ABERRANT EFFECT OF SOME SELECTED URBAN DUMPSITES SIMULATED LEACHATE ON THE CHROMOSOMES AND MITOSIS OF THE ROOTS OF ONION (*Allium cepa* L.)

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Abstract
The aberrant cell effect of simulated leachate from Minna metropolis solid waste dumpsites on the chromosomes and root of onion (Allium cepa L.) were investigated. The roots of A. cepa were generated by suspending the onion bulb over distilled water contained in 50 ml beaker for 48 hours. Roots of the A. cepa (2-3cm length) generated were treated with 2.5%,5%, 10%, 20% and 40% (v/v) of simulated leachate samples for 24 hours. Different chromosomal aberrations were induced in the roots' meristems. The simulated leachate samples from Kateren Gwari dumpsite solid waste had the highest percentage total aberrant cells (40.0%) of the A. cepa root treated with 40% leachate concentration while the simulated leachate samples from Kpakungu dumpsite solid waste had the least percentage total aberrant cells (32.3%) of the A. cepa roots treated with 40% leachate concentration.There were observed cytogenetic effects of some chemical compounds/constituents inherent in the urban dumpsites leachate analysed. The Chromosome damages observed in the root tip cells of the onion were more of bridges and sticky chromosomes. Chromosomes with fragments and disturbed spindles were also available in varying numbers.The physico-chemical analysis of the leachate samples were also carried out. The leachates from kateren Gwari dumpsite solid waste had the highest metallic ion proportion/constituents while the leachate samples from Kpakungu dumpsite solid waste had the least metallic ion proportion/constituents. The physico-chemical analysis showed substances with known teratogenic, carcinogenic and mutagenic effects. Therefore, the results obtained in this study may serve as basis for the evaluation of the harzardous potential of chemical constituents of leachate from urban waste dumpsites and it environs.

Keywords: leachate, Allium cepa, dumpsites,aberrations,wastes, meristems.

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1. INTRODUCTION

The production of solid wastes in the world varies from 0.5 to 4.5kg per person per day which constitute an important management problem.There are Three major ways of managing these wastes:landfill,incineration and production of compost (Cabrera *et al.*,1999).In Nigeria,wastes disposal continues to be a serious environmental problem;population explosion and poorly controlled urbanization have been suggested as being responsible for high wastes (Nigerian Environmental Study Action, 1991). Solid waste production is inevitable and its indiscriminate spread within the environment is of environmental health and public concern. The generation of leachate due to the passage of water/precipitation through the mass of waste and its biodegradation results to a mixture of xenobiotic organic compounds, heavy metals, dissolved organic matter, inorganic macro-components and different species of microorganisms (Bakare *et al.*,2013). The combination of physical, chemical and microbial processes are undergone during disposal and processing of solid wastes in dump sites and landfills (Christensen *et al.*, 2001).

Leachates are wastes extract products from dumpsites, containing mostly synthetic organic compounds, volatile organic compounds and heavy metals, in absence of protective measures like liners. Leachate collection and treatment system undoubtedly poses serious threat to the water system (Dinesh, 2001).Leachate is any liquid that, in passing matter, extracts solute, suspended solids or any other component of the material through which it has passed, (Encyclopedia.the free dictionary).Open dumping of waste is very common in Nigeria (Bakare *et al* 1999a).Dumped solid waste is leached by rainfall, which extracts contaminants from it. The contaminants are than carried through runoff wastes into near by water bodies leading to significant pollution of such resources. They can further percolate and migrate through soil and rock formations to contaminate the underground aquifer. The characteristics of the contaminating leachate depend on those of leached waste and the rain water (Jones – Lee and Lee, 1993). The assessment of risk of leachate is not based only on the interactions among its chemicals and/or toxic degradation products with biota but also on it chemical analysis for it constituents/compositions (Kjeldsen *et al*.,2002). One of the impact of greatest concern of an existing dumpsite is the pollution of surface and/or ground waters by its leachate. It is known that many potential mutagens are present in the garbage and others are formed during their degradation. All these chemical and biological agents may go into the leachate to pollute the environment. Leachate is highly polluting, whether it comes from household or from industrial dumpsite or from a co-disposal dumpsites. (Finnnecy, 1988).

Leachate contains hundreds of different chemicals. The quality of municipal landfill leachates varies greatly within different landfill. Many factors influence leachate composition including the type of wastes deposited in the landfill, the amount of precipitation in the area and other site – specific conditions. The rate of biological and chemical activity taking place in a specific landfill or landfill cell can also affect leachate quality, by altering the way that waste dissolves in or migrate with leachate (Charnley and Gail, 1988). Other substances found in leachate and leachate/ground water mixtures may adversely affect human health. Many of the numerous studies conducted in the chemical quality of leachate have shown that samples of leachate as well as sample leachate mixed with underlying ground water often contains toxic chemicals in excess of Federal or State standards for drinking water quality (Barlaz *et al*; 1990).

Leachates could be simulated or natural or simulated,the simulated ones are those existing from test lysimeters containing a composite of typical solid waste materials and operated under a careful control set of temperature and precipitation rates to simulate actual landfill condition, while natural leachate is one originating from full-scale existing land fill operations (Cameron and Koch, 1980).Small amounts of dumpsite leachate can pollute a large volume of ground water, rendering them unusable for domestic and many other purposes. (Lee and Jones Lee, 1996). The long term effects of these chemicals carried in the water table and accumulated in the equifers will constitute a source of worry for generations to come. Evidence of genetoxic health effect, such as cancer, birth defects and reproduction anomalies have also been reported. (Gold man *et al* 1985; and Paigen and Goldman, 1987;Houk,1992). Human exposure to industrial waste have lead health effect ranging from headaches, lungs skin irritations and nausea to serious impairments of liver and neurological functions (Buffer *et al*., 1985). Increased incidences of bladder and gastro intestinal cancers (Griffith *et al*; 1989) and congenital malfunctions (Goldman *et al*., 1985) have all been reported in populations living near harzardous waste dumpsites.

The chromosome aberration on thesensitivity of the *A. cepa* assay was achieved due to the metacentric nature and large size of the chromosomes (Ma *et al.*, 1995). *A. cepa* assay has achieved wide used for evaluation of the mutagenic and cytogenotoxic activities of leachates from rural refuse dump sites, municipal landfill, industrial solid waste, electronic wastes, hospital wastes incinerated bottom ash. . Solid waste leachates inhibition of the mitotic index of the dividing cells and influence of different types of chromosome aberrations/damages and chromatid, as well as micronuclei in the meristematic cells of *A. cepa* has been reported previously by Cabrera and

Rodriguez (1999); Bakare *et al*. (2000); Obidoska and Jasinka (2008) ;Akinbola *et al*. (2011) and Kwasniewska *et al*.(2012). Chromosomal aberration in *A. cepa* (2n = 16) assay/test was the first out of the nine plant used for cytogenetic test systems and to be accepted in the USEPA genotoxic programme and its widely in use for application in monitoring of contamination of water as reported by Fontanetti *et al*.(2011). The first-tier assay for the indication of environmental chemicals pollution that may cause genetic hazards from a wide range of pollutants such as effluents of sewages has been achieved using *Allium cepa* (L) as reported by Ukaegbu and Odeigah (2009). DeMarini, (1991); Fiskesjo (1993) also reported that the useful estimate of a total cytotoxic effect as a result of the treatment of the cell's root tip by mixture of wastes is generally provided by *Allium* test or assay.For this study,leachates were simulated from solid wastes collected from some five (5) selected dumpsites in Minna area of Niger State,Nigeria.

2. MATERIAL AND METHODS

2.1. Collection of Samples and Analysis

Solid wastes were collected from the dumpsites (Kateren Gwari, Maitumbi, Bosso, Chanchaga and Kpakungu) in july, 2013. Simulation was done using the America Society for Testing and Material (ASTM) method.Simulation of solid waste samples was done using distilled water.An extraction procedure of Perket *et al* . (1982) with slight modification was used.0.7 kg of the waste samples from an initial sample of 2 kg were taken and packed in 3 liters glass volumetric flask.3000cm^3 volume of distilled water was added to each solid waste samples respectively. The waste mixture was thoroughly mixed and was allowed to stand for 48 hours at room temperature (23±1^{0}C). Stirring of the mixture was done manually and continuously at every 2 hours interval.The solid and liquid portions were separated and pH of the liquid portion recorded and stored at 4^{0}C±1^{0}C.

2.2. Allium cepa Assay

The methods used are those described by Fiskesjo (1985) and Bakare *et al*; (1999b). The roots of *A. cepa* were generated by suspending the onion bulb over distilled water in 50ml beaker for 48 hours. When the roots were about 2 -3 cm long, they were treated with 2.5%, 5%, 10%, 20% and 40% concentrations of the simulated leachates for 24 hours.The negative control of onion (*A. cepa*) roots was generated in distilled water in 50ml beaker. Roots from the treated bulb and those from the control were harvested and fixed in ethanol: acetic acid (3:1,v/v) for 24hours. After fixing, the roots were hydrolyzed with 1N HCL at 65^{o}C for 3 minutes. Slides were prepared with the hydrolyzed roots using the acetocarmine stain squash method. The slides were then observed under the microscope at 1000x magnification and the cells observed for chromosomal aberrations. The data were expressed in terms of mitotic index, number and percentage of cytogenetic aberrations for each simulated leachate sample respectively.

2.3. Physico-chemical analysis

The physico-chemical properties of the simulated leachate samples were determined in accordance with the standard method of APHA (1985). The metals (copper, lead, iron, cadmium, silver, manganese and nickel) and chloride were identified after the analysis of the simulated leachate samples using the Atomic absorption spectrophotometer (AAS).

3. RESULTS

Cell damages were observed when the *A.cepa* roots were treated with different concentrations (2.5%, 5%, 10%, 20% and 40%) of the simulated leachate samples. Table 1 to 5 showed the aberrant effects of simulated leachate samples on *A. cepa*. The mitotic indices were lower in all treatments when compared with the control.

Table1. Observed chromosomal aberrations during mitosis in *A. cepa* treated with the simulated leachate from Chanchaga dumpsite solid waste

Concentrations (%)	Cells in division	Mitotic index	Cytogenetic observations				Total aberrant cells	Percentage total aberrant cells (%)
			Anaphase bridge	Sticky chromosome	Disturbed spindle	Chromosome condensation		
2.5	200	4.00	1	1	2	-	4	3.7
5.0	182	3.64	3	2	6	1	12	11.2
10.0	166	3.32	7	3	7	2	19	17.8
20.0	143	2.86	11	6	11	3	31	29.0
40.0	107	2.14	15	9	12	5	41	38.3
Control	488	9.76					107	100

-:absent

Table 2. Observed chromosomal aberrations during mitosis in *A. cepa* treated with the simulated leachate from Kpakungu dumpsite solid waste

Concentrations (%)	Cells in division	Mitotic index	Cytogenetic observations				Total aberrant cells	Percentage total aberrant cells (%)
			Anaphase bridge	Sticky chromosome	Disturbed spindle	Chromosome condensation		
2.5	189	3.78	3	3	2	2	10	6.1
5.0	171	3.42	9	5	7	4	25	15.2
10.0	143	2.86	13	6	99	5	33	20.1
20.0	118	2.36	16	9	11	7	43	26.2
40.0	96	1.92	19	12	14	8	53	32.3
Control	488	9.76					164	100

Table 3. Observed chromosomal aberrations during mitosis in *A. cepa* treated with the simulated leachate from Kateren Gwari dumpsite solid waste

Concentrations (%)	Cells in division	Mitotic index	Cytogenetic observations				Total aberrant cells	Percentage total aberrant cells (%)
			Anaphase bridge	Sticky chromosome	Disturbed spindle	Chromosome condensation		
2.5	192	3.84	1	-	1	-	2	2.1
5.0	188	3.76	3	2	5	1	10	10.5
10.0	162	3.24	5	4	7	2	18	19.0
20.0	140	2.80	8	7	8	4	27	28.4
40.0	112	2.24	11	10	11	6	38	40.0
Control	488	9.76					95	100

-:absent

Table 4. Observed chromosomal aberrations during mitosis in *A. cepa* treated with the simulated leachate from Maitumbi dumpsite solid waste

Concentrations (%)	Cells in division	Mitotic index	Cytogenetic observations				Total aberrant cells	Percentage total aberrant cells (%)
			Anaphase bridge	Sticky chromosome	Disturbed spindle	Chromosome condensation		
2.5	196	3.92	2	1	1	1	5	4.5
5.0	189	3.78	3	3	3	4	13	11.8
10.0	164	3.28	6	5	4	6	21	19.0
20.0	139	2.78	8	7	6	9	28	25.5
40.0	116	2.32	11	11	10	11	43	39.0
Control	488	9.76					110	100

Table 5. Observed chromosomal aberrations during mitosis in *A. cepa* treated with the simulated leachate from Bosso dump site solid waste

Concentrations	Cells in division	Mitotic index	Cytogenetic observations				Total aberrant cells	Percentage total aberrant cells (%)
			Anaphase bridge	Sticky chromosome	Disturbed Spindle	Chromosome condensation		
2.5	197	3.94	1	1	2	-	4	4.1
5.0	190	3.80	2	2	4	2	10	10.3
10.0	167	3.34	4	4	7	4	19	19.6
20.0	141	2.82	6	6	9	7	28	28.9
40.0	120	2.40	9	8	10	9	36	37.1
Control	488	9.76					97	100

-:absent

It was observed that as the concentration of the leachate increases from 2.5% to 40%, the cell damages increases, with the highest percentage (%) total aberrant cells of 38.3 and least percentage (%) of total aberrant cell of 3.7 (Table 1). The percentage total aberrant cells were high with 40% concentration of the leachate (32.3%) and lower with 2.5% concentration (6.1%) (Table 2). It was also observed that cytogenetic damages were increasing in relation to the increase in simulated leachate concentration with 40% leachate concentration having the highest effects of percentage total aberrant cell of *A. cepa* (40.0%) and at 2.5% concentration of leachate sample with the least percentage total aberrant cell (2.1%) (Table 3). Total aberrant cells of 39% were observed after the treatment of *A. cepa* roots with 40% concentration of the simulated leachate from the dumpsite, while 4.5% total aberrant cells were observed after treatment of *A. cepa* roots with 2.5% concentration of simulated leachate samples from the dumpsites. (Table 4). Chromosomal aberrations were observed after the treatment of *A. cepa* with concentrations of simulated leachate from the dumpsite. Total aberrant cells of 37.1% were recorded after the treatment of *A. cepa* roots with 40% concentration of the simulated leachates while 4.1% total aberrant cells were recorded after the treatment of *A. cepa* roots with 2.5% concentration of the leachate sample. (Table 5). These findings showed that leachate depressed cell division at the tested concentration with the lowest number of dividing cells at the higher concentration of all the leachate samples collected. The observed aberration in Table 1 through 5 were sticky chromosomes at anaphase, vigrant chromosome, bridge at anaphase, mitotic spindle disturbance at anaphase and chromosome condensation. The results of the *A. cepa* test with simulated leachate sample provide cytological evidence that urban dumpsite leachate can be mutagenic and carcinogenic at the chromosomal level. It was generally observed that at 40% concentration of the leachate sample from Kateren Gwari dumpsite solid waste had the highest percentage (%) total aberrant cell (40.0%) of the *A. cepa* roots. Followed by leachate from Maitumbi dumpsite solid waste (39.0%)while leachate from Chanchaga dumpsite solid waste (38.3%) followed by leachate from Bosso dumpsite solid waste (37.1%) while leachate from Kpakungu dumpsite solid waste had the least percentage total aberrant cells (32.3%) of *A. cepa* roots at 40% leachate concentrations. (fig.1).

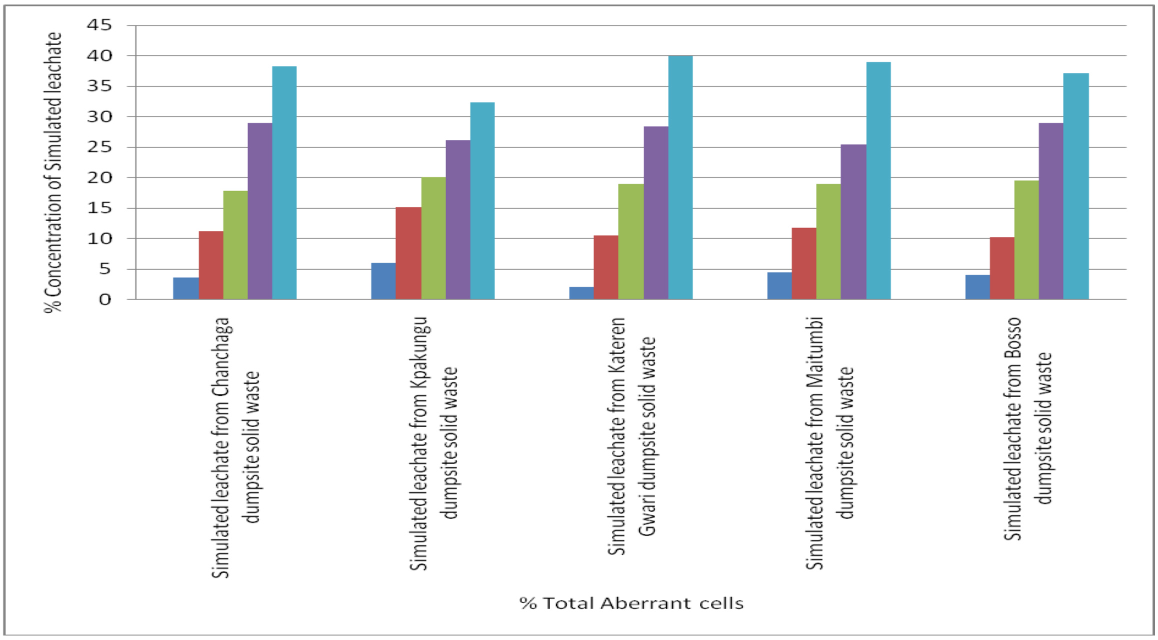

Fig 1.Effects of simulated leachate on chromosomes and roots of onion (*Allium cepa* L.)

Table 6. Physico-chemical analysis of the simulated leachate from urban waste dumpsite solid wastes

	simulated leachates from :				
Parameters	**Chanchaga dumpsite solid waste**	**Kpakungu dumpsite solid waste**	**Kateren Gwari Dumpsite solid waste**	**Maitumbi Dumpsite solid waste**	**Bosso Dumpsite solid waste**
pH	5.50	4.90	5.90	5.00	5.40
Colour	Light brown	Brown	Dark brown	Dark brown	Brown
Total solid (TS)	4001.28	3908.00	4164.30	4086.11	3906.02
Total dissolve solid (TDS)	2910	2306	3010	2940	2880
Total hardness	200.20	1980.21	200.19	199.15	198.16
Copper	1.0001	1.3004	1.9081	1.6825	1.2872
Lead	0.6342	1.0005	1.0223	1.0023	1.0002
Iron	7.1141	8.2472	9.6676	9.2173	8.4212
Cadmium	0.0500	0.0453	0.0561	0.0511	0.0451
Silver	0.1234	0.2600	0.3273	0.2651	0.2352
Manganese	0.1146	0.1435	0.2521	0.1920	0.1960
Nickel	1.0215	1.0141	1.2661	1.1010	1.0171
Chloride	36.20	35.00	40.10	37.40	36.02

*All values are in mg/L except pH

The physico-chemical analysis of the leachate samples revealed that the leachate from the Kateren Gwari dumpsite solid waste had the highest metallic ion proportion and this might be as a result of the kind of wastes deposited on the dumpsite,which are mainly mixture of household and industrial/mechanic work shop wastes.Followed by leachate from Maitumbi dumpsite solid waste, Chanchaga dumpsite solid waste, Bosso dumpsite solid waste, while simulated leachate from Kpakungu dumpsite solid waste had the least metallic ion propotion and this might be due to the kind of wastes deposited at the dumpsite which are mostly domestic waste. (Table 6). The phyco-chemical analysis of the leachate samples include parameters such as the pH of samples, colour of the samples, total solids, total dissolve solids, total hardness present of chloride, copper, lead, iron, cadmium, silver, manganese and nikel. (Table 6).

4. DISCUSSIONS

The simulated leachates analysed had aberrant effects on *A. cepa* chromosomes and roots. The metallic constituents of the leachate samples may be responsible for the observed effects.This findings is similar to the reports of Gupta *et al*. (2005) that the appreciable inhibition of inductions of chromosomal/ mitotic aberrations (CA/MA), and micronuclei (MN) formation and mitotic index (MI), were observed in all experimental groups of *A.cepa* treated with dye waste leachate (DWL) and metal waste leachate (MWL). This is in conformity with the earlier observations on some of the metals by Maitra and Bernstein (1970) who reported complete inhibition of root growth at 2 x 10^{-2}M and germination stopped all together at 10^{-1}M lead acetate in rice. In *A. cepa*, lead also reduces root growth and frequency of mitotic cells in meristematic zones (Lerda, 1992). The simulated leachate samples in this study contained chemicals (metallic ion proportions) that probably interact with DNA and thus induce mutation in *A. cepa*. The metallic constituents of the leachate samples may be responsible for the observed chromosomal effects. This is similar to the reports of Gupta *et al*.(2005) that at laboratory conditions, to simulate the field, onion bulbs were assayed in aqueous medium and on soil for 48 h to 2.5–10% leachates concentrations. The findings revealed that both and dye waste leachate (DWL) and metal waste leachate (MWL) had high concentrations of nickel, chromium and iron that mostly induced cytogenetic aberrations/ alterations. This findings also agrees with the report of Gorsuch *et al*. (1995) that Cd, Cr, Cu, Mn, Ni and Zn inhibited root elongation in cucumber, lettuce and millet of 5 and 7 days exposure of the tested plants to concentration of leachates respectively.This is similar to the report of Kjeldsen *et al.*(2002) that the major inorganic constituents of leachates which are macro-components for example [iron (Fe),magnesium (Mg), potassium (K), sodium (Na), calcium (Ca), ammonium (NH_4+), manganese (Mn), sulphates ($SO4^{2-}$), chloride (Cl^-), and bicarbonates (HCO_3-)] and the concentrations of these macro-components depends on the processes that occurred in the dumpsites or landfills for proper stabilisation results.

Similarly,the induction mechanism of the DNA aberrations from leachate in living cells may be as a result of some of the metallic constituents with DNA and/or proteins cross-linked. This could be possible through DNA repair inhibition processes in the cells, and exert unique metals have been reported to mechanism (s) of inhibition repair as reported by Hartwig and Schwerdtle (2002). It may also be due to creation of free radicals, either through enzyme-catalyzed oxidation of organic compounds or by auto-oxidation in the leachates. These radicals which are free can cause a broad spectrum of sudden change in the DNA (genetic mutations) including apurinic/apyrimidinic (AP) sites base modification, DNA single and double strand cuts/breaks and bulky adducts as revealed by Halliwell and Aruoma (1991); Sang and Li (2004).The disturbance/obstructions of mitotic process and chromosomal aberration/damage were observed in this study which is similar to the finding of Ahlberg *et al*. (1972) and Lerda. (1992) who reports that triethyl and diethyl lead chlorides were found to cause disturbances in the spindle fibre mechanism of *A. cepa* at concentration of 10^{-6}M – 10^{-7}M and it also induces chromosomal damage and disturbance of mitotic process. Ni is known to produce highly selective damage to heterochromatin. The mechanism by which it does this is through its reaction with proteins and amino acids present in the chromatin. By thus interaction, Ni cross – link certain amino acids and proteins to DNA, thus leading to the selective damage (Costa *et al*., 1994). Ni observed in this study could have acted via this mechanism to reproduce some of the chromosome damage or aberrations.The mitotic stages after aberrant cell damages could have been the the result of poisoning of the spindle that causes disturbances in the chromosome during mitotic cell division. Several heavy metals are known to induce micronucleus formation, chromosome breaks,fragments in mammalian and plants test systems (Knasmuller *et al*., 1998).

The aberrant effects observed in the treated roots of *A. cepa* in this study may have resulted from obstructions of the onset of Anaphase or arrest of one of the mitotic process by the metallic constituents of the simulated leachate. This findings is similar to the reports of Kabarity *et al.* (1979).Knasmuller *et al.*(1998) reported similar findings that the significant and concentration depend on the induction of chromosomal aberrations including the formation of micronucleus in root tip cells of *A.cepa* treated with leachates containing nickel, iron and chromium is an indication of the genotoxic effects of industrial wastes. Similar observations were reported by Vrijheid *et al.*(2002) that the toxicity on gene by an unknown mixture is evaluated by subjecting the sample to substances which is of biological origin and then examined for genetic aberrations/damage. Several number of bioassays using eukaryotic and prokaryotic organisms have been used to determine the potentials of solid waste leachates:natural or similated to induce cytogenetic/cytological damage.Leachate contaminated water bodies and leachates induced mutagenic and genotoxic effects in plant,animal and microbial systems. Several short-term assays have also been developed and used in the last three decades to assist in the identifications of genetic aberration in biological systems within the vicinities were solid waste are found as reported by Heath *et al*. (1984); Vrijheid *et al.* (2002). The induction of bridge, irregular nuclei and nuclear buds, loss and chromosome stickiness, polyploidy are parameters for the genotoxicity. The chromosome breaks and micronuclei are used to evaluate the effects of the mutagenicity as reported by Fernandes *et al*.(2007); Leme and Marin-Morales (2009); Souza *et al*.(2009).The cell aberrations observed in this study showed that simulated leachate from dumpsites were able to induce damages at the mitotic/ chromosomal level.

The physco-chemical parameter of leachate revealed in this study showed that the chemical interaction that produced the observed cytogenetic effects could be synergistic, individual or antagonistic. However the synergistic and antagonistic effects are of constant possibilities. The chemicals present in this study were known to be of mutagen, carcinogen and teratogenic. This result is similar to the findings of Buchinger and Schmid (1972) which revealed that Lead (pb) was strong carcinogen which breaks chromosome in Chinese hamster ovary cells, in bone marrow erythrocytes of rat (Tachi *et al.*, 1985) and in cells of *A. cepa* (Lerda, 1992). Cadmium, Nikel produced highly selective damage to heterochromatin in Chinese hamster genome (Costa *et al*., 1994; Ellinder and Jarup, 1996). Kjeldsen *et al.* (2002) revealed that the soluble organic component of the solid waste leachates which are dissolved organic matter is usually expressed as), total organic carbon (TOC) , chemical oxygen demand (COD) or biochemical oxygen demand (BOD). The leachates colours: yellow, brown, dark or black is as a result of the decomposition of organic matter present in solid wastes as revealed by Aziz *et al*.(2007).

This study further confirms the mutagenic/carcinogenic and teratogenic capacity of dumpsite leachates either in natural or simulated form. Bakare *et al*. (1999a, 1999b, 2000) reported the carcinogenic, cytotoxic and mutagenic damages of raw and stimulated leachate from institutional, domestic and industrial waste dumpsite in South-West Nigeria. Similarly, Cabrera *et al*. (1999) reported the genetoxic effects of landfill leachates on *A. cepa.* The metacentric nature and large size of the chromosomes could be reasons for the sensitivity of the *A. cepa* to the chromosome aberration observed in this study.

In conclusion,the aberrant effects observed in the onion roots/chromosomes exposed to different concentrations of the simulated leachate is an indication that the leachate could be mutagenic,carcinogenic or teratogenic when exposed to. These also explains the danger of exposure to the present and future generations of communities living in the vicinity of dumpsites.The significance of this study can not be over emphasized. Consequently, results from genetic bioassays such as the results obtained in this research are relevant to human health because the toxicological target is DNA, which exist in all cellular forms/arrangements.

5. CONCLUSIONS

The results of the study is relevant in environmental management,so we therefore recommend that the general populace should stop generating dumpsites within their environment:these could reduce/eradicate soil and underground water contamination resulting from leachate generation and percolation. The effects of such uncontrolled disposal systems renders surface and underground waters unsafe for human,agriculture and recreational use,destroys biotic life,poison the natural ecosystems,poses a threat to human life and its therefore against the principle of sustainable development.

Allium cepa test techniques should be employed for the evaluation of chemicals in the environment that may cause mutation from a wide range of contaminants or pollutants such as sewage effluents from different sources and leachates from dumpsites.

Avoid construction of wells,boreholes etc down the location of dump sites:because if constructed,the leachates generated from the solid wastes may percolate through permeable soil strata and pollute/contaminate surface or underground aquifer (water) which may flow down to the wells,boreholes etc.

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