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Chemical Studies on Leaching of metals at E-Waste Site of municipality of Sidhi city of m.P. India

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Abstract: *The Present day world facing the negative impact of E-waste, where, natural resources like air, soil and water are being affected largely. In the present work the discarded electronic components were allowed to leach in water samples and the leachate were analyzed for the presence of heavy metals. The result obtained that even if the contact time is short the toxic elements tend to leach to a great extent. The result obtained signals that most of the metals have a tendency to leach and the extent of leaching depends on the quality of water (Such as Rain Water, River Water, used waste water etc) The leaching of metals results into the physicochemical properties of the water used for leaching purposes. These results signal the danger of dumping of the discarded electronic components at the municipal waste site where the water is stagnated.*

Key Words: *Toxicity, leachate, E-waste, metals.*

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I. Introduction

With the electronic revolution, use and throw culture of the advanced society presently it become the major problem for the municipalities to manage the E-Waste properly for saving the mankind from environmental pollution.The central pollution control board of India (CPCB) has been projecting the amount of generated E-Waste time to time since this problem came into existence. According to its report 65 cities in India generate more than 60% of the total E-Waste. The largest quantity of E-Waste generated by Maharashtra followed by Tamilnadu, Andhra Pradesh, U.P. W.B. Delhi, Karnatka, Gujrat, M.P. and Punjab. The city which generates largest quantity of E-Waste is Mumbai followed by Delhi, Bangalore and Chennai.Toxic substances like lead, Cadmium and mercury leach into the soil and finally pollute the ground water if E-Waste is dumped into the ground. The metals because of their strong toxicity even at low concentration affect the water resources to the greater extent therefore this study focused, the change in the quality of water due to the leaching of metals specially heavy metals and the negative impacts on environment and in the human health.

II. Materials And Methods

Sample collection, preparation and Analysis done with the help of appropriate and prevalent methods. Water sample were collected randomly from Sukha Nalah of Sidhi city and E-Waste from municipal waste site and house hold waste. The sample were heated to about 100^0C in a furnace and crushed into minute particle using motor. The leachate solution were prepared by taking 20 gram of the crushed material in 100 M.L. of the different water sample in a 250 ML beaker and allowing to stand for 6 days with random stirring. After 6 days the suspension was filtered using whatman filter paper this filtrate in now called as leachate.Determination of various physicochemical properties were carried out with the help of the procedure laid down by (APHA) American public health Association the result has been reported in the following table 1, and 2, The quantitative analysis of toxic metals was done with the help of spectrometer at the (NIT) MANIT Bhopal and has been given in table-3 and in the last table-4 National/International standards for water quality has been shown.

Table-1Chemical Parameters

S. No.	Chemical Parameter	Sukha Nalah Water Sample (SNWS)					
		SNWS1	SNWS1+Leac	SNWS2	SNWS2+	SNW	SNWS3+Le
1.	Alkalinity (PPM)	500	550	350	400	600	690
2.	Hardness (PPM)	490	550	370	385	530	560
3.	Chloride (PPM)	160	175	190	250	200	240
4.	Calcium (PPM)	150	380	190	400	420	600
5.	Magnesium (PPM)	270	--	300	150	150	150
6.	Phosphate (PPM)	>0.4	>0.4	>0.4	>0.4	>0.5	>0.5
7.	Iron (PPM)	1.2	<0.4	<0.4	<0.4	<0.3	<0.3
8.	Ph (PPM)	5.82	6.75	4.92	4.32	6.39	7.12

Table-2 Physical Parameter at 30^0 C

Sample	Conductance1MS=1 Micro mhos		TDS 1ppt=1g/L		Density Kg/M^3	Viscosity X 10^{-4} NSM^{-2}	Ultrasonic Velocity $X10^3$ MLS
	20 MS	200 MS	20 PPT	200 PPT			
SNWS-1 SNWS1+Leachate	5.48 2.72	5.39 2.5	2.08 3.01	2.07 3.80	995.0 998.0	1.08 1.06	1.25 1.48
SNWS-2 SNWS2+Leachate	4.80 10.57	4.70 11.30	2.46 4.48	2.7 4.6	992 945	1.03 1.031	1.266 1.610
SNWS-3 SNWS3+Leachate	4.18 8.27	4.90 8.1	2.78 4.21	2.7 4.2	995 993	1.58 1.19	1.57 1.28

Table-3 Quantitative Analysis of Metals in the Leachate

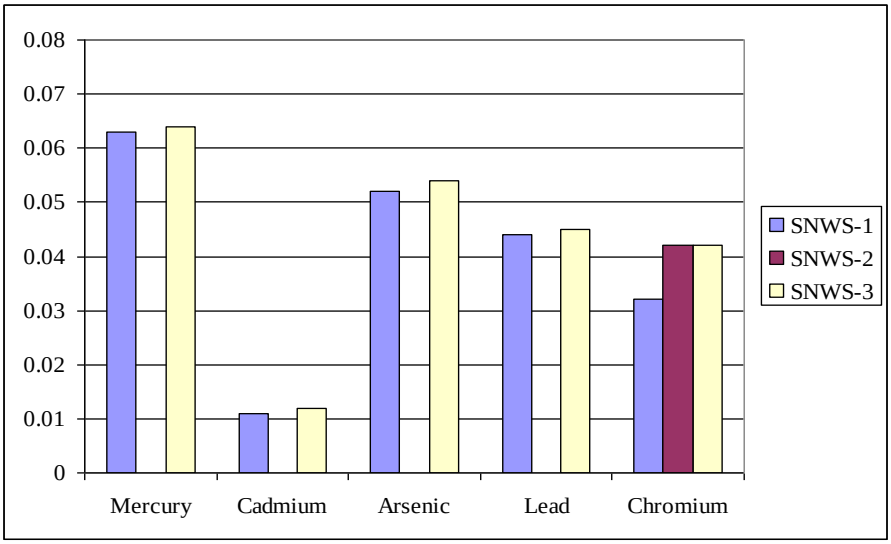
S. No.	Heavy Metal Concentration	Leachate 20 %		
		SNWS1+Leachate	SNWS2+Leachate	SNWS3+Leachate
1.	Lead	<0.044	BDL	<0.045
2.	Mercury	<0.063	BDL	<0.064
3.	Arsenic	<0.052	BDL	<0.054
4.	Cadmium	0.011	BDL	<0.012
5.	Chromium	0.032	<0.042	0.042

Table-4 National and International Standards of water quality

S. No.	Parameters	Drinking Water					
		BIS		ICMR		WHO	NSDWR
	Measured in Mg/L	Desirable limit	Admissible limit	Highest limit	Desirable limit	Permissible value	
1.	TDS Mg/L	500	2000	500	1500-3000	1000	500
2.	Alkalinity	200	600	--	--	--	--
3.	Hardness	300	600	300	600	500	--
4.	Calcium	75	200	75	200	--	--
5.	Magnesium	30	100	50	--	--	--
6.	Chloride	250	1000	200	1000	250	250
7.	Sulphate	200	400	200	400	--	--
8.	Iron	0.3	1.0	0.1	1.0	0.3	0.3
9.	Arsenic	0.01	0.05	--	0.05	0.05	--
10.	Cadmium	0.01	NR	--	0.05	0.05	--
11.	Chromium	0.05	NR	--	--	0.05	--
12.	Lead	0.05	NR	--	0.05	0.05	--
13.	Mercury	0.001	NR	--	0.001	0.001	--
14.	Copper	0.05	1.5	--	--	--	1.0
15.	PH	6.5 to 8.5	NR	7.0-8.5	6.5-9.2	6.5-8.5	6.5-8.5

NR- No Relaxation

Fig-1 Presence of Toxic elements



III. Result and Discussion

When the E-Waste mixed with water samples the parameters like PH, hardness conductance and TDS have changed (As shown in the table 1, 2, and 3) the water sample SNWS-3 (Sukha Nala) at the time of its collection was more acidic than that of SNWS-2 and SNWS-1 and thereafter when mixed with E-Waste it became more acidic. The PH value was found more with sample SNWS-3 and least with SNWS-2. The hardness of water has increased in all the leachates. The conductance value of the sample SNWS-1 decreased to half in the leachate while the value with other samples (SNWS-2 and SNWS-3) were seen increased to twice or more than twice. The TDS value showed an increase in the all leachate with all the samples. The physical parameters like density and viscosity did not vary much due to the leaching of E-Waste with water.Fig-1 shows that some of the toxic elements are below the detection level (BDL) along with trace of some toxic elements such as Arsenic, Cadmium, Chromium, Mercury and Lead were also found when the E-Waste mixed with the water samples.The standard value for water quality has been shown in the table-4 where BIS, (Bureau of Indian Standards) ICMR (Indian Council of Medical research) WHO. (World Health Organization) and NSDWR has declared their standard value, with these value when compared the value obtained with this work it is found that the elements like Cadmium, Arsenic, Chromium, Lead and Mercury have MCL value (Maximum contaminant value) of 0.01 Mg/L, 0.05 Mg/L, 0.05 Mg/L, 0.05 Mg/L, and 0.001 Mg/L respectively.The average concentration of the toxic elements evaluated by (AAS) Atomic absorption spectrophotometer in the water samples of the Sukha Nala of Sidhi town, were found to have Zn (2.2 ppb), Fe (0.32 ppb), Cu (0.0066 ppb), Cr (0.001 ppb), pb (0.0039 ppb), Ni (0.0173 ppb), As (0.2330 ppb), Cd (0.00606 ppb).The Sukha Nala flow from North to south across the middle of the sidhi town and it has stagnated water which once filled in during rainy season along with house hold and other activities oriented waste water discarded electronic waste etc. throughout the year hence the presence of toxic elements were quantitatively observed.It is also observed that due to stagnated water in the Sukha Nala the toxic metals leaches within a short period and make the water harmful for drinking and for other domestic purpose even harmful for irrigation purposes.

IV. Conclusion

This study concluded that leaching of E-Waste with Sukha Nala Water resulting in to making surface water and underground water harmful for drinking purposes in the whole of the geographical area of Sidhi town.

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