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Physicochemical and Heavy Metal Analyses of Leachate at Dumping Sites of Selected Areas in Damaturu Yobe State, Nigeria

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ABSTRACT

Protection of surface and groundwater is a major environmental issue the importance of water to human quality of life is of great interest. This study was conducted to assess the physicochemical and heavy metal of leachate in surface water and soil sediment at dumping sites of Nayinawa and Babban-Tsangaya, Damaturu, Yobe State. Simple random sampling was used for collection of the samples. The physiochemical parameters were analyzed in accordance with standard analytical procedure. Concentration of heavy metals was determined using Atomic Absorption spectrophotometer (AAS). Physiochemical analysis results showed significantly high dissolved oxygen (DO) (21.13 mg/L, Total Suspended Solid (TSS) (1115 and Turbidity (138.9 and 856.4 mg/L and sulphate (212.6 and 345 mg/L from both Nayinawa and Babban-Tsangaya, these revealed higher values of above WHO and NSDWQ permissible limit. However TDS was below FAO permissible limit. Heavy metals concentration for arsenic (2.17 mg/L, cadmium (2.27 mg/L) and chromium (1.89 mg/L) were also above WHO, FAO and NSDWQ permissible limit except lead (1.45 mg/L which was below FAO permissible limit. The development and application of integrated leachate treatment process of different physical, biological and chemical technologies could be a suitable option to reduce the contamination levels of the leachate. This study revealed that water from the study areas (Nayinawa and Babban-Tsangaya) has significant levels of heavy metal which poses a serious health risk to the people in the area.

Keywords*:* Concentration; Parameter; Contamination; Leachate; Physicochemical

INTRODUCTION

Wastes dumped in landfills are subject to either surface water, groundwater underflow, infiltration from precipitation and water percolates through picks up a variety of inorganic and organic compounds (Duwiejuah *et al.* 2023), these create a flow out of the wastes and accumulate at the bottom of the landfill (Raman and Narayanan, 2008). The resulting contaminated water can percolate through the soil and affect groundwater (Aderemi*et al.*, 2011). Soil, groundwater acidification and nitrification have been linked to waste dumps as well as microbial contamination of soil (Zhang *et al.*, 2023) and groundwater system (Amadi*et al.*, 2012). The discharge of landfill leachate can lead to serious environmental problems (Michael *et al.*, 2023). Leachate contains four groups of contaminants: dissolved organic matters; inorganic compounds (Usoh *et al.*, 2023), such as ammonium, calcium, magnesium, sodium, potassium, iron, sulphate, chlorides; heavy metals such as cadmium, chromium, copper, lead, zinc, Arsenic and xenophobic organic substances (Abdelwaheb *et al.*,2012; Lilian *et al.*, 2023). The rate and characteristics of leachate produced depends on many factors such as solid waste composition, particle size, degree of compaction, hydrology of site, age of landfill, moisture and temperature conditions, and available oxygen (Irma *et al.*, 2016; Jidi *et al.*, 2023).

Waste dumping has been identified as one of the major threats to surface and groundwater sources (Michael *et al.*, 2023); it is the most common method of waste disposal in Nigeria (U.S.EPA, 2008). Protection of surface and groundwater is a major environmental issue since the importance of water quality on human health has a great deal of interest (Irma *et al*., 2016). Assessing surface and groundwater quality and developing strategies to protect aquifers from contamination are necessary for proper planning and designing water resources (Ejikeme and Kewve, 2015; Duwiejuah *et al.* 2023). The study aim at determination of metals such as Nitarates, Posphate and Sulphate along physical and chemical charcteristics of leachate at the dumpsites Nayinawa and Babban-Tsangaya dumpsite. This study will inform policy on waste management and resource use, to mitigate human activities at the dumpsite, this will surely reduce the risk of various contamination of ground water and soil pollution in the area and environs.

MATERIALS AND METHODS

Description of the Study Area

Yobe is a state located in northeastern Nigeria, Yobe State is located within latitude 11° North and longitude 13.5° East. The capital of the State is Damaturu, and its largest and most populated city is Potiskum. Yobe is situated in the North Eastern flank of Nigeria, Yobe State occupies 45,502 square kilometers. The population of the State according to the National Head Count conducted in 2006 is about 2.6 million (NPC, 2006). The climate condition of Yobe is warm with daily temperature of 37 °C (98.6 °F). November being the sunniest month and rainy month is between August and December (World Data, 2022). Nayinawa and Babban-Tsangaya were selected Sampling sites where people around Gashua and its environs dump their generated wastes and the water from the pit is used for domestic and irrigation purposes. The waste dumped in the water generated chemical reaction and may resulted in leachate which may percolates through and cause contaminations of the water (Figure 1).

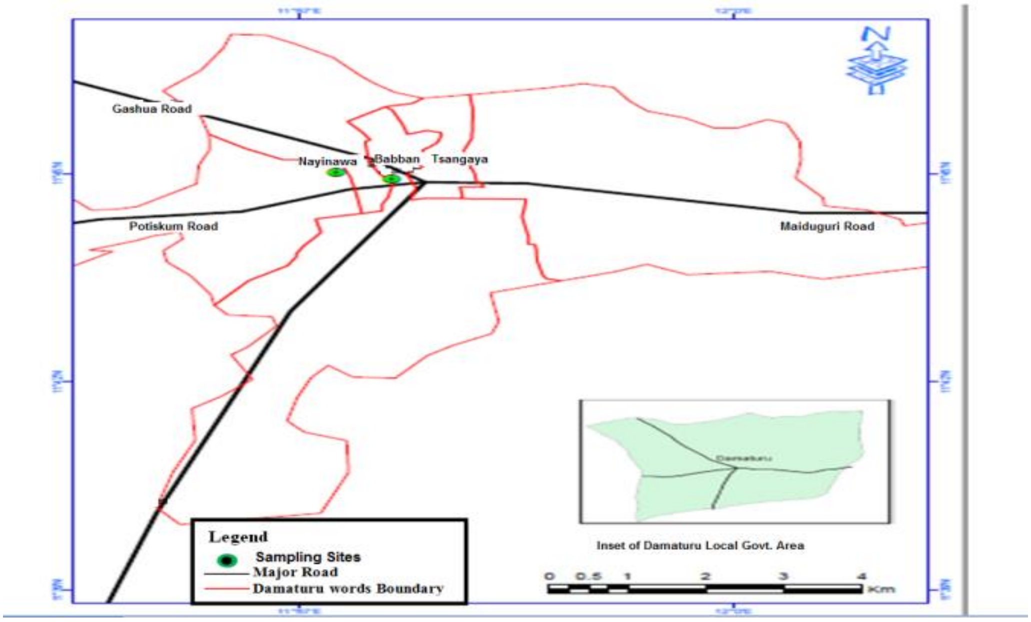

Figure 1: **Map of the Study Area Showing Sampling Sites (Source: Ministry of Land and Survey Damaturu, 2018)**

Physicochemical Determination

Physicochemical analyses such as temperature, Dissolved Oxygen (DO), pH and Electrical Conductivity (EC) were carried out *in-situ* accordance to standard analytical procedure (Nagarajan *et al.*, 2012). pH and EC were determined using a digital PHS-3C pH meter (Naveen *et al.*, 2016).Turbidity was measured with a turbidity meter (Naveen *et al.*, 2016). Dissolved Oxygen and Biological Oxygen Demand for five days were measured by following the instruction in LaMotte water quality test kit instruction manual (Pushpendra *et al.*, 2012). Nitrate and phosphate were analyzed using Nitrate-N and Phosphate low range comparator bar - 3120-01(Abdelwaheb *et al*., 2012). Sulphate was determined using turbidimetric method (Tabatabai, 2009).

Determination of Heavy Metals

The determination of a given metal concentration in the experimental solution was based on its Respective Dissolved Oxygen (DO). pH and Electrical Conductivity (EC) Spectra Calibrations curve. A stock solution of each metal ion of (1000 ppm) was prepared by dissolving the appropriate volume of the analytical reagents to be used in container of demonized water and then diluted to 1 liter in a volumetric flask (Agbozu *et al*., 2015). Concentration of the metal ions present in the sample was determined using Atomic Absorption Spectrophotometer (Buck scientific model 210GP) relative absorbance was compared with standard calibration curve (Slomczyska and Slomczynski, 2004) and the metals of investigation were recorded.

Statistical Analysis

Simple descriptive statistical analysis and standard deviations tools were employed to analyses the raw data. Analysis of Variance (ANOVA) to ascertain the difference between the means and Fisher`s Least Significant Difference (LSD) at (P<0.05) for multiple comparison with the aid of DSAASTAT (Ver. 1. 101 of 2014).

RESULTS

The results of physicochemical parameters of leachate from Nayinawa and Babbn-Tsangaya is presented in Table 1 and 2. The pH value was high and above the Nigeria Standard for Drinking Water Quality (NSDWQ), indicating that the dumping sites of Babban-Tsangaya is older than that of Nayinawa which ranges from 7.6, 7.63, 7.3 to 6.3 with mean value of 7.21mg/L (Chian and Dewalle, 2006; Kjesldsen et al., 2002). Higher pH (>8) value indicates the alkaline nature of leachate which revealed that the biochemical activity in the landfill was that organic load was biologically stabilized (Eshanthini and Padmini, 2015; Mherzi et al., 2023). The highest value of DO and BOD_5 was recorded in April from Babban-Tsangaya sites (24.6 mg/L and 12.4 mg/L) while Nayinawa was recorded as the lowest (4.2 mg/L), this corroborate the work of Mherzi et al. of 2023. The BOD was also higher (10.8 mg/L; 12.4 mg/L) in the month of April from both Nayinawa and Babban-Tsangaya. Higher value of BOD revealed maturity of the landfill/dumpsite. This corroborates the findings of Christensen et al. (2001) as normal range for a typical municipal landfill leachate. TDS values (1016.6 and1093.2 mg/L) were also higher in March and April were above WHO and NSDWQ standard limit, however, lower than that of FAO. According to WHO, 2004 high level of TDS may be responsible for reduction in the palatability of water, causes gastro-intestinal inconveniences in human (Michael *et al*., 2023).

Table 1: Mean Physicochemical Parameters of Leachate at Nayinawa Dumpsite, 2018

Month	Parameter							
	Temperature (°C)	pH	DO (mgL^{-1})	BOD_5 (mgL^{-1})	TDS (mgL^{-1})	TSS (mgL^{-1})	TS (mgL^{-1})	Turbidity (NTU)
March	29 .3±0.0	7.6±0.2[d]	18.3±3.0	9.6±0.87	1075.4±50	2114±40.7	3188.7±45.7	138.9±29.3
April	29.0±0.1	7.03±0.8[b]	21.13±1.0	10.8±0.5	1115±30	2190.7±99	3306.3±69	136.5±28
July	29±1.0	7.3±0.1[c]	13..0±1.6	6.52±1.0	1041±27	1071±67	2112.7±55.2	127.7±26.2
August	29.0±1.5	6.3±3.4[a]	7.0±1.0	4.2±0.1	1027±25	1082±28	2109.9±24.2	125.4±25.2
Mean ± SD	29.1±0.2		14.9±5.2	7.8±2.8	1064.6±39.2	1614.4±621.7	2679.4±657.7	132.13±101.4
WHO$_{(2004)}$	-	-	5	-	1000	-	-	5
FAO$_{(2007)}$	-	6.5-8.5	-	-	2000	-	-	2
NSDWQ$_{(2007)}$	-	-	-	-	500	-	-	-

Key: DO= Dissolved Oxygen, BOD5= Biochemical Oxygen Demand, EC= Electrical Conductivity, TDS= Total Dissolved Solid, TSS= Total Suspended Solid, TS= Total Solid, NSDWQ= Nigerian Standard for Drinking Water Quality, FAO= Food Agricultural Organization.

Table 2: Mean Physicochemical Parameters of Leachate at Babban-Tsangaya Dumpsite, 2018

Month	Parameter							
	Temperature (°C)	pH	DO (mgL^{-1})	BOD_5 (mgL^{-1}	TDS (mgL^{-1})	TSS (mgL^{-1})	TS (mgL^{-1})	Turbidity (NTU)
March	29.7±0.6	8.0±0.4[b]	22.04±0.3	10.6±0.3	1016.6±45	3162.7±33	4199.9±10	
April	29.1±0.56	8.1±0.2[b]	24.6±0.6	12.4±0.3	1093.2±90	3236±47	4329.3±25	855±99.5
July	29±0.6	6.8±1.0[a]	18.3±0.2	9.2±0.1	993±32	17245±57	2717.3±53 2746±98	181±70.2 154±57
August	27.7±1.0	6.7±2.7[a]	9.7±0.1	5.8±0.1	1012±55	1743±92		
Mean ±SD	28.7±0.8		18.7±6.5	9.5±2.8	1028.7 ±44.2	2464.4±849.2	3498.3±886.5	511.5±397.4
WHO$_{(2004)}$	-	-	5	-	1000	-	-	5
FAO$_{(2007)}$	-	6.5-8.5	-	-	2000	-	-	2
NSDWQ$_{(2007)}$	-	-	-	-	500	-	-	-

Key: DO= Dissolved Oxygen, BOD5= Biochemical Oxygen Demand, EC= Electrical Conductivity, TDS= Total Dissolved Solid, TSS= Total Suspended Solid, TS= Total Solid, NSDWQ= Nigerian Standard for Drinking Water Quality, FAO= Food Agricultural Organization.

The TSS values were found to be higher in Babban-Tsangaya with highest value in April and the lowest values were recorded in August at Nayinawa. The mean values TSS were 2464.4 mg/L for Babban-Tsangaya while for Nayinawa was lower (1614.6 mg/L). Total suspended solids is the turbidity due to silt and organic matter, however, when the concentration of suspended solids is high it may be aesthetically unsatisfactory for bathing (APHA, 2002). Mean physicochemical parameters of leachate (water and sediment) at Nayinawa and Babban-Tsangaya were presented in Table 3 and 4.

The turbidity value was lowest in March, 2018 (138.9) at Nayinawa and higher (855.99.4 mg/L) was recorded in Babban - Tsangaya. High turbidity was an indication of pollution and confirmed leachate infiltration into the wells (Ogedengbe and Akinbile 2004; Mohamed *et al*. 2009; Michael *et al.*, 2023). Pollution from Nitrites poses serious risk as it react directly with hemoglobin in human blood to produce methemoglobin, which destroys the ability of blood cells to transport oxygen (Fatta, 2007; Shuai *et al.*, 2023; Usoh *et al.*, 2023). Nitrite form the studies ranged from 1.91 to 7.14 mg/L and all this agreed with the findings of Igbinosa and Okoh in 2009 in their respective studies despite being below the WHO and NSDWQ values for potable water. This condition is especially serious in babies under three months of age as it causes a condition known as methemoglobinemia or "blue baby" disease. This call for biological materials introduction for neutralization to reduce the impact on human health (Mherzi *et al*., 2023). Conductivity (EC) is an important and fast method that measures the total dissolved ions and is directly related to total solids. EC is a measure of total salt content in water; it’s a determination of levels of inorganic constituents in water (Pushpendra*et al.*, 2016). EC value for Babban-Tsangaya (235) and Nayinawa (276) were higher in July, although there is significant difference between the whole months at ($p<0.05$), the values were below FAO and NSDWQ standard limit for irrigation and water quality (Table 3 and 4).

The Nitrate values for Babban-Tsangaya (0.99 and 2.86 mg/L), Nayinawa (0.63 and 4.40 mg/L) water and soil were higher in April, and were below WHO, NSDWQ and FAO standard. The nitrate values were also significantly different across the months. Nitrates (NO_3) are conservative contaminants as they are not affected by biochemical processes and natural decontamination processes taking place inside the landfill as well as their infiltration into the vadose zone. This explains why nitrates are potential threat to groundwater pollution (Fatta*et al.*, 1999). According to (Akan *et al*., 2007) nitrate concentration was above the limit, while sulphate was below the WHO limit of 200 mg/L for the discharge of waste water into sewage. These disagree with the recent findings. In addition to naturally occurring nitrates, it is also contributed to water sources by the application of fertilizers to lands. The mean concentration of phosphate from Nayinawa (0.87 mg/L) and Babban-Tsangaya (0.87 mg/L) were below the limit set by FAO. The presence of PO_4 in a leachate is dangerous as its presence in water increases eutrophication and correspondingly promotes the growth of algae. A small quantity of phosphate as low as 0.01 mg/L in groundwater may result in the water being slimy and also promotes the growth of algal (Adetunde *et al*, 2010).

The mean concentrations of the sulphate for Babban-Tsangaya water and soil (320.43 and 657.1 mg/L) were higher in April; however Nayinawa (212.6) values were higher also higher in April. Both the values exceed the limit set by FAO and NSDWQ.

The values were significantly different across the months. High quantity of sulphate (SO_4) in water is dangerous as it causes dehydration and diarrhea in children than adults (Longe*et al*, 2010). This present work revealed that most of the parameters analyzed were above the standard limit of WHO, NSDWQ and FAO which is similar with the work of (Salami *et al.,* 2015) that the values of all the dumpsites evaluated were above the standard which indicated that the leachate generated from these dumpsites are contaminated.The dumping sites of Babban-Tsangaya and Nayinawa were at high risk of contamination as shown from the analysed data. As shown by the previous work, physico-chemical characteristics of leachates change over the course of a dumpsite’s duration, this was similar work of Isah *et al.,* in 2023 and Shuai *et al.,* 2023 were they study the physicochemical parameters of the metals in the landfills.

Cadmium in the study was observed to be highest in Nayinawa (2.279 mg/L), although there is significant difference between the months at ($P< 0.05$) while highest value of Chromium was observed from Babban-Tsangaya (1.89 mg/L) there is also significant difference between the months. However, according to the finding revealed by Christopher and Akinbile, in 2012, that presence of chromium (0.25 mg/L) in the sample at 100m distance from the landfill may suggest pollution from a nearby abattoir and not from the landfill site. Chromium is not a common element and does not occur naturally in elemental form but mainly in compounds. It can be released to the environment through leakage and poor storage. The main sources of chromium contaminated soil and groundwater are electroplating, textile manufacturing, leather tanning, pigment manufacturing wood preserving, and chromium waste disposal (Slack *et al.,*2015). Cadmium is widely distributed in the earth’s crust. Human activities (such as mining, metal production, and combustion of fossil fuels) can result in elevated cadmium concentrations in the environment (Moses *et al.,* 2016). The chemical property of the cadmium in the soil is to a great extent controlled by pH concentration. Under acidic conditions as stated in the pH concentration cadmium solubility increases and very little adsorption of cadmium by soil colloids, hydrous oxides, and organic matter takes place (U.S.EPA. 1999, Moses *et al.,* 2016). Most heavy metals tested for were not detected with the exception of iron, lead, zinc, and chromium which indicated the presence of toxic wastes coming perhaps from disposed of battery cells, used aerosol cans, and other materials with a certain degree of toxicity as revealed by Chian and Dewalle (2006). This work disagrees with the findings of the recent work.

The quantity of Pb is attributed to availability of Pb related wastes such as batteries, paints and photography processing chemicals in the dump site as suggested by Mor *et al*. (2005). The highest value for lead concentration in the site was 0.89 mg/L, higher than target value therefore, lead concentration on the site, though moderate, is dangerous if allowed to infiltrate towards the groundwater table (Christopher and Akinbile, 2012). The concentration of Pb for Nayinawa (0.89 and 1.45 mg/L) and Babban-Tsagaya (0.10 and 1.44 mg/L) water and sediment were higher in March and April, and there is no significant difference between the months. There is evidence from human studies that adverse effects rather than cancer may occur at very low lead levels and that a guideline thus derived would also be protective for carcinogenic effects, it is considered appropriate to derive the guideline using the TDI approach (WHO, 2011, Moses *et al.,* 2016). Although the concentration value for Pb were beyond WHO and NSDWQ but it’s below FAO standard limit crop irrigation, from both sites.

The accumulation of heavy metals were considered the greatest hazard on the dumpsites from the study, when these chemical elements are absorbed by soils, the toxins can pass into the food chain through grazing animals (Shuai *et al.*, 2023).

Table 3: Mean Physicochemical Parameter of Leachate at Babban-Tsangaya Dumpsite (water & soil sediment), 2018

Months	**Parameters**									
	EC(μs/cm)		**NO$_2$(mg/L)**		**NO$_3$(mg/L)**		**PO$_4$(mg/L)**		**SO$_4$(mg/L)**	
	W	**S**	**W**	**S**	**W**	**S**	**W**	**S**	**W**	**S**
March	145±4.6^{b}	164±2.3^{b}	2.2±0.5^{a}	0.06±0.4^{a}	0.92±0.1^{a}	2.20±0.5^{b}	0.87±0.2^{a}	0.90±0.1^{a}	275±201^{b}	590±251^{b}
April	90±12.3^{a}	150±13.2^{a}	1.91±0.4^{a}	0.07±0.6^{b}	0.99±0.3^{a}	2.86±0.2^{b}	0.87±0.2^{a}	1.00±0.3^{a}	320±234^{c}	657±321^{c}
July	225±3.1^{c}	235±11^{d}	4.88±0.8^{b}	0.07±0.7^{b}	0.4±0.1^{b}	1.76±0.1^{a}	0.07±0.2^{b}	0.80±0.2^{b}	253±142^{a}	485±102^{b}
August	223±1.7^{c}	228±14^{c}	6.89±0.1^{c}	0.04±0.1^{a}	0.4±0.1^{b}	1.10±0.3^{a}	0.05±0.0^{b}	0.80±0.1^{b}	271±230^{b}	460±160^{a}
Standards										
WHO$_{(2004)}$	-			-		50	-		-	
FAO$_{(2006)}$	1000			-		10	2		20	
NSDWQ$_{(2007}$	700			-		50	-		100	

Values are presented as means±SD. Means in the same column followed by the same letter(s) are not significantly different ($p<0.05$).
Key: W= Water, S= Sediment.

Table 4: Mean Physicochemical Parameter of Leachate at Nayinawa Dumpsite (water & soil sediment) 2018

	Parameters									
	EC(µs/*cm*)		**NO_2(mg/L)**		**NO_3(mg/L)**		**PO_4(mg/L)**		**SO_4(mg/L)**	
	W	S	**W**	**S**	**W**	**S**	**W**	**S**	**W**	**S**
March	138±21^{a}	178±24^{a}	0.44±0.3^{a}	3.08±1.1^{a}	0.25±0.3^{b}	3.81±1.0^{b}	0.6±0.2^{a}	0.67±0.97^{b}	212±147^{d}	345±54^{d}
April	143±7.3^{b}	195±15^{b}	0.35±0.2^{b}	3.37±0.2^{b}	0.63±0.2^{d}	4.40±0.2^{c}	0.7±0.2^{b}	0.87±0.2^{c}	198±126^{c}	313±89^{c}
July	276±6.4^{d}	232±12^{d}	0.28±1.2^{c}	5.79±1.3^{c}	0.47±0.1^{c}	3.81±0.1^{b}	0.73±0.2^{b}	0.53±0.3^{a}	147±41^{a}	246±45^{b}
August	179±4.5^{c}	206±23^{c}	0.13±0.6^{d}	7.14±0.1^{d}	1.59±0.5^{a}	1.76±0.5^{a}	0.9±0.01^{c}	0.67±0.1^{b}	162±102^{b}	197±130^{a}
Standards										
WHO$_{(2004)}$	-		-		50		-		-	
FAO$_{(2006)}$	1000		-		10		2		20	
NSDWQ$_{(2007)}$	700		-		50		-		100	

Values presented as means±SD. Means in the same column followed by the same letter(s) are not significantly different ($p<0.05$). Key: W= water, S= Sediment

Table 5: Concentrations of Heavy Metal in Water and Sediment at BabbanTsangaya Dumpsite, 2018

Months	**Heavy Metals (mg/L)**							
	As		Cd		Cr		Pb	
	W	S	W	S	W	S	W	S
March	0.43±0.5^{b}	1.81±0.45^{b}	0.10±0.38^{ns}	0.49±0.38^{ns}	0.69±0.7^{ab}	1.39±0.72^{ab}	0.1±0.20^{ns}	1.44±0.20^{ns}
April	2.17±1.4^{a}	3.22±1.5^{a}	0.04±0.48^{ns}	1.01±0.48^{ns}	1.12±0.87^{a}	1.89±0.87^{a}	0.53±0.69^{ns}	1.27±0.69^{ns}
July	0.97±1.3^{ab}	1.56±1.29ab	0.66±0.91^{ns}	1.76±0.91^{ns}	0.03±0.04^{b}	0.12±.04^{b}	0.05±0.04^{ns}	0.08±0.04^{ns}
August	0.63±0.8^{b}	1.03±0.83b	0.53±0.48^{ns}	0.92±0.48^{ns}	0.02±0.03^{b}	0.09±0.03^{b}	0.03±0.03^{ns}	0.04±0.03^{ns}
LSD$_{(0.05)}$	1.26	1.46	0.43	0.62	0.68	0.83	0.43	0.51
Standards								
WHO($_{2004}$)	0.01		0.03		0.05		0.01	
FAO$_{(2006)}$	0.1		0.01		0.1		5	
NSDWQ$_{(2007)}$	0.01		0.03		0.05		0.01	

Values are presented as Mean±SD. Means in the same column followed by the same letter(s) are not significantly different ($p<0.05$) Key: W= water, S= soil sediment

Table 6: Concentrations of Heavy Metal inWater and Sediment at Nayinawa Dumpsite, 2018.

Months	**Heavy Metal (mg/L)**							
	AS		Cd		Cr		Pb	
	W	S	W	S	W	S	W	S
March	0.33±0.55ns	0.54±0.55ns	1.27±0.97^{a}	1.97±0.97a	0.40±0.77ns	0.74±0.77ns	0.53±0.48ns	0.92±0.48ns
April	0.8±0.84ns	0.41±0.84ns	1.62±0.90^{a}	2.27±0.90a	1.03±0.92ns	1.77±0.92ns	0.89±0.72ns	1.45±0.72ns
July	0.42±0.26ns	0.57±0.26ns	0.06±0.02^{b}	0.08±0.02b	0.70±0.80ns	0.95±0.80ns	0.51±0.49ns	1.34±0.49ns
August	0.35±0.53ns	0.63±0.53ns	0.03±0.03^{b}	0.05±0.03b	0.34±0.36ns	0.83±0.36ns	0.42±0.48ns	0.64±0.48ns
LSD$_{(0.05)}$	0.70	0.81	0.80	0.85	0.90	0.97	0.67	0.70
Standards								
WHO$_{(2004)}$	0.01	0.03			0.05		0.01	
FAO$_{(2006)}$	0.1	0.01			0.1		5	
NSDWQ$_{(2007)}$	0.01	0.03			0.05		0.01	

Key: W= water, S= soil sediment Values are presented as means±SD. Means in the same column followed by the same letter(s) are not significantly different ($p<0.05$)

CONCLUSION

Leachate analyses of Babban-Tsangaya and Nayinawa showed high concentration of some inorganic constituent. Physicochemical analysis results showed that the dissolved oxygen, total dissolved solid, turbidity and sulphate were significantly high from both Nayinawa and Babban-Tsangaya water and soil sediment. The analyzed parameters were above WHO and NSDWQ permissible limit however. Total dissolved solid was below FAO standard limit. The heavy metal concentrations for Arsenic, cadmium, chromium, and lead from both BabbanTsangaya and Nayinawa were also above WHO and NSDQW permissible limit for both water and soil sediment while Lead was below FAO permissible limit. This study revealed that the waste water used in the study area for irrigation and domestic use poses a serious health risk to the people in the area.

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