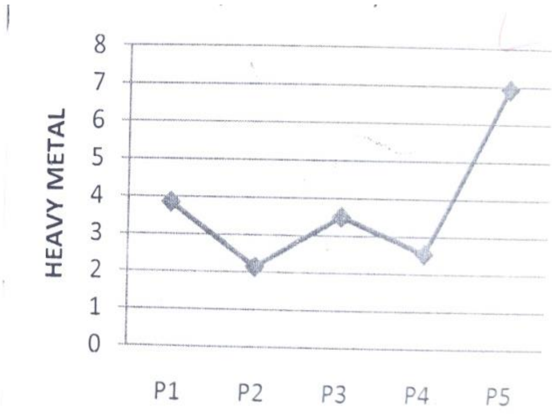
Pb is high in both dry and wet season in P1 and least in P2 and P4

Fig 9
Fe^{2+} Variation in Dry Season



SAMPLED POINTS

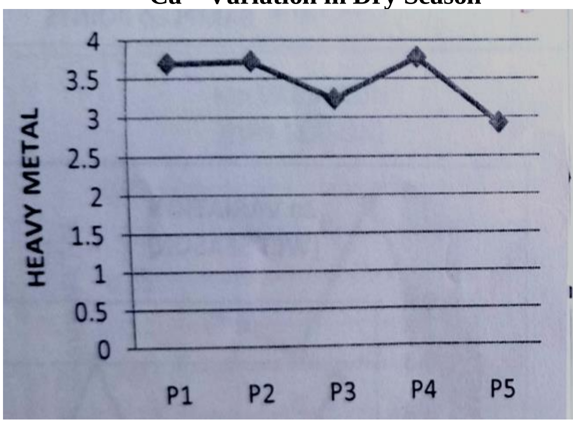
Fig 10
Fe^{2+} Variation in Wet Season



SAMPLED POINTS

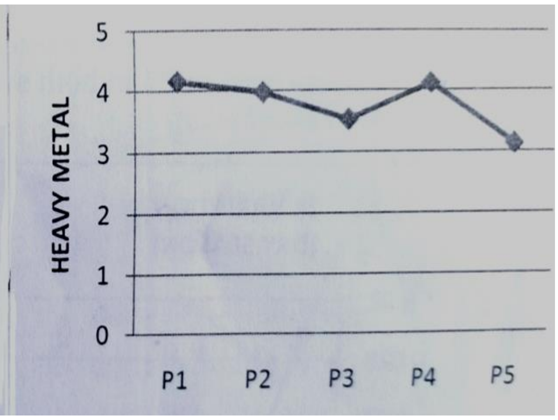
Fe^{2+} is high in P5 in both season and least in P2 respectively

Fig 11
Ca^{2+} Variation in Dry Season



SAMPLED POINTS

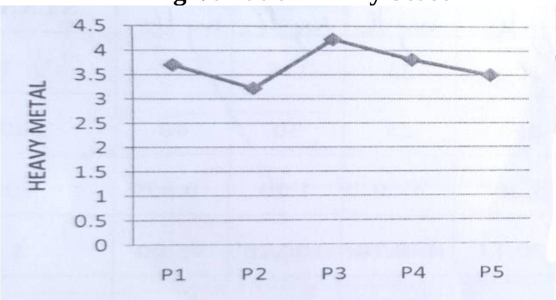
Fig 12
Ca^{2+} Variation in Wet Season



SAMPLED POINTS

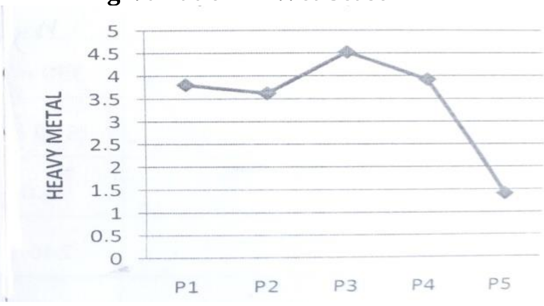
Calcium is high in P4 and least in P5

Fig 13
Mg Variation in Dry Season



SAMPLED POINTS

Fig 14
Mg Variation in Wet Season



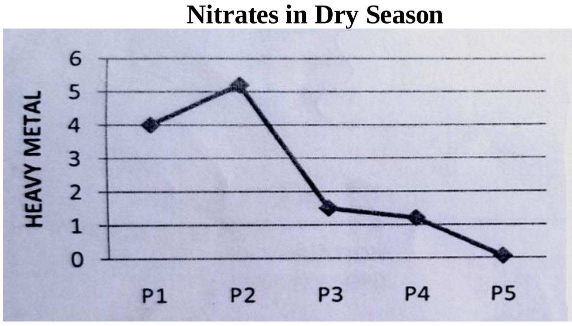
SAMPLED POINTS

Mg is high in P3 and least in P5 in both season

TABLE 3
CHEMICAL - RESULT FOR DRY AND WET SEASON

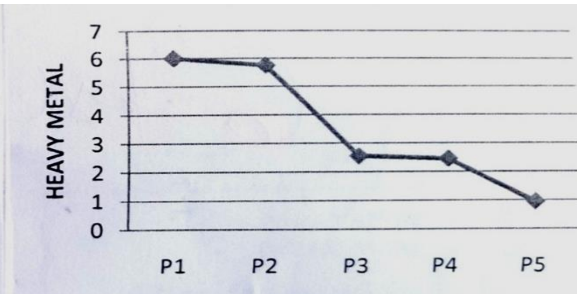
Sampling Point	P^1 Mean mg/L	P^2 Mean mg/L	P^3 Mean mg/L	P^4 Mean mg/L	P^5 Mean mg/L	WHO STANDARD
Total Acidity (DRY)	350	104	25	115	17	NS
Total Acidity (WET)	2295.0	95.0	230	105.0	15.1	NS
Total Alkalinity (DRY)	1300	250	25	30	40	200 mg/kg^{-1}
Total Alkalinity (WET)	1200.0	230.0	25.0	26.5	36.0	200 mg/L
Nitrates (DRY)	4.00	5.20	1.50	1.20	0.05	10mg/L
Nitrates (WET)	6.00	5.75	2.55	2.45	0.95	10 mg/L
Phosphates (DRY)	240.14	120.13	140.10	100.20	95.00	5mg/L
Phosphates (WET)	260.13	150.12	150.3	102.10	80.12	5 mg/L
Sulphates (DRY)	108.17	95.21	50.31	54.20	60.10	250mg/L
Sulphates (WET)	210.13	105.21	60.12	65.100	45.12	250 mg/L
Chlorides (DRY)	195.40	150.21	130.10	110.00	65.04	250 mg/L
Chlorides (WET)	230.42	160.21	140.15	140.30	70.28	250 mg/L

Fig 15
Nitrates in Dry Season



SAMPLED POINTS

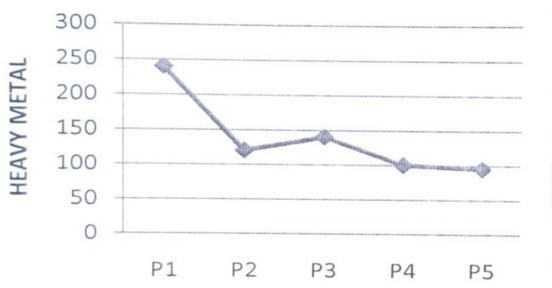
Fig 16
Nitrates in Wet Season



SAMPLED POINTS

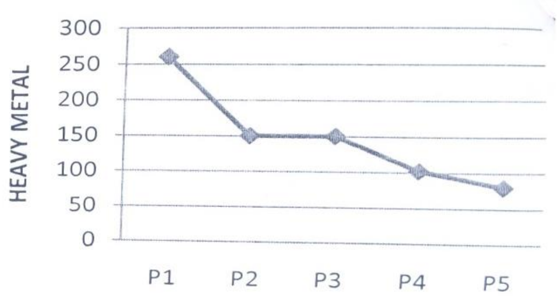
Nitrate is high in P1 in both season and least in P5

Fig 17
Phosphates in Dry Season



SAMPLED POINTS

Fig 18
Phosphates in Wet Season

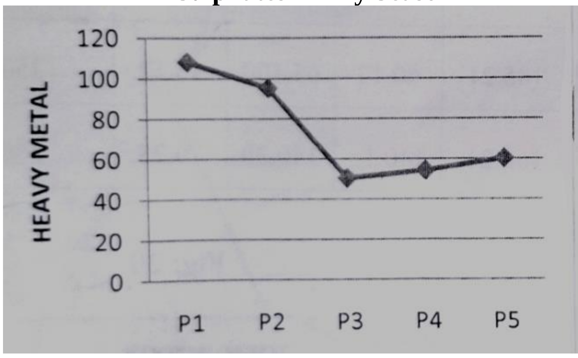


SAMPLED POINTS

$Po4^{2+}$ is high in P1 in both season and least in P5

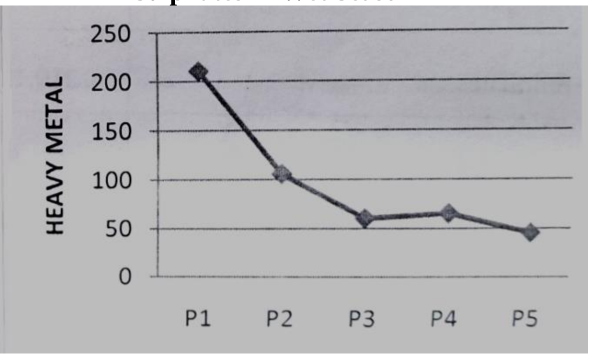
ISSN No:-2456-2165

Fig 19
Sulphates in Dry Season



SAMPLED POINTS

Fig 20
Sulphates in Wet Season

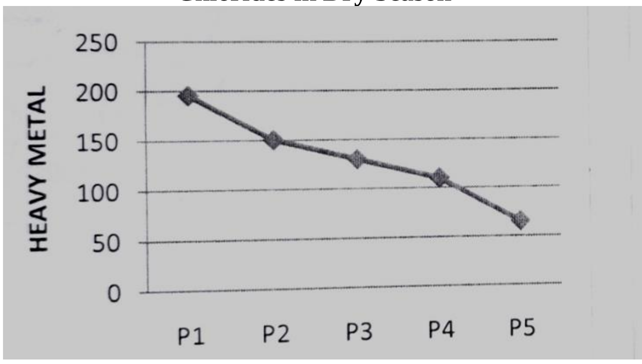


SAMPLED POINTS

$So4^{2-}$ is high in P1 in both season and least in P3.

Fig 21

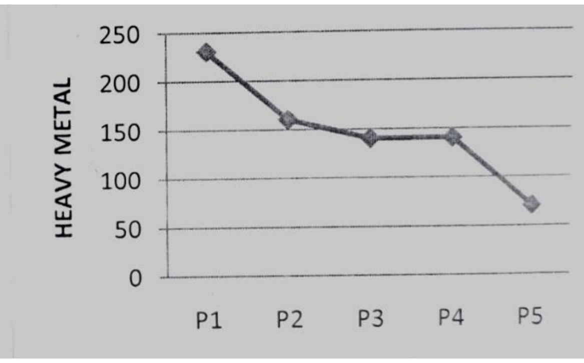
Chlorides in Dry Season



SAMPLED POINTS

Fig 22

Chlorides in Wet Season



SAMPLED POINTS

Cl^2 is high in both season in P1 and least in P5

III. RESULTS AND DISCUSSION

The results of the parameters in this studies were compared with the WHO standard as presented in tables 1.0, 2.0 physical parameters and heavy metals and chemicals respectively. While tables 3 represent the chemical properties of both the dry and wet seasons respectively. Table 1.0 represent the mean values of the result for the physical parameters of the abattoir effluent from fire different sites (P_1 to P_5) respectively. From the result conductivity values recorded for the dry season ranged from 0.16μCm^{-1} to 2.74 μScm^{-1}, with mean value of 0.37 μScm^{-1}. While the conductivity values of wet season ranged from 0.26 μScm^{-1} to 0.92 μscm^{-1} with mean values of 0.75 μscm^{-1}. The water holding capacity and electrical conductivity in polluted soil/abattoir could be due to the accumulation of organic wastes (horns, bones, hairs flesh, blood and foals Narasimha et al, (1999) reported that discharge of effluents from cotton ginning mill increased the soil water holding capacity. In contrast the effluent of quarry industries had lower water holding capacity and electrical conductivity (Shanthi, 1993).

pH values recorded for the abattoir samples ranges from 4.80-6.53 dry season with mean values of 5.47. While the pH values of the wet season ranges from 4.90 to 6.60 with mean value of 5.58. The pH values in this studies tend towards neutral (Rabah et al, 2010). WHO standard of 6.5-8.5 which interestingly tend towards alkaline with pH of near 8.5.

The results of the concentrations of the heavy metals (Pb, Fe, Ca^{2+}, and mg) studied are presented in table 2.0 from the results obtained a mean concentration of value of Pb was 0.110mg/L^{-1}, for dry season and 0.146 mg/L^{-1} for wet season which is far higher than WHO standard value of 0.015 mg/L^{-1}. Fe had 3.52 mg/L^{-1}and 3.80 mg/L^{-1} in wet and dry season respectively. This is relatively higher than 0.03 mg/L^{-1} of WHO standard signifying the accumulation of Fe. in the abattoir of Abeokuta metropolis. While the values of Ca^{2+} and mg^{+} are relatively low as mean values are far lower than the WHO standard table 2.0. The result obtained with the presence of pH and Fe indicates that the activities of abattoir sites actually affect the heavy metal concentrations negatively. Osakwe *et* al 2013 reported similar behavior in the effluence of Okpai in Delta state of Nigeria.

Other parameters studied were (N_{03}^{2-}, P_{04}^{2-}, S_{04}^{2-}, and chloride). With values ranging from 2.39 to 3.54 mg/L^{-1} for N_{03}^{2-} which is lower than 10.0 mg/kg^{-1} of WHO standard of 1988. The values of P_{04}^{2-} ranges from 111.0 to 148.5 mg/L^{-1} which is significantly higher than 5.0 mg/L^{-1} of WHO standard. However, the values of concentration of S_{04}^{2-} and Cl^{2-} in the abattoir are lower than the WHO standard. That is 73.40 – 97.14 mg/L^{-1} for S_{04}^{2-} and 130.00 – 148.27 mg/L^{-1} for WHO standard. Hence the higher concentrations of phosphates gives an indication of possible effluent contamination in the surrounding soil and its organisms as a result of butchering activities. Nevertheless the values of chloride still signify toxicity but its relatively lower than WHO standard.

IV. CONCLUSION

The samples at P1 to P5 from different abattoir sites within Abeokuta have shown contamination, while chloride and nitrates had average values of chloride 319.30 mg/l, phosphate 1660 mgl. These values were slightly higher than both the control site as well as WHO. Abattoir activities in Abeokuta metropolis impact negatively on the soil. This need to be adequately corrected in the nearest future.

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