



Contamination and Pollution Studies of Heavy Metals in Sand Filter Media Waste Dumpsite in Yenagoa, Bayelsa State, Nigeria

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ABSTRACT: The contamination and pollution level of five Heavy Metals in spent Sand Filter Media [SFM] waste dumpsite was investigated to ascertain the contamination, pollution and possible migration in that environment. Samples were collected at the surface, 0.1m depth and 100m away from the dumpsite and analysed using Flame Atomic Absorption Spectrophotometer (FAAS) for concentration of Cr, Fe, Mn, Ni and Pb ions. Geochemical Pollution Indices were used to evaluate the contamination and pollution level of the HMs comparatively using the world shale average values and the experimental control value. Results obtained showed highest concentration of 12.50mg/kg for Fe and lowest detectable concentration of 0.2mg/kg for Ni at the top of the dumpsite. All five heavy metals had low concentrations compared to WHO and national standards for soil quality both at the top and 0.1m depth of the dumpsite. Percentage concentrations of the heavy metals at the top showed 78.81, 12.04, 7.88, 1.26% in the order Fe >>> Cr > Mn > Ni > Pb with the values of Ni and Cr at 0.1m depth slightly higher indicating some level of migration. Contamination Factor C_f , depicts very severe contamination to slight pollution at the top with minimum of 0.714 and maximum of 1.471. Degree of Contamination C_d , of <8 and Modified Degree of Contamination mC_d <1.5 showed low contamination. The pollution load index, PLI values of <50 depicts that no drastic rectification measure was needed which concludes that the SFM dumpsite was contaminated but technically not polluted.

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The surface mobility, biochemical redox reactions and underground bioaccumulation of heavy metal contaminants and their related impact in the ecosystem is of considerable concern to chemists and other environmentalists around the world (Leizou *et al.*, 2015). Among the underground water contaminants, heavy metals are known to be of most concern to environmentalists because their compounds (ligands) are indeed still in reaction and are capable of many more reactions while the central metals are relatively inert and can accumulate from small quantities to quite larger quantities (Dube, *et al.* 2001). Further environmental concern of HM contaminants reported by Wu *et al* (2012), are due to their prolonged persistent stay in the environment unchanged, their ability to be recycled biochemically in the same form that they were, their ability to accumulate and increase their concentration biologically, their biological toxicity to flora and fauna, their capability to undergo reduction & oxidation reactions with or without availability of oxygen, their ability to undergo precipitation, solubilisation, to aggregate or flocculate in solutions, the ability of their ligands to undergo chelation and finally their ability to put all the above together and be toxic in nature (Ademeroti 1996).

Specifically, compounds of Cr in both oxidation states (Cr^{3+} , Cr^{6+}) are biologically harmful to living things,

carcinogenic and damage digestive systems (Fawell *et al.*, 2003). High concentrations of Mn cause hallucination to even forgetfulness and it affects both flora and fauna and the cause of dark colouration to water and pipings (Du, *et al.* 2011). Ni is carcinogenic at high concentrations and inhalation is known to cause severe lung cancer or nasal tumours as it can replace Zn and Mg ions in DNA-polymerase (Fawell, *et al.* 2007). Pb is transported through intake and carried by the haemoglobin in blood and is therefore poisonous to man and can even transfer into foetus through umbilical cord. Pb even at small dosages is known to cause adverse mental situations (Cotruvo, *et al.* 2011). In addition, water treatment chemicals are also a huge sources of HMs and contributors to reaction by-products that lead to health risk (Stoddart and Gagnon 2015). The process of water purification using SFM requires aluminium sulphate powder (alum) and chlorine gas or powdered sodium hypochlorite HTH as chemical enhancement (Mustafa and Yusuf 2012)). Depending on pH and temperature, sedimentation/flocculation processes produces Al^{3+} , Fe^{2+} , $3+$ by-products of organic and inorganic anions (Sielechi, *et al.* 2010). Disinfection process effectively produces hypochlorous acid with other significant carcinogenic organic by-products like trihalomethanes [THM], haloacetic acids, etc, while ozone disinfectant produces harmful by-products as well (WHO 2011).

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The substance of this study, Sand Filter Media [SFM], is commonest, cheapest means and most widely used in water filtration and it is still the best option in developing countries (Lynn *et al.*, 2013). The SFM accumulate these heavy metal and other contaminants to an extent that the filtration is no longer effective and it is removed from the filter vessels into a dumpsite and the filter vessels are recharged (Cakmakci *et al.*, 2009). Studies on trace metals from different areas including the niger delta area of Nigeria, showed HM contamination (Nariman and Mohammed, 2011, Babagana *et al.*, 2014).

This paper reveals studies carried out to show the concentration level of selected heavy metals adsorbed in the SFM dumpsite and the environmental concern upon evaluation with standard pollution indices. In this part of the world, more attention is focused on environmental degradation activities and wastes mainly from oil exploration, and manufacturing activities with minimal attention on the waste from essential public facilities (municipal water producing or health facilities), since these are mostly government infrastructures. However, several works on waste dumpsites mostly showed significant enrichment and pollution (Li and Feng 2012). Although, a few have reported minimal contamination as well (Amos-Tantua *et al.*, 2014).

MATERIALS AND METHODS

Study Area: The study city, Yenagoa, is the capital city of Bayelsa State, Nigeria and lies between latitude 4° 50' to 5° 00' North and longitude 6° 11' to 6° 25' East. The city is located in a humid tropical wetland area with mean annual rainfall of about 2539mm and an average mean temperature of 26.2°C (Ayolagha, 2001). The SFM dumpsite that is studied is the Ovom Waterworks located at Geographic Positioning System [GPS] 4.934245,6.266297 interpreted to read 4°56'03.3''N 6°15'58.7''E.

Sampling: Three distinct soil samples were obtained. Sample A_{TM} was 2kg deposit of Sand-Filter-Media [SFM] collected on the surface of the dumpsite between 0-10cm at five (5) different points in the sample location using a soil auger. Half of these were put separately in a black plastic bag, labelled sample A_{TM} 1, 2-5, stored in a cool place for digestion. The other half of the five portions were mixed together to get a representative sample of the entire top surface of the SFM dumpsite and put into a plastic bag, labelled as Sample A_{TM} and stored in a cool place. Sample B was collected at a depth of 100cm in a 100cm x 100cm x 200cm vertical hole dug with a shovel down the centre of SFM dumpsite. Four separate samples were collected after the 100cm marked depth at the four corners of the 100cm x 100cm x 200cm hand-dug hole. The collected four samples from the four-corners were mixed together to get a representative sample at 100cm depth and 1kg of the representatively mixed sample

was put into a plastic bag and stored in a cool place and labelled Sample B. Sample C was collected at surface of the top soil of an unoccupied land space at a distance of about 100m away from the SFM dumpsite, as a control sample. About excess of 1kg of each sample was collected, stored in a cool place. All the samples were analysed within 48 hours of sampling.

Sample Preparations: Sample digestion was done using standard procedure for acid digestion (APHA 1992). Portions of Samples A_{TM}1-5, A_{TM}, B and C were each separately mixed thoroughly in the bag, air-dried openly for about 5 hours and then sieved to remove the larger coarse particles. 1g of each of the samples was measured and put into 150ml crucible and a 1:2:2 mixture of 5ml of concentrated nitric acid (HNO₃, 70% w/w), with 10ml of hyperchloric acid (HClO₄, 60% w/w) and 10ml of Hydrofloric acid (HF, 40% w/w) was added. The mixture was digested in a hot plate in a fume cupboard for 3 hours at about 80°C (Leizou *et al.*, 201). The mixture was allowed to cool and 10ml of distilled water was added to the digest and filtered into 100ml volumetric flask. The digested mixture was made up to 100ml by adding deionized water. The digested mixture was then transferred to a 15ml sample bottle and labelled A_{TM}1. The same procedure was used for samples A_{TM}2-5, sample B and control sample C and these are now re-labelled as A_{TM}2, A_{TM}3, A_{TM}4, A_{TM}5, A-TM, B-TM and C-TM. Analysis of the heavy metals concentration for lead (Pb), Iron (Fe), Nickel (Ni), Chromium (Cr) and Manganese (Mn) was done using a Buck Scientific 210 VGP Flame Atomic Absorption Spectrophotometer AAS following prescribed procedures by the manufacturers.

RESULTS AND DISCUSSION

Results obtained from the analysis done for selected five selected HMs is showed in table 1. *Statistical Evaluations:* Evaluation of relationship of results using calculations of the Pearson's Correlation Coefficient is given as thus;

$$r = \frac{\sum d_A d_B}{\sqrt{\sum d_A^2 \sum d_B^2}}$$

Where, r = Correlation Coefficient, d_A and d_B are concentration results at the sample points A and B. Calculated Correlation Coefficient, r is 0.9959611. Correlation Coefficient, r, was read in the standard table with n = 3 [being 2 less than the 5 heavy metals as variables considered] are 0.991 at probability of 0.001, 0.959 at probability of 0.01, and 0.878 at probability of 0.05. For correlation to be significant, the calculated r value should exceed the tabulated r value. The calculated Correlation Coefficient, r, is higher than the tabulated values at all probabilities. This implies that the correlation in the results at the top and 100cm depth below the SFM waste dumpsites show significant correlation (Horsfall 2014).

Table 1. Summary of Analysis

S/N	Sample ID	Pb, [mg/kg]	Fe, [mg/kg]	Ni, [mg/kg]	Cr, [mg/kg]	Mn, [mg/kg]
i	Sample A _{TM} - 1	0.00	12.49	0.21	1.93	1.26
ii	Sample A _{TM} - 2	0.00	12.52	0.20	1.90	1.24
iii	Sample A _{TM} - 3	0.00	12.48	0.19	1.89	1.24
iv	Sample A _{TM} - 4	0.00	12.52	0.20	1.92	1.27
v	Sample A _{TM} - 5	0.00	12.48	0.20	1.91	1.25
	Mean A_{TM:5}	0.00	12.50	0.20	1.91	1.25
	Std. Dev. A_{TM:5}	0.000	0.018	0.006	0.014	0.012
1	Sample A _{TM}	0	12.5	0.2	1.91	1.25
2	Sample B _{TM}	0	12.3	0.29	2.14	0.28
3	Sample C _{TM}	0	12.1	0.28	2.29	0.85

Table 2. Total HM concentration in Samples A_{TM}, B_{TM} and C_{TM}

S/N	SAMPLE ID	[Pb]	[Fe]	[Ni]	[Cr]	[Mn]
A	Sample A _{TM} [mg/kg]	0.00	12.50	0.20	1.91	1.25
	Sample A _{TM} [%]	0.00%	78.81%	1.26%	12.06	7.88
B	Sample B _{TM} [mg/kg]	0.00	12.30	0.29	2.41	0.28
	Sample B _{TM} [%]	0.00%	81.95%	1.93%	14.26%	1.87%
C	Sample C _{TM} [mg/kg]	0.00	12.10	0.28	2.29	0.85
	Sample C _{TM} [%]	0.00%	77.96%	1.80%	14.76%	5.48%

Total Heavy Metals Concentration: Comparative evaluation of the concentrations of the selected HMs from the three (3) different sampling points is given in Table 2. The results showed high Fe concentration which was possibly due to the Fe content of the underground water in the Niger Delta area (Agbalagba, et al. 2011). The lowest concentration of HM was Ni which was 0.20mg/kg while Pb was undetected in the samples. The percentage concentration of the five metals in the top of the SFM shows that Fe had 78.81% of the total concentration followed by Cr with 12.04%, Mn with 7.88%, Ni with 1.26% and Pb with undetected concentration. The percentage concentration in Sample B_{TM}, 100cm below the surface, reveals that Fe increased to 81.95% of the total metal concentration, Cr increased to 14.26%, Mn decreased to 1.87%, Ni increased to 1.93% while Pb was undetected. This increase can be attributed to the migration of the HMs from the surface down the SFM dumpsite may be due to seepage, run off and metals bound to exchangeable and carbonate fractions that are relatively looser (Beltran, et al. 2010). The sample C_{TM}, from 100m away, gave the concentration of Fe as highest being 77.96%, while Cr was 14.76, Mn was 5.48%, Ni was

1.80% and Pb again was undetected. A comprehensive look at the results of the total metal concentration at the three points [top, below and away] from the SFM reveals the trend below:

Sample A_{TM} - Top SFM: Fe >>> Cr > Mn > Ni > Pb
 Sample B_{TM} - 100cm below: Fe >>> Cr > Mn > Ni > Pb
 Sample C_{TM} - 100m away: Fe >>> Cr > Mn > Ni > Pb

Geochemical Indices: Geoaccumulation Index, I_{geo} , is used to determine the level of contamination of heavy metals in soils essentially for recognizing and managing soil pollution. It is expressed as;

$$I_{geo} = \log_2 \frac{C_n}{1.5B_n}$$

Where C_n = measured conc. of element in the sediment or soil, B_n = geochemical background value, and 1.5 = constant to analyse fluctuations in the environment.

The result of the Geoaccumulation Index, I_{geo} , is expressed in USA, Europe and Nigeria as comparative of seven grades as given in table 3.

Table 3. I_{geo} Classes and contamination level [Muller, 1981]

I_{geo}	I_{geo} class	Contamination level
< 0	0	Uncontaminated
0 < 1	1	Uncontaminated – moderately contaminated
1 < 2	2	Moderately
2 < 3	3	Moderately – highly polluted
3 < 4	4	Highly polluted
4 < 5	5	Highly polluted – very highly polluted
5 < 6	6	Very seriously polluted

The baseline value, B_n , of each heavy metal is the concentration of that element in average shale either directly measured from relatively presumed uncontaminated soil of the same texture or taken from the literature of a related work in that area. However, getting actual background concentration levels of most soils is questionable because of unquantifiable anthropogenic inputs of heavy metals over time

(Hamon et al, 2004). The table 4 shows geochemical index calculated using the Sample C being the experimental control value (EC) taken 100m way from SFM dumpsite (relatively presumed uncontaminated soil of the same texture) and world shale average values (WSA) for the five metal considered in the study (Edori and Kpee 2017).

Table 4. I_{geo} values using EC and WSA as B_n

I_{geo} for SFM at Top (B_n = EC)					
Heavy Metal	HM Conc.	B _n	1.5B _n	Conc/1.5B _n	I _{geo} = log ₂ [Conc/1.5B _n]
Pb	0	0	0	0	0
Fe	12.5	12.1	18.15	0.688705234	-0.538041453
Ni	0.2	0.28	0.42	0.476190476	-1.070389328
Cr	1.91	2.29	3.435	0.556040757	-0.846737461
Mn	1.25	0.85	1.275	0.980392157	-0.028569152

I_{geo} for SFM at Top (B_n = WSA)					
Heavy Metal	HM Conc	B _n	1.5B _n	Conc/1.5B _n	I _{geo} = log ₂ [Conc/1.5B _n]
Pb	0	20	30	0	0
Fe	12.5	47200	70800	0.000176554	-12.46760555
Ni	0.2	68	102	0.001960784	-8.994353437
Cr	1.91	90	135	0.014148148	-6.143242959
Mn	1.25	850	1275	0.000980392	-9.994353437

The Geo-accumulation, I_{geo}, evaluations showed that almost all the results are < 0. The results belong to class I of the I_{geo} scale as given by Muller et al (1981). Results showing negative or < 0 implies that there is no significant difference between the baseline concentration values B_n and the accumulated concentration of that contaminant HM. Thus, there is no significant accumulated contamination in the metals considered at both the surface of the SFM and 100m depth below the surface of the SFM (Alfred, et al. 2013). However, the I_{geo} values calculated using the WSA values as the baseline concentrations, B_n, were lower since they had higher negative values. This is so because the B_n values were higher than those from the EC values gotten from the research area.

Contamination Factor C_fⁱ and Degree of contamination C_d: The contamination Factor is a single element evaluation and thus it is given as;

$$C_f^i = \frac{C_o^i}{C_n^i}$$

Where; C_oⁱ is the mean concentration of metals from least five sampling sites, and C_nⁱ is the pre-industrial concentration of the individual element.

The C_f is determined upon comparison with standard table of index established in figure 5. The Contamination Factor C_f, at the top of the SFM and 100cm below the SFM were calculated using both the concentrations of the experimental control, EC, and the world shale average, WSA, concentration established as given in table 6.

Table 5. Contamination factor, C_f [Edori O.S. et al, 2017]

C _f	Significance
<0.1	very slight contamination
0.10 - 0.25	Slight contamination
0.26 - 0.5	Moderate contamination
0.51 - 0.75	Severe contamination
0.76 - 1.00	Very severe contamination
1.10 - 2.00	Slight pollution
2.10 - 4.00	Moderate pollution
4.1 - 8.0	Severe pollution
8.1 - 16.0	Very severe pollution
>16.0	Excessive pollution

Table 6. Contamination factor, C_f at Surface and 100cm depth

Heavy Metal	Co	Cn=ctl	Cf = Co/Cn	Co	Cn=wsa	Cf = Co/Cn
Pb	0	0	0	0	20	0
Fe	12.5	12.1	1.03305785	12.5	47200	0.0002648
Ni	0.2	0.28	0.71428571	0.2	68	0.0029412
Cr	1.91	2.29	0.83406114	1.91	90	0.0212222
Mn	1.25	0.85	1.47058824	1.25	850	0.0014706

Contamination factor, C_f at 100cm depth						
Heavy Metal	Co	Cn=ctrl	Cf = Co/Cn	Co	Cn=wsa	Cf = Co/Cn
Pb	0	0	0	0	20	0
Fe	12.3	12.1	1.01652893	12.3	47200	0.0002606
Ni	0.29	0.28	1.03571429	0.29	68	0.0042647
Cr	2.14	2.29	0.93449782	2.14	90	0.0237778
Mn	0.28	0.85	0.32941176	0.28	850	0.0003294

Results of C_f at the top of the SFM using WSA gave quite lower values compared to that of the EC. The C_f

obtained using the EC values revealed that no result was below 0.5. The values for Ni and Cr had C_f of

0.714 and 0.834 respectively. This is categorized as Very Severe Contamination. Iron, Fe and Manganese Mn had C_f of 1.039 and 1.471 respectively and are classified as Slight Pollution. The level of contamination of Iron Fe and Manganese Mn is not unconnected with the high concentration of these metals in underground water in the Niger Delta and particularly in Yenagoa environs [Agbalagba et al, 2011].

The Contamination factors, C_f , for the five metals studied at 100cm depth of the SFM is given in table 6. The results obtained using EC showed that Mn with 0.329 was classified as Moderate contamination. Ni, Cr and Fe with C_f of 1.0357, 0.9345 and 1.0165 are classified as Very severe contamination.

The Degree of Contamination, C_d is the sum of contamination factors for all five elements examined and is given as;

$$C_d = \sum_{i=1}^n C_f^i$$

The Contamination factors C_f for the five element studied [Pb, Fe, Ni, Cr & Mn] and the Degree of Contamination C_d classes and terminologies is given in table 7 (Alfred, et al. 2013). The calculated values for the Degree of Contamination, C_d for the five studied metals at the top of the SFM using the EC and WSA respectively is given in table 8a and 8.b.

Table 7. Degree of contamination classes

<i>Cd Classes</i>	<i>Classes & terminologies</i>
< 8	Low contamination
> 8 to <16	Moderate contamination
> 16 to > 32	considerable contamination
> 32	High contamination

Table 8. C_d values at top of SFM and 100cm depth

<i>Heavy Metal</i>	<i>Cf = Co/Cn-ctl</i>	<i>Cf = Co/Cn-wsa</i>
Pb	0	0
Fe	1.033057851	0.000264831
Ni	0.714285714	0.002941176
Cr	0.834061135	0.021222222
Mn	1.470588235	0.001470588
$C_d = \sum C_f$	4.051992936	0.025898817
<i>Cd values at 100cm depth of SFM</i>		
<i>Heavy Metal</i>	<i>Cf = Co/Cn-ctl</i>	<i>Cf = Co/Cn-wsa</i>
Pb	0	0
Fe	1.016528926	0.000260593
Ni	1.035714286	0.004264706
Cr	0.934497817	0.023777778
Mn	0.329411765	0.000329412
$C_d = \sum C_f$	3.316152793	0.028632489

The results revealed that the C_d value at the top of SFM dumpsite using WSA gave 0.02589 which is lower than the EC, which was 4.5199. However, both values of C_d are lower than 8 (<8) and are classified as class 1 with low contamination. The low contamination value implies that there was minimal contamination by the cumulative concentration of all the analysed heavy metals at the top of the SFM dumpsite. The Degree of Contamination C_d at the top revealed a decrease in both baseline values [EC. WSA] from 4.05199 and 0.0258 to 3.316 and 0.0286 at 100cm depth in SFM. Again the overall sum of the contamination factors $\sum C_f$ of all five elements called the C_d was less than 8 (<8) and is termed low contamination.

Modified Degree of Contamination mCd: This is the modified or generalised form of equation for the calculation of the modified degree of contamination, mC_d for a given sampling site. It is given as;

$$mC_d = \frac{\sum_{i=1}^n C_f^i}{n}$$

Where, n = number of analysed elements; C_f^i = Contamination Factor

Accordingly, the mC_d for the five metals using the two scenarios of Cn-ctrl from experimental control and that of Cn-wsa from world shale average is calculated and compared to the standard index table for the mC_d and their classes given in table 9. Calculated results of the mC_d is given in table 10.0. The results showed that the mC_d is lower for the calculated values using the world shale average, Cn-wsa being 0.005179 at the top 0.005726 at 100cm depth as compared to calculated mC_d values of 0.8104 at the top and 0.6632 at 100cm depth of SFM from the experimental reference Cn-crl, However, the values of mC_d using both reference cases were below the lowest class of contamination in the standard index. Therefore, the modified degree of contamination for the five metals in this study were less than 1.5 and are classified as very low degree of contamination. *Pollution Load Index, PLI:* The Pollution Load Index, PLI is used for detecting pollution which permits a comparison of pollution levels between sites and at different times. It enables

or gives an estimate of the metal contamination status and the necessary action that should be taken. It is given in the equation below (Qingjie, et al. 2008);

$$PLI = n \sqrt{cf_1 \times cf_2 \times \dots \times cf_n}$$

PLI \geq 100 indicates an immediate intervention. PLI \geq 50 indicates a more detailed study is required while

a PLI < 50 indicates that a drastic rectification measures were not needed.

Pollution Load Index, PLI at the Top for Cn = ctrl and Cn = wsa are given in table 11.

Table 9. Modified Degree of contamination Classes, mCd [Alfred et al, 2013]

mCd Classes	Modified Degree of Contamination level
mCd < 1.5	Very low degree of contamination
> 1.5 to 2	Low degree of contamination
> 2 to 4	Moderate degree of contamination
> 4 to 8	High degree of contamination
> 8 to 16	Very high degree of contamination
> 16 to 32	Extremely high degree of contamination
> 32	Ultra high degree of contamination

Table 10. mCd of Top and 100cm in SFM

Sample area	$\sum C_i^i$	mCd = $\sum C_i^i / 5$
Top, Cn = ctrl	4.051992936	0.810398587
Top, Cn = wsa	0.025898817	0.005179763
100cm depth, Cn = ctrl	3.316152793	0.663230559
100cm depth, Cn = wsa	0.028632489	0.005726498

Table 11. Pollution Load Index, PLI at the Surface and 100cm depth of SFM

Heavy metal	Cf = Co/Cn-ctl	Cf = Co/Cn-wsa
Pb	0	0
Fe	1.033057851	0.000264831
Ni	0.714285714	0.002941176
Cr	0.834061135	0.021222222
Mn	1.470588235	0.001470588
$Cf_1 \times Cf_2 \times Cf_3 \times Cf_4 \times Cf_5$	0.905077105	2.43092E-11
PLI = (x) ^{1/5}	0.980250598	0.007536231
Pollution Load Index, PLI at 100cm depth in SFM		
Heavy Metal	Cf = Co/Cn-ctl	Cf = Co/Cn-wsa
Pb	0	0
Fe	1.016528926	0.000260593
Ni	1.035714286	0.004264706
Cr	0.934497817	0.023777778
Mn	0.329411765	0.000329412
$Cf_1 \times Cf_2 \times Cf_3 \times Cf_4 \times Cf_5$	0.324098562	8.70488E-12
PLI = (x) ^{1/5}	0.798243555	0.006136949

The PLI at the top of the SFM using the experimental control Cn-ctrl was 0.9802 and that using the world shale average Cn-swa was 0.00754. Both results are less than the minimal pollution index scale of <50. Therefore, the top of the SFM was not polluted with the five metals analysed. Table 11 shows the PLI at 100m in the SFM. The results showed that the PLI at 100m in the SFM using the experimental control Cn-ctrl was 0.798 and that using the world shale average standard values was 0.00613. These two values were both below the minimal pollution index of <50. This implies at 100m in the SFM, there was no need for drastic remediation measure because there was minimal pollution at this point.

Conclusion: The investigation of the contamination and pollution level of selected five Heavy Metals [HMs] in spent Sand Filter Media [SFM] waste dumpsite revealed generally low total HMs concentrations with those at 100cm depth, relatively lower, revealing that there was mobility of metal ions

possibly due to leaching and chemical reactions. Generally, the concentrations were lower or within the permissible limits given by WHO and national standards with the trend; Fe >>> Cr > Mn Ni > Pb which agrees with high concentration of Fe in the underground water in this region. Geochemical Indices evaluation carried out using the world shale average (WSA) and the experimental control (EC) values revealed that for the Geoaccumulation Index, Igeo, there was no contamination. But the Contamination Factor, Cf, showed that was contamination at the top using EC values with slight pollution by Fe and Mn and at 100cm depth, there was 'moderate contamination' from Mn, while Fe, Cr, Ni were classified 'very severe contamination'. The Degree of contamination, Cd, and Modified Degree of Contamination, mCd, indices revealed 'low contamination'. The Pollution Load Index, PLI, index classified the dumpsite as 'requires no remediation measure' due to non-pollution at the time of this study.

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