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Hazards Of Heavy Metal Contamination In Ground Water

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Abstract: Heavy metal pollution is a problem associated with areas of intensive industry, road ways, areas of dumpsites and automobiles. Usage and their un controlled discharge in to the environment has caused last of hazards to man, other organisms and the environment itself. Over last three decades there has been increasing global Concern over the public health impacts attributed to environmental pollution, in particular, the global burden of disease. Improper management of solid waste is one of the main causes of environmental pollution and degradation in many cities , especially in developing countries many of these cites lack solid most regulations and proper disposal facilities, including for harmful waste. In high Dosages, these heavy metals are highly toxic to human, even deadly. The study was therefore aimed at evaluating the implication of Heavy metals on the groundwater surrounding a municipal solid waste. Different literatures dealt with heavy metals contamination on ground water were assessed. Contamination assessment revealed heavy metals to be extremely contaminated in the Groundwater. Heavy metals are found to be from anthropogenic source and correlated significantly with each other. Thus, Heavy metals if not checked could lead to major health problems like tooth discoloration, low mental development and kidney problems on the public.

Key terms: Heavy metals, waste treatment, cadimium, ground water.

1. Introduction

Heavy metal pollution is a problem associated with areas of intensive industry. However, road ways, areas of dumpsites and automobiles now are considered to be one of the largest sources of heavy metals (Abdullah Kandy Rootle, 1972). Human existence on earth is almost impossible without the heavy metal. Even though important to mankind exposure to them during production, usage and their un controlled discharge in to the environment has caused last of hazards to man, other organisms and the environment itself different heavy metals used by man are maintained to exhibit toxic effects on lives (Nowierski, M; oxen ,D.G;B orgmann,U., 2006).) Over last three decades there has been increasing global Concern over the public health impacts attributed to environmental pollution, in particular ,the global burden of disease .The world Health organization (WHO) estimates that about aquarter of the diseases facing man kind to day occur due to prolonged exposure to environmental pollution (WHO,2006). Improper management of solid waste is one of the main causes of environmental pollution and degradation in many cities , especially in developing countries many of these cites lack solid most regulations and proper disposal facilities ,including for harmful waste. Such waste may be infection, toxic or radioactive. Municipal waste dumping sites are designated places set aside for waste disposal. waste management poses a great challenge to the well –being of city residents, particularly those living adjacent the dumpsites due to the potential of the waste to pollute water, food sources of waste thus leads to environmental degradation, destruction. Depending on cities level of waste management, such waste may be dumped in uncontrolled manner, segregated for recycling purposes, or simply burnt .poor of the ecosystem and poses great risks to public health. Generally, salt, salinity, sea water intrusion, lateral migration, vertical seepage, hazardous waste disposal sites, underground storage tanks, urban storm water runoff, mine drainage, wells and oil-field brines are the major sources of heavy metals for ground water contamination.

1.1. OBJECTIVES

1.1.1. General objectives

- ✓ To study the Hazards of heavy metal contamination in ground water

1.1.2. Specific objective

- ✓ To identify types of Hazard metal contamination of ground water
- ✓ To understand the health effect of heavy metal contamination.

2. Heavy metals contamination and their nature

Pollution of groundwater sources by leachate from landfills have been recognized for a long time. Clark (2006) described landfill practices as the disposal of solid wastes by infilling depressions on land. The depressions into which solid wastes are often dumped include valleys, (abandoned) sites of quarries, excavations, or sometimes a selected portion within the residential and commercial areas in many urban settlements where the capacity to collect, process, dispose of, or re-use solid waste in a cost-efficient, safe manner is often limited by available technological and managerial capacities. In most developing countries such as Nigeria, several tons of garbage is left uncollected on the streets each day, acting as a feeding ground for pests that spread disease, clogging drains and creating a myriad of related health and infrastructural problems (Oyeku and Eludoyin, 2010). The practice of landfill system as a method of waste disposal in many developing countries is usually far from standard recommendations. A standardized landfill system involves carefully selected location, and are usually constructed and maintained by means of engineering techniques, ensuring minimized pollution of air, water and soil and risks to man and animals. Land filling involves 'placing' wastes in lined pit or a mound (sanitary landfills) with appropriate means of leachate and landfill gas control. In most cases however, 'landfill' in developing countries' context is usually an unlined shallow hollow. Zurbrugg *et al*. (2003) referred to it as 'dumps' which receive solid wastes

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in a more or less uncontrolled manner, making a very uneconomical use of the available space and that which allows free access to waste pickers, animals and flies, and often produce unpleasant and hazardous smoke from slow-burning fires. Besides, instances have been shown that revealed that even the lined (protected) landfills have been inadequate in the prevention of groundwater contamination (Oyeku and Eludoyin, 2010). In Nigeria, open dump is almost the verily available option for solid waste disposal, even in the capital cities. Sanitary landfill, however, is rare and unpopular, except perhaps among few institutions and few affluent people. Financial and institutional constraints are the immediate identifiable reasons for this in Nigeria and some other developing countries, especially where local governments are weak or underfinanced and rapid population growth continues. Other reasons include the issue of inappropriate guidelines for sitting, design and operation of new landfills as well as missing recommendations for possible upgrading options of existing open dumps. Often the available guidelines for landfills available are those from high-income countries, and they are based on technological standards and practices suited to the conditions and regulations of the source countries, they often do not take into account for the different technical, economical, social and institutional aspects of developing countries. In another case, many of the municipal officials think that uncontrolled waste disposal is the best that is possible. According to Zurbrugg et al. (2003), one out of four people in cities, in developing countries, lives in 'absolute poverty' while another one in four is classified as 'relatively poor. It has also been revealed that municipal authorities in these countries tend to allocate their limited financial resources to the richer areas of higher tax yields where citizens with more political pressure reside (Oyeku and Eludoyin, 2010). Furthermore, acidification and nitrification of groundwater have been linked to dumpsite around their outlets while a number of dumpsites have been implicated for bacterial contamination of drinking water in some cases, causing poisoning, cancer, heart diseases and teratogenic abnormalities. Although there have been no in-depth studies yet concerning groundwater quality around the Olusosun or Lagos State Waste Management Authority (LAWMA) dumpsite in Nigeria, it will be in interest of the future of Lagos State, Nigeria and development agencies in other developing cities to be aware of the environmental impact of uncontrolled and improper waste disposal in the society. It is therefore the aim of this study to provide benchmark information on the extent of pollution brought about by the open dumpsite on groundwater sources of those selected areas. The objectives are to map and describe the distribution of some selected heavy metals like cobalt (Co), cadmium (Cd), lead (Pb) and copper (Cu)) in the groundwater around the Olusosun landfill in Ojota area of Lagos State, Nigeria(Oyeku and Eludoyin, 2010). Hydro chemical results of different literatures indicate that the leachate and groundwater (in ppb) revealed different trace metals of Pb, Zn, Cu, Fe, Cd, Mn, Fe. According to the report of Laniyan *et al*. (2011) in Nigeria, the mean concentration of the metals when compared with standards showed that all the metals found in the groundwater of the area were within the standards except Pb, Fe and Cd; while the metals of leachate was found above in nearly all the metals with the exception of Zn and Ba which was found below the water standards. The result showed that the influx of leachates through the water flow is gradually affecting the groundwater particularly that of Pb, Fe and Cd that is extremely high. Inter-elemental analysis of the metals showed a strong and positive correlation with all the metals. These revealed that all the metals are from the same source which may be coming from the dumpsite and thus, makes it of anthropogenic in origin (Oyeku and Eludoyin, 2010).

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Table 1. Comparison of the Result with Recommended Standard

Element	Mean	Range	Standard deviation	leachate	W.H.O (2006) ppb	E.P.A (2009) (ppb)	SON (2007) (ppb)
Ba	65.10	14.20-152.37	41.23	336.50	700	2000	700
Cd	0.80	0.09-1.59	0.55	4.40	3	5	-
Cr	1.1	0.5-5.2	1.1	1171.0	50	100	-
Cu	12.0	2.3-41.3	10.4	605.0	2000	1300	1000
Mn	69.51	6.96-184.75	50.25	643.60	400	50	200
Pb	5.8	1.2-26.9	6.3	485.0	10	15	10
Zn	19.6	4.1-73.7	16.0	3777.0	3000	5000	3000
Fe	2019	11-21675	5828	16753	50	300	300

Table 2. Correlation of Heavy Metals

	Ba	Cd	Cr	Cu	Fe	Mn	Pb	Zn
Ba	1							
Cd	**0.77**	1						
Cr	**0.84**	**0.85**	1					
Cu	**0.84**	**0.82**	**0.99**	1				
Fe	0.00	0.00	**1.00**	0.49	1			
Mn	**0.92**	**0.84**	**0.94**	**0.94**	**0.52**	**1**		
Pb	**0.83**	**0.84**	**0.99**	**0.99**	**0.76**	**0.90**	**1**	
Zn	**0.84**	**0.83**	**0.99**	**0.99**	**0.51**	**0.90**	**0.99**	1

Table 3. Concentration of minor and trace elements in water samples

Water Source	S. No.	Minor elements		Trace elements					
		NO_3^- (ppm)	PO_4^{-} (ppm)	Zn^{++} (ppm)	Cu^{++} (ppm)	Pb^{++} (ppm)	Cd^{++} (ppm)	Fe^{++} (ppm)	Mn^{++} (ppm)
Quaternary aquifer	1	60	20	0.40	0.606	0.076	0.095	0.303	0.33
	2	65	26	0.41	0.547	0.073	0.097	0.467	0.58
	3	30	14	0.47	0.353	0.126	0.054	0.537	0.45
	4	10	5	0.36	0.342	0.128	0.092	0.445	0.49
	5	5	2	0.40	0.350	0.125	0.090	0.460	0.44
	6	4	3	0.45	0.760	0.148	0.076	0.445	0.38
	7	13	2	0.87	0.620	0.137	0.088	0.531	0.46
	8	35	3	0.15	0.348	0.112	0.079	0.474	0.37
Miocene aquifer	9	3	2	0.26	0.145	0.020	0.060	0.158	0.25
	10	4	1	0.24	0.120	0.021	0.047	0.169	0.27
	11	4	1	0.29	0.183	0.087	0.054	0.184	0.21
	12	3	2	0.25	0.120	0.022	0.062	0.109	0.26
	13	2	2	0.28	0.170	0.067	0.082	0.188	0.20
Irrigation water	14	6	10	0.22	0.120	0.029	0.017	0.129	0.27
	15	14	7	0.20	0.166	0.006	0.012	0.147	0.26
Drainage water	16	40	12	0.21	0.556	0.191	0.090	0.393	0.50
	17	5	2	0.33	0.645	0.155	0.025	2.30	0.55
	18	10	3	0.45	0.314	0.180	0.058	0.504	0.48
	19	15	2	1.01	0.652	0.144	0.081	0.525	0.85
	20	12	3	0.21	0.460	0.159	0.082	0.635	0.34
	21	14	2	0.20	0.534	0.161	0.056	0.420	0.57
Oxidation pond	22	20	2	0.95	1.035	0.285	0.207	0.708	1.03
	23	17	1	0.92	0.490	0.135	0.135	0.663	0.33
	24	12	2	0.31	0.97	0.182	0.182	0.512	0.39
	25	10	2	0.44	0.89	0.126	0.126	0.528	0.38

Table 4. Standards of some minor & trace elements in drinking & irrigation water (WHO, 1993).

Elements	Drinking water (ppm)	Irrigation water (ppm)
Nitrate (NO_3^-)	50	135
Phosphate (PO_4^{3-})	-	-
Zinc (Zn^{2+})	-	2
Copper (Cu^{2+})	1	0.2
Lead (Pb^{2+})	0.01	5
Cadmium (Cd^{2+})	0.003	0.01
Iron (Fe^{2+})	0.3	5
Manganese (Mn^{2+})	0.5	0.2

2.1 Defintion of heavy metals.

Heavy metals are metals that have density morethan 5g/ml. the name heavy metals means it doesn’t mean that they are havier than other rather to show their effect. In very small concentration since they are toxic in nature the name heavy metal will be given to them. Then, here are the lists of heavy metals which are prominent in ground water as well as in other water and land body.

2.1.1 Cadmium ($Cd^{2+)}$)

Cadmium does not exist in nature as native metal but principally as sulfide ore namely greenokite, which is strongly associated with the zinc sulphide as salphalerite, and is recovered from some copper ores during smelting and refining. It is rarely found in natural water. Cadmium is considered to be toxic if its concentration exceeds 0.01 mg/L both in drinking and irrigation water (Hem, 1989). The effects of acute cadmium are high blood pressure, kidney damage, destruction of testicular tissue as well as destruction of red blood cells (Taha, 2004). In industry, cadmium is used mainly for electroplating on other metal to prevent corrosion, for paint, printing ink, plastics, electrical batteries and fluorescent, as well as video tubes. Many of these uses tend to make the element available to water that comes in contact with buried wastes. Another factor of importance is the tendency for cadmium to enter the

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atmosphere through vaporization at high temperature. Therefore, cadmium may be liberated to the environment in metallurgical processes and in the combustion of fossil fuel. Pollutant cadmium in water may arise from industrial discharges and mining wastes (Taha, 2004). The concentration of cadmium content in groundwater of the Quaternary aquifer ranges between 0.010 and 0.062 ppm with an average of 0.039 ppm whereas it varies between 0.054 and 0.082 ppm with an average of 0.06 ppm for Miocene aquifer. Cadmium content of irrigation canals ranges from 0.012 to 0.017 with an average of 0.15ppm. It varies from 0.025 to 0.09 with an average of 0.07ppm for drainage channels. In oxidation ponds, it varies from 0.068 to 0.207ppm with an average of 0.1ppm (Taha, 2004). The above results indicate that, the concentration of cadmium content in groundwater, surface water, drainage channels and oxidation ponds is high relative to the recommended values of cadmium in drinking and irrigation water. The high content of cadmium in different water samples is attributed to plating bath or industrial discharges or through the deterioration of galvanized plumbing (Taha, 2004). A cadmium objective occurs naturally in ores together with zinc. Lead and copper. Cadmium Compounds are used as stabilizers in PVC products, Color pigment, several alloys and, now most commonly, in rechargeable nickel - Cadmium batteries. Metallic Cadmium has mostly been used as anticorrosion agent (cadmiution). Cadmium is also present as a pollutant in phosphate fertilizers. Cadmium containing products are rarely re-cycled, but frequently dumped together with house hold waste, there by contaminating the environment, especially if the waste is incinerated. Natural as well as anthropogenic sources of Cadmium, Including industrial emissions and the application of fertilizer and sewage to farm land, may lead to contamination of soils, and to increased Cadmium up take process of soil Cadmium by plants is enhanced at low PH. Graph, Berglund M, Linder CG, Nordberg G vaster et w; 1998;24 (Taha, 2004). Legate smoking is a major source of Cadmium exposure. Biological monitoring of Cadmium in the general population has shown that cigarette smoking may cause significant increases in blood Cadmium B – Cod levels the concentrations in smokers being on average 4 up to 5 times higher than those in non-smokers. Food is the most important source of Cadmium exposure in the general nonsmoking population in most countries. The Cadmium is present in most food stuffs, but concentrations vary greatly, individual in take also varies considerably due to difference in dietary habits: women usually have lower daily cadmium intakes, because of lower energy consumption than men gastro intestinal absorption.

2.1.1.1 Health effects in halation of Cadmium fumes or particles can be life threatening, and although acute pulmonary effects and dates are uncommon, sporadic cases still occur: Cadmium exposure may cause kidney damage.

2.1.1.2 Cancer the LALC has classified Cadmium as a human carcinogen (group) on the basis of sufficient evidence in both humans and experimental animals. IARC however, noted that the assessment was based on few studies of lung cancer in occupationally exposed population, often with imperfect exposure data, and without the capability to consider possible can founding by smoking other associated exposures (such as nickel and arsenic)

2.1.2 Mercury (Hg)

Mercury compound cinnabar (rigs) was used in pre-his tonic cave paintings for red colors, and metallic mercury was known in ancient Greece where it (as well as white lead) was used as cosmetic to lighten the skin. In medicine, a part from the previously mentioned use of mercury as accrue for syphilis, mercury critic's compounds have also been used as dui critics [calomel (Hg_2Cl_2**]** and mercury amalgam is still used for filling teeth in many countries. Inorganic mercury is converted to organic compounds, such as metal mercury, which is very stable and accumulates in food chain. Until 1970s metal was commonly used for control fungi on seed grain

2.1.2.1 Health effect organic mercury

Methyl mercury poisoning has latency of month or longer after acute exposure and the main symptoms relate to nervous system damage: was B, eta; 2002; 110 (supple): 851-4

2.1.2.2 Inorganic mercury

Inorganic acute mercury exposure may give rise to lung damage. Chronic, poisoning is characterized by neurological and psychological symptoms, such as tremor, changes in personality, result lenses, and piety, sleep disturbance and depression. The symptoms are reversible after cessation of exposure. B/c of the blood –brain barrier there is no central nervous involvement related to inorganic mercury exposure.

2.1.3 Lead

The general population is exposed lead from air and food in roughlyefual proportions. Earlier, lead in food stuff originated from pots used for cooking and storage, and lead acetate was previously used to sweeten wine, during the last century, lead emissions to ambient air have further polluted our environment, over soil of lead emissions are igniting from petrol.

2.1.3.1 Health effect of lead

The symptoms of acute lead poison in gore headache, irritability, admiral pain and various symptoms related to the nervous system. Lead enlephalopatayis characterized by sleeplessness and restlessness. Children may be affected by behavioral disturbances, learning and concentration difficulties.

2.1.4. Arsenic

Arsenic is a widely distributed metalloid, occurring in rock, soil, water and air. In organic arsenic is present in ground water used for drinking in several countries all over the world (e.g. Bangladesh, Chile and chain) where as organic arsenic compounds (such as arsenobetabaine) are primary found in fish, which may pavers to human exposure.

2.1.4.1 Health effect of Arsenic

In organic arsenic is acutely toxic and intake of large quantities leads to gastrointestinal symptoms, severed

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disturbances of the cardiovascular and central nervous systems, and eventually delta.

3. Summary, Conclusion and Recommendation

3.1 Summary

The objective of this study to determine the negative effect or the hazardness of heavy metals found in the natural ground water. Heavy metals in their nature they persist in the natural water due to different reactivity of the soil. The source of these heavy metals was from the ground rock found nearest to the natural water. Specially, natural water sources nearest to rift vally places are known by the presence of heavy metals. Heavy metals such as Mercury (Hg), Cadimium (Cd), Arsenic (As) as well as Lead (Pb) are the common known heavy metals that they may found in the ground water.Ground water is water body found in internal body of the land that can be face contamination using different heavy metals coming from different elements found in the form of elemental rock. Having entrance of those heavy metals in the body of peoples my leads to different health problems such as cancer, kidney problem, nausea, high blood pressure ingeneral series health problems will bring for the healthy person as being they are carcegonic in small concentration.

3.2. Conclusion

The geo chemical study of the metals reveals that pub, man and fee have values above the recommended standards unite virtually all the elements from the same anthropogenic source from the inter elemental study while the contamination assessment showed fee to have contaminated the waters most quality of the water in the study area could be termed contaminated and un healthy for consumption. Thus, the effect of fend pub to man could lead to delays in physical and mental development and light difficult in attention span and learning abilities in infants and children; kidney problems and high blood pressure in adult, while fee and man that was high in the ground water cause cosmetic effect such as test, odor, color in drinking water which may also lead to nausea, vomiting, diarrhea, as well as blood clotting and if exceeding high in human system threatens life.

3.3. Recommendation

According to findings of different of different literatures Cadmium (Cd^{2+})**,** Mercury, Lead and Arsenic causes substantial ground water contamination. Salt, salinity, sea water intrusion, lateral migration, vertical seepage, hazardous waste disposal sites, underground storage tanks, urban storm water runoff, mine drainage, wells and oil-field brines are assumed to be the major sources of heavy metals for ground water contamination. Thus, the dosage of heavy metals should be at optimum condition before taking water for consumption or other related purposes. Furthermore, through disposal of different wastes which could be sources of ground water contamination could result in minimizing of ground water contamination. The unsafe and un-recommended use of different agrochemicals should also be taken in to consideration in order to minimize ground water contamination. Therefore, as being we are developing countries everyone should control his environment by keeping our water from any flood, waste water moving from the city should be measured enough and water treatment fascility should be developed enough.

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