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ASSESSING THE DISPERSION LEVELS OF TRACE ELEMENTS IN AIR FROM CONCRETE SITE BY DRY DEPOSITION

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Abstract
A Concrete Site and a Residential Area situated at 100 meters from the concrete Site at Terama in Port-Harcourt City were chosen for the study. Port- Harcourt City geographical coordinates are $4^0 47' 21''$ North, $6^0 59' 55''$ East. Dry deposition on filter papers was carried out on a monthly basis for 12 months. The masses of the samples were measured by digital electronic weighing balance and subsequently subjected to Neutron Activation Analysis (NAA) to determine their elemental constituents. Neutron Activation Analysis of the concrete dust samples collected on filter papers from the concrete Site and Residential Area for the period under study revealed the presence of the following trace elements—aluminum (Al), titanium (Ti), vanadium(V), chromium (Cr), iron (Fe), manganese (Mn), nickel (Ni), rubidium (Rb), zirconium (Zr), cerium (Ce), and thorium (Th). The 8-hour time-weighted average permissible exposure limits of the trace elements for Residential Area and Concrete Site are given as follows: Al---9.20 mg/m^{3}and 39.97 mg/m^3; Ti---1.29 mg/m^3 and 34.00 mg/m^3; V---0.009 mg/m^3 and 0.03 mg/m^3; Cr--- 0.02 mg/m^3 and 0.05 mg/m^3; Fe---9.96 mg/m^3 and 24.37mg/m^3; Mn---0.14mg/m^3 and 0.26 mg/m^3; Ni---0.02 mg/m^3 and 0.05 mg/m^3; Rb---0.05 mg/m^3 and 0.08 mg/m^3; Zr---0.17 mg/m^3 and 0.27 mg/m^3; Ce---0.04 mg/m^3 and 0.63 mg/m^3; and Th---0.01 mg/m^3 and 0.03 mg/m^3--a weak radioactive metal respectively. These values show that the trace element; Al, Ti, Fe, Mn and Ni concentrations of the samples collected during the period were higher than the 8-hour time-weighted average permissible exposure limit established by Occupational Safety and Health Administration (OSHA), recommended exposure limit by National Institute for Occupational Safety and Health (NIOSH) and threshold limit value established by American Conference of Governmental Industrial Hygienists (ACGIH). This study confirms that particles are also dispersed from concrete site to other surrounding areas, such as Residential Areas, depending on the prevailing atmospheric conditions. This means that the health and environmental impacts associated with these trace elements will be more on the Concrete Site workers than those residing at the Residential Areas located some few meters from the Concrete Sites. Exposure of workers and occupants of Residential Areas located some few meters from Concrete Site to high levels of aluminium (Al) may suffer Alzheimer's disease. Inhalation of Titanium dust could result in breathing difficulty, coughing, and chest pain. Long time inhalation of high concentration of iron oxide fumes could result in development of a benign pneumoconiosis. Other trace elements as revealed in this study are potentially harmful to humans if inhaled in high concentration. Therefore, there is need for adequate air quality monitoring at Concrete Sites and its environs in order to avert any serious health problems associated with occupational exposure of Concrete Site workers and those living some few meters from Concrete sites.

Keywords: Dispersion, Trace Elements, Concrete, Dry Deposition

Introduction

Trace elements also called trace minerals or micro-elements essentially refer to those elements that are found in small concentration in virtually every material in the environment. These elements could be found in air, water, animals, plants, and soil. In analytical and geochemistry, concentration of trace elements are 100 parts per million and1000 parts per million respectively. A group of elements such as iron (Fe), zinc (Zn), fluorine (F), strontium (Sr), molybdenum (Mo), copper (Cu), bromine (Br), silicon (Si), cesium (Cs), iodine e(I), manganese (Mn), aluminum (Al), lead (Pb), cadmium (Cd) boron (B) and rubidium (Rb) whose concentration ranges from 0.00001% to 0.01% are classified as trace elements while those elements such as selenium (Se), cobalt(Co),

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vanadium (V), chromium (Cr), arsenic (As), nickel (Ni),lithium(Li),barium (Ba), titanium (Ti), silver (Ag), tin (Sn), beryllium (Be), gallium (Ga), germanium (Ge), mercury(Hg),scandium(Sc),zirconium (Zr), bismuth (Bi), antimony (Sb), uranium(U), thorium (Th), rhodium (Rh) whose concentration is lower than 0.000001% are known as ultra-trace elements(Skalnaya & Skalny, 2018).

For instance, a research study has shown the presence of high concentrations of trace elements such as barium (Ba), strontium (Sr), and manganese (Mn) in Portland cements in New Zealand concretes (Tamas & Abonyi, 2002). According to Badea & Iures (1988) concrete is defined as an artificial stone which is obtained after hardening the homogeneous mixtures of element, water, aggregates and sometimes admixture and or additive (to modify the fresh and hardened concrete property). Mc Cormac and Brown (2013) defines concrete as a mixture of sand, gravel, crushed rock, or other aggregates held together in a rocklike mass with a paste and cement.

Concrete is one of the basic materials for construction industry. Construction industry has been identified to contribute about 4% of particulate matter (PM) emissions which is responsible for air, water and soil pollution (Robert et al., 2018). Concrete has a number of uses such as buildings, roads, bridges, dams, pavement, stadia, and shore protection. Concrete being a typical composite material, may have some or all of the trace elements like iron, zinc, fluoride, selenium, copper, chromium, iodine, manganese, molybdenum, aluminum, cadmium, mercury, arsenic and lead, depending on the aggregate constituents. Research findings have shown that at very high concentration, these elements are toxic to the environment and humans. Some of these trace elements, especially chromium and arsenic have been identified to be responsible for cancer of the lungs and skin (National Academy of Science, 2018). According to Swaine (2000), the association of trace elements with environmental issues and humans, animals and plants health makes trace elements very important. Construction and renovation activities in office settings can greatly expose building occupants to pollution caused by the release of airborne particulates, biological contaminants, and gases (National Institute for Occupational Safety and Health (NIOSH, 2013).

Sources of Trace Elements

Trace elements exist naturally as minerals (such as rock phosphate, greensand, granite dust and basalt) and organic chelates (North Country Organics, 2018). Leafy vegetables have also been identified as good sources of trace elements. Velciov et al. (2015) absorption spectrometry analyses of some leafy vegetables indicated the presence of the micro-elements; iron (Fe), manganese (Mn), zinc (Zn), copper (Cu), cobalt (Co), nickel (Ni) and chromium (Cr). Other sources of trace elements include sea fish, shellfish, seaweed, meat, egg, cereals and nuts (British Nutrition Foundation, 2009). Trace elements such as copper and selenium are present in fish (Peter and Boughton, 2016). More so, certain amount of atmospheric trace elements has been attributed to emanating from sea surface.

Additionally, a research study conducted by Wang et al. (2018) on characteristics and sources of trace elements in particulate matter ($PM_{2.5}$) in two megacities in Sichuan basin of Southwest China also revealed the composition of this particulate contained trace elements: aluminum (Al), iron (Fe), copper (Cu), manganese (Mn), nickel (Ni) and arsenic (As). Coal mining and coal combustion have also been identified as contributing to trace elements in the environment (Finkelman, 1999).

Importance of Trace Elements

Trace elements, though have some environmental impacts, they also play a number of important roles in the proper functioning of plants, animal and humans. According to Yatoo et al. (2013), trace elements enhance growth and production. Trace elements are important components of hormones, enzymes and cells in the human's body (Batra, 2018). Trace elements in moderate amount in the soil improve stock and crop development (Agmin, 2016). Some trace elements like selenium exhibit antioxidant properties that help to prevent the cells from being damaged by free radicals (Baretta, n.d).

Effects of Trace Elements

Trace elements are important elements; however, high concentration of these elements can pose serious negative impacts on growth, reproduction, and other biological functions (Peter and Boughton, 2016). It has also been noted that high atmospheric transport of trace elements can affect organisms, even at large distances. Significant hearing impairment has been attributed to arsenic pollution from the power plant emissions (Finkelmann, 1999).

Some trace elements such as zinc, selenium, copper, manganese induce immunomodulatory (suppression of the immune system) effects, which in turn create room for a variety of viral infections to thrive (Lukac & Massanyi, 2007). The risk of Alzheimer and cardiovascular disease could increase due exposure to aluminum dust(Peters et al., 2013).

Effects of Measured Atmospheric Variables on Aerosol Particles

According to Derek et al. (2016), meteorological properties such as temperature and relative humidity influence aerosol formation.

Temperature: According to Ren and Tong (2006), PM was found to exhibit more adverse health effects on warm days than cold days. The results of the investigation of the influence of ambient temperature on aerosol particles emissions from gasoline-powered vehicles indicated that aerosol particles' emissions increased exponentially as temperature decreased (Nam et al., 2010). A study on the effect of temperature on atmospheric particles, especially small particles, showed that particle deposition is enhanced by thermophoretic force (Han et al., 2011).The concentration of aerosol concentration depends on sea surface temperature (Gert, n.d). The effects of temperature have been identified to be more at high levels of PM_{10} (Ren, et al., 2006). In a study of nine European cities, it was noted that high temperature has interactive effects on the levels of PM_{10} and its attendant consequence of deaths (Analitis et al., 2018). According to new study, increase in concentrations of particles active in cloud formation depends on increase in temperature, as plants release more gases into the atmosphere to increase the size of aerosol particles (International Institute for Applied Systems Analysis, 2013). Increase in atmospheric temperature enhances the formation of cloud condensation nuclei (CCN) (Liao et al., 2014). One important phenomenon that prevents dispersion of PM is thermal or atmospheric inversion --a condition that causes accumulation of particulate matters to the ground due to formation of warm air above cold air. In this scenario, particulate matter and other pollutants are restricted from being lifted into the earth's atmosphere. According to Pmetro (2015), thermal or temperature inversion can become a problem in cities where many pollutants exist as dust and pollutants are no longer lifted from the surface due to still air.

Relative Humidity: According to Tecer et al. (2008), an increase in relative humidity also results to an increase in PM emission. Kujundzic (2017), states that humidity can worsen particulate matter pollution by adding some water to it, making them heavier and closer to the ground level. The influence of humidity is effective on subsiding particulates in the coastal region (Jayamurugan et al., 2013). Results from laser desorption ionization mass spectrometry shows that relative humidity affects characterization of particulate matter, in terms of distribution of ions and their relative intensities (Neubauer et al., 1998). Tijjani et al (2014) identified high humidity as a factor that increases the potential of marine tropical aerosols to scatter light. In a research study carried out by Gaoshuo et al. (2011), using a self-made indoor environmental smog chamber, the result showed that increase in relative humidity increases the rate at which O_3 wall losses. Csavina (2014) showed that the concentration of atmospheric dust is determined by both relative humidity and wind speed. Relative humidity has been identified to increase the velocity of particle deposition (Han *et al.*, 2011).He et al.(2019) stated that an increase in relative humidity increases the rate of agglomeration of particles.

Wind Speed: At wavelength of 1020-nm, there exists strong dependence of aerosol optical depth on wind Speed (Smirnov et al., 2003). Wind fields influence the levels of aerosols in a number of ways, especially, dispersal of aerosol particles that results in a cleaner atmosphere (Rocio *et al.*, 2015). According to Lumen (n.d), the most important factor in the ability for wind to move sediments is how fast the wind is blowing and some small particles, such as silt and clay can be transported over great distances, even halfway across a continent or an entire ocean basin. Liu and Dikhut (1998) observed that the thickness of the surface microlayer (SM) of particulate matter decreased linearly with increased wind speed. Stagnant air has a way of creating a build-up of pollutants near the ground, particularly during a weather phenomenon called temperature inversions (Fort Air Partnership, 2015). Wind and vegetation cover have been attributed to increase in aerosol concentrations (Gert, n.d). There is clear dependence of aerosol number density on the near-surface wind speed (Parameswaran *et al.*, 1995). Wind speeds below aerosols are also reduced by aerosol particles as they bring air molecules to stability and decreasing the vertical transport of horizontal momentum (Jacobson & Kaufman, 2006). The emission of sea-salt components of aerosols from ocean increases as the wind speed across ocean surfaces increases (Latham & Smith, 1990). A research study of dust-wind interaction in eastern China showed that the occurrence of dust storm and strong winds decreases visibility as the dust storm (Yang et al., 2017).

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Rainfall: An increase in rainfall was observed to causes a decrease in all $PM_{2.5}$ components through scavenging (Tai et al., 2010). Research study conducted by Tecer et al. (2012) showed that during non-rainy days, the episodic events for $PM_{2.5}$ and PM_{10} were increased by 30 and 10.7%, respectively due to increase in the use of fossil fuels, still air masses formed because of low temperature and low wind speed. Rain drops attract aerosols particles by the process of coagulation and helping to clean the atmosphere of particulate matter pollutants (Chu, 2015). A study in eastern China has shown that high concentration of aerosols decreases the diameters of rain droplets, and by so doing, hinders weak precipitation (Xu et al., 2017).

Materials and Methods

Study Area: The sampling location is Terama in Port- Harcourt City, also called the Garden City or Oil and Gas Capital of Nigeria. It is the capital of Rivers state. It has a geographical coordinates of $4^0 47' 21''$ North, $6^0 59' 55''$ East; and positioned 16 meters above sea level. It is one of the coastal cities in the Niger Delta Region of Nigeria and host to many oil and gas companies. The map of Port-Harcourt is shown below with the red triangular and green outline object indicating the sampling location.

Source: www.viewphotos.org/nigeria/fat-map-of- Portharcourt-70-html

Materials:

The following materials were used in the collection of particulate matter: 0.125m diameter Whatman filter paper, plastic-funnel, wooden rod of about 2 meters; hygrometer and digital thermometer for measuring relative humidity and temperature respectively, and digital electronic balance for measuring the mass of particulate matter.

Methods

Method of collection of sample was dry deposition on filter paper- a sampling process that has to do with the settling of aerosols particles on solid surfaces such as filter papers.

Sample Collection: 0.125 m Whatman filter paper was placed in a funnel of about the same size and suspended on 2.0 meters wooden rod, positioned at 20 meters from concrete site for one month. The second filter paper was placed at a residential area--100 meters from the concrete site. The filter papers were replaced at the end of each month and the masses of the samples collected on the filter papers were measured with the aid of digital electronic balance. This was done for a period of 12 months.

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Results and Discussion

The masses of the aerosol particles collected on filter papers at Concrete site and the Residential area for the period are shown in figure1.

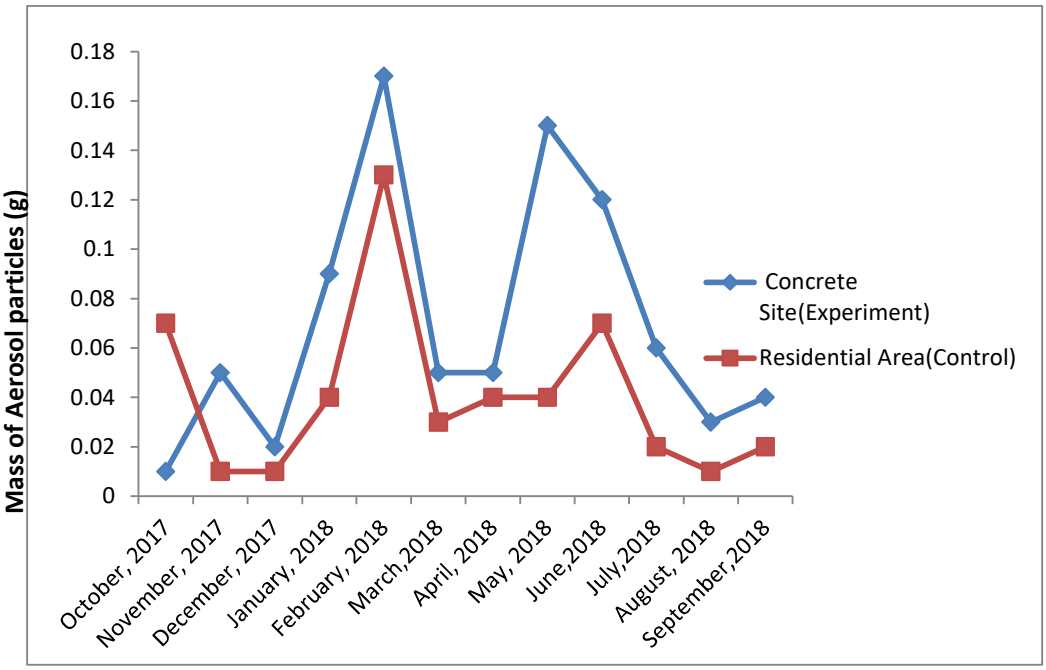

Figure 2: A plot of masses of aerosol particles collected at concrete Site and Residential Area

In figure 2, the blue curve shows that the mass of aerosol particles collected at the Concrete site is higher than that of the Residential Area except the month of October where we have 0.01g and0.07g for Concrete Site and Residential Area respectively. This difference could be attributed to some metrological factors and the amount of construction work done within the month. The month of February has the highest amount of aerosol particles for both Concrete Site and Residential Area. The values are 0.17g and 0.13g respectively. The month of October has the least value of 0.01g aerosol particles for Construction Site while Residential Area, the least value of 0.01g was recorded in the months of November, December and August.

Table1: Elemental composition of the particulate matter as analysed by NAA

		ELEMENTS [Concentration in ppm]										
		$_{13}$Al	$_{22}$Ti	$_{23}$V	$_{24}$Cr	$_{26}$Fe	$_{25}$Mn	$_{28}$Ni	$_{37}$Rb	$_{40}$Zr	$_{58}$Ce	$_{90}$Th
Month/Year	Residential Area	66744.73	1109.16	19.94	34.04	13839.37	255.51	31.97	78.30	150.45	26.41	4.27
Oct,2017	Concrete Site	480957.50	5962.61	119.27	98.76	19632.73	319.70	96.63	122.342	172.583	69.163	12.33
	Residential Area	61863.20	1186.32	23.77	41.55	13587.10	154.22	28.36	34.41	141.53	29.10	4.35
Nov,2017	Concrete Site	414090.00	10706.30	158.88	262.03	51892.80	640.70	228.35	266.82	497.63	168.44	26.56
	Residential Area	089.00	2724.07	00.00	47.13	29839.90	327.45	40.09	42.28	336.95	38.13	7.43
Dec,2017	Concrete Site	172542.00	5354.43	22.89	84.67	25189.30	393.59	103.92	102.30	202.12	72.98	11.91
	Residential Area	11042.36	1694.0770	12.80	23.45	14023.87	208.68	8.06	23.18	72.38	11.13	1.63
Jan, 2018	Concrete Site	18851.00	4457.3190	22.57	26.80	42072.64	237.64	8.94	30.25	93.77	218327.00	2.92
	Residential Area	21822.78	1782.21	19.88	21.50	12393.89	163.71	10.02	21.52	151.99	23.08	3.44
Feb,2018												

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	Concrete Site	28290.83	2635.41	27.19	24.02	25262.20	223.02	13.14	35.84	148.11	34.68	4.75
March, 2018	**Residential Area**	13736.87	3730.13 0	14.46	22.75	9181.88	155.65	7.42	22.98	75.74	14.22	1.9647
	Concrete Site	28259.74	6400.74	0.00	37.41	20044.79	277.23	12.81	38.89	177.68	24.53	3.85

Table1: Elemental composition of the particulate matter as analysed by NAA (continuation)

		ELEMENTS [Concentration in ppm]										
		$_{13}$Al	**$_{22}$Ti**	**$_{23}$V**	**$_{24}$Cr**	**$_{26}$Fe**	**$_{25}$Mn**	**$_{28}$Ni**	**$_{37}$Rb**	**$_{40}$Zr**	**$_{58}$Ce**	**$_{90}$Th**
April,2018	**Residential Area**	x	3121.81	x	27.81	8438.28	x	9.91	24.98	149.47	16.72	2.59
	Concrete Site	16224.87	5485.643	15.56	25.03	16004.51	169.57	12.88	27.89	141.82	17.44	2.67
May,2018	**Residential Area**	21071.03	3723.00	19.59	17.67	9253.58	223.14	6.85	16.20	65.01	0.501	2.17
	Concrete Site	47119.98	5053.33	28.38	29.70	45874.48	231.18	13.17	21.73	257.69	24.11	3.87
June,2018	**Residential Area**	4070.17	2801.72	8.64	8.61	4298.70	65.32	3.70	8.70	37.83	3.80	0.60
	Concrete Site	20346.09	4221.58	20.35	29.98	15442.88	184.74	7.87	34.22	105.77	18.01	2.57
July,2018	**Residential Area**	21.68	0	0	33.5	14561.52	252.00	26.39	155.53	100.12	21.68	3.64
	Concrete Site	235420.80	6105.99	77.53	139.99	57559.20	753.56	136.92	146.21	355.95	89.06	17.25
Aug,2018	**Residential Area**	82456.28	1762.48	32.1241	40.14	13420.71	194.75	54.43	46.09	181.01	28.76	5.04
	Concrete Site	127418.50	2948.96	21.044	50.76	14988.68	177.55	65.53	60.49	131.77	34.07	6.42
Sept,2018	**Residential Area**	9275.28	2860.55	0	56.41	14599.90	234.49	44.69	54.43	107.16	27.03	5.19
	Concrete Site	160588.00	3128.87	49.75	68.26	35246.80	455.60	82.53	54.43	9 291.51	50.90	10.33

Table1 shows elemental composition of the aerosol particles as analysed by Neutron Activation Analysis (NAA). The Neutron Activation Analysis (NAA) of the particulate matter samples for both the Concrete Site and Residential Area indicate the presence of the following trace elements; aluminum (Al), titanium (Ti), vanadium (V), chromium (Cr), iron (Fe), manganese (Mn), nickel (Ni), rubidium (Rb), zirconium (Zr), cerium (Ce), and thorium (Th) and their concentrations in parts per million (ppm).

Table 2: Occupational Safe Limits and the Measured Annual Mean Concentration Values of the Trace Elements

Trace Element	**Osha Pel**	**Nioshrel**	**Acgih Tlv**	**Source**	**Annual Mean Concentrations of Trace Elements at the Concrete Site and Residential Area**	
					Residential Area	Concrete Site
$_{13}$Al	15 mg/m^3	10 mg/m^3	---	National Institute for Occupational Safety and Health (2019, October 30)	26868.71mg/m^3	116706.62mg/m^3
$_{22}$Ti	15 mg/m^3	2.4mg/m^3	10 mg/m^3	(Substance Fact Sheet 2016, May)	3777.10mg/m^3	99288.79mg/m^3
$_{23}$V	0.5mg/m^3	0.05mgV/m^3		(NIOSH, 2019)	26.25mg/m^3	97.82mg/m^3
$_{24}$Cr	5 µg/m^3	---	--	*(OSHA, 2019)*	66.38mg/m^3	155.49mg/m^3
$_{26}$Fe	10 µg/m^3	5 µg/m^3	--	(CDC 2019, October 30)	29083.66mg/m^3	71166.22mg/m^3
$_{25}$Mn	5mg/m^3	1mg/m^3	0.02 mg/m^3	3M (2016, September 18; CDC 2019, October 30)	415.27mg/m^3	764.24mg/m^3
$_{28}$Ni	1 mg/m^3	0.015 mg/m^3		(OSHA, 2016)	54.39mg/m^3	156.58mg/m^3
$_{37}$Rb	Nil	----	Nil	EPSI Metals (2015, July)	153.99mg/m^3	238.62mg/m^3
$_{40}$Zr	5mg/m3	--	--	USEPA (2012, Dec.27)	488.00mg/m^3	801.02 mg/m^3
$_{58}$Ce	Nil	----	Nil	EPSI Metals (2015, July)	114.90mg/m^3	1852.28 mg/m^3

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$_{90}$**Th**	----	---	1mg/m^3	Taylor and Francis Online (2007). (https://www.tandfonline.com /doi/citedby/10.1080/0002 8895909343746?scroll=& needAccess=true)	33.78 mg/m^3	84.22 mg/m^3

PEL --- Permissible Exposure Limit; REL--- Recommended Exposure Limit; TLV---Threshold Limit Value, TWA--- Time Weighted Average

Table 2 shows the established exposure limits by Occupational Safety and Health Administration (OSHA), National Institute for Occupational Safety and Health (NIOSH), and American Conference of Governmental Industrial Hygienists (ACGIH) versus the measured annual mean concentrations of the trace elements for the Residential Area and Concrete Site in milligram per meter cube (mg/m^3)**.**

From Table 2, the 8-hour time-weighted average (TWA)permissible exposure limits of the trace elements for Residential Area and Concrete Site are given as follows: **Al**---9.20 mg/m^{3}and 39.97 mg/m^3; **Ti**---1.29 mg/m^3 and 34.00 mg/m^3; **V**---0.009 mg/m^3 and 0.03 mg/m^3; **Cr**--- 0.02 mg/m^3 and 0.05 mg/m^3; **Fe**---9.96 mg/m^3 and 24.37mg/m^3; **Mn**---0.14mg/m^3 and 0.26 mg/m^3; **Ni-**--0.02 mg/m^3 and 0.05 mg/m^3; **Rb**---0.05 mg/m^3 and 0.08 mg/m^3; **Zr**--- 0.17 mg/m^3 and 0.27 mg/m^3; **Ce-**--0.04 mg/m^3 and 0.63 mg/m^3; **Th-**-0.01 mg/m^3 and 0.03 mg/m^3--a weak radioactive element respectively.

Comparing these values with their established 8-hour time-weighted average (TWA) occupational exposure limits, aluminum (**Al**) is approximately three times higher than the 8-hour time-weighted average permissible exposure limit established by OSHA and four times higher than the recommended exposure limit by NIOSH for Concrete Site, but falls within the safe limits for Residential Area. For titanium (**Ti**), its concentration is two times higher than the 8-hour time-weighted average permissible exposure limit established by OSHA, 14 times higher than the recommended exposure limit by NIOSH, and three time higher than the threshold limit value established by ACGIH for Concrete Site, but falls within the safe limits for Residential Area. Iron (Fe) is two and five times above the permissible exposure limit and recommended exposure limit established by OSHA and NIOSH respectively, but twice the recommended exposure limit established by NIOSH and falls within the permissible exposure limit established by OSHA for Residential Area. Manganese (Mn) is seven and 13 times above 0.02 mg/m^{3}threshold limit value established by ACGIH for both the Residential Area and Concrete Site, but within the safe limits established by OSHA and NIOSH. Nickel (Ni) is three times higher than NIOSH recommended exposure limit of 0.015 mg/m^{3}for the Concrete Site, but 0.005 mg/m^3 above NIOSH recommended exposure limit of 0.015 mg/m^{3}at the Residential Area. The measured concentrations of vanadium (V), chromium (Cr), and zirconium (Zr) are within the 8-hour time-weighted average safe limits established by OSHA and NIOSH. There is no exposure limit established for rubidium (Rb) and cerium (Ce). Thorium (Th) is 0.01 mg/m^3 and 0.03 mg/m^3 for Residential Area and Concrete Site, but below the safe limit of 1mg/m^3**.**

Conclusion

It is clear from the concentration values that aluminum (Al), titanium (Ti), and (Fe) have the highest annual concentration for both Residential Area and Concrete Site respectively. The elemental component annual mean concentration for Concrete site is higher than that of the Residential Area. The result of this study confirms that particles from concrete site are also dispersed to other areas, such as residential areas, depending on the prevailing atmospheric conditions. This means that the health and environmental impacts associated with these trace elements will be more on the Concrete Site workers than those living at the residential Areas located some few meters from Concrete Sites. Exposure of workers and occupants of residential areas located some few meters from concrete sites to high levels of aluminum (Al) may suffer Alzheimer's disease. Inhalation of Titanium dust could result in breathing difficulty, coughing, and chest pain, Long time inhalation of high concentration of iron oxide fumes could result in development of a benign pneumoconiosis. Thorium is a weak radioactive element and also a carcinogenic substance. Therefore, there is need for adequate air quality monitoring at Concrete sites and its environs in order to avert any serious health problems associated with occupational exposure of concrete site workers and those living some few meters from Concrete sites.

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