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Evaluation of chemical contamination of surface water and groundwater in the landfill city of Ardabil

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ABSTRACT

Todays in our country the problem of waste disposal and the effects of entry alluvial aquifer their leachate and pollution of aquifers by hydrodynamic thickness in the direction of groundwater flow is highly regarded analytical descriptive study was conducted. To this purpose, the concentration of heavy metals plumb and cadmium and some physicochemical and biological parameters of surface water and groundwater around the landfill city of Ardabil in two time periods in spring 2015 and summer seasons were measured. Sampling, preparation and analysis of samples in accordance with the standard method of station 10 to within 5.5 km of landfill were Ardabil. Measurement of heavy metals, plumb and cadmium by atomic absorption were performed. The Results were analyzed by SPSS software, for the comparison of each parameter with drinking water standards and Agriculture tests comparing the average (T-TEST) was used. The results showed that groundwater and surface water of heavy metals, non-contaminated area and their results are below international standards. The mean values of microbiological and physicochemical parameters other than normal turbidity level and at the level of 1% were significantly lower than international standards.

Keyword: *Environmental pollution, heavy metals, municipal solid waste, landfill, Ardabil*

Introduction

Quality of water resources in each region is influenced by factors of natural or artificial origin changes to the physical, chemical and biological cause. These changes are serious limitations to the exploitation of water resources pose as the origin of life. The process of development in the country, including Iran has created widespread issues of water pollution and this becomes more important to show that more than 52 percent of its water from groundwater sources. Among the sources of underground pollutants, solid waste disposal by burial in the ground is the major sources of pollutants and can say unequivocally that all developed countries, developing and developed, with the face. In this way, 92% of the world accounted for the disposal of solid waste (Abedi Kupaei, 2001). The problem of man after food and water supply, waste disposal problem is (Galin, 2004). If the landfill and solid waste leachate and gas emissions are not controlled may exhibit different environmental impacts. Leachate generated in the landfill of municipal waste contains large quantities of contaminants including organic matter (such as fatty acids and alcohols) and inorganic (e.g. metal and ammonium nitrogen) (Androtetla et al., 1992). A leachate wastewater with high concentrations of organic and inorganic waste and sometimes sewage with high levels of toxic pollutants is defined (Kuwati et al., 2009). Leachate can contaminate surface water and groundwater, which is one of the main difficulties landfills have leachate problem of groundwater contamination due to penetration (Sing et al., 2010). Landfill leachate can be divided into two types of leachate and old. Landfill leachate formed in the early decomposition of waste. This type of latex, especially during aerobic decomposition stage, which includes biodegradable arise. BOD and COD of leachate have a high. Funeral that was to grow old leachate at the site of the largest concentration of pollutants dropped it is formed. 30-25 years old, after a landfill, waste is fully stabilized. Low concentrations of leachate are pollutants in such a place. This type of a funeral cannot be too harmful leachate (Khan et al., 2003). The water that we use as drinking water, we should be in accordance with existing standards, which will be presented by national and international organizations accredited (Amirbeygi, 2004). Unsanitary disposal of solid waste will be

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followed by numerous environmental consequences. Leachate contamination of groundwater resources, one of the most important environmental concerns associated with the disposal of solid waste is incorrect (Wagner, 2009). Non-observance of site selection, preparation inappropriate and unscientific landfill and improper disposal techniques, leading to the production and release of leachate in the landfill and leachate underground layers is downward (Aywood 2007). Concerns about heavy metals in drinking water are increasing (Yeh et al, 1976; Ahmad et al., 2009). Today, water pollution with heavy metals has become a global problem (Skabyra et al., 2010). Groundwater from both quantitative and qualitative aspects are dealt with, the developing countries and the Third World, according to find the most suitable aquifers to supply water for drinking, agriculture and industry are concentrated. However, less attention is given to maintaining quality aquifers (Datta 1997).

Leakage of heavy metals through pipe corrosion, pollution of drinking water makes up a significant percentage (Crayon et al. 2001). Login municipal waste, inappropriate waste disposal industry, agriculture, environment are other ways of getting infected by the human environment. The importance of water resources, particularly surface runoff (rivers) the water needs of humans, animals and industries, the need to protect them in more than ever. With the arrival of municipal waste, industrial and agricultural water supplies, many biological and chemical contaminants such as heavy metals into these methods.to-be (Prabhu 2009, Kahn et al., 2012). Heavy metals are stable in the environment and are toxic to living organisms and tend to accumulate in the tissues of plants and animals. This way synthetic metals such as burning fossil hardness, mining, agricultural wastewater, surface water collection, sewage treatment plants, transportation and waste disposal centers etc. (Bahaskar 2010, humad et al. 2009),) and natural ways such as rainfall, soil erosion and soluble salts dissolved into water tanks placed (Netpay et al., 2009).

Trace elements are present naturally in small amounts in water (Fikt et al. 2007). Many of these elements have a dual role in the human body. So that at least harmless values and in some cases even beneficial to health, but higher than standard drinking water can have serious effects on health (Ahmad et al., 2009 Khan et al. 2003). Lead is the most common metals in the earth's crust which amounts to 13 mg per kg there. Lead is the most serious heavy metal pollution of the atmosphere. Halides of lead from automobile exhaust are the most common form of lead in the atmosphere. Cadmium is one of the few elements that have no constructive purpose in the human body. This element and that even a small amount of soluble compounds, toxic (Piruhit 2007). The maximum limit for cadmium in drinking water is based on the average daily consumption of drinking water equivalent to 2.5 liters, for a man weighing 70 kg, 0.005 mg per liter (Ahmadi, 2008). Lead concentrations in drinking water are usually in the range of 25-2 I /g µ is (Yaghmaeiyan, 2001).

1.1.Necessity and Objective of Research

Because of the proximity of landfill in rural and urban areas and environmental risks, the effect of landfill leachate center of Ardebil on surface and underground water resources in the region and provide the necessary policies to reduce emissions for municipal solid waste landfill leachate Ardebil for the first time this study was conducted.

2.Methods and Materials

This study was descriptive, analytical and measuring the concentration of heavy metals as well as some physicochemical and biological parameters surface and groundwater around the landfill was Ardebil city. In the spring and summer 2015 sampling interval from surface water and groundwater was carried out. 10 water samples to measure the pollution of the waters around the area, including 5 samples of surface water and 5 underground water was were taken, sampling of surface water and groundwater from the 2 km radius of 5.5 km of landfill Ardebil (village Taleb Gheshlaghi) is done. For sampling the dark-colored polyethylene containers the volume of 1.5 liters was used. In order to protect water samples to measure heavy metals 1.5 ml per liter of concentrated nitric acid were added to the sample pH is less than 2. In the case of surface water sampling was carried out according to standard methods of sampling and refrigerated at 4 ° C until used. Testing of heavy metals lead and cadmium by atomic absorption and chemical oxygen demand by Perkin Elmer model DR-2000, total

dissolved solids by gravimetric method, acidity with acidity and electrical conductivity by a conductivity meter digital meter in situ measurements. After testing and data logging parameters determine the average concentration rate and then compare the results with the standards of drinking water and agriculture in chemical pollution caused by leachate percolation to groundwater resource has been determined. The physic-chemical properties and microbiological surface water around the landfill were also examined. Statistical analysis of data was done by SPSS software. For the comparison of each parameter with the standards of drinking water and agricultural and previous results, the test compares the average with fixed number (T- Test) were used.

3.Research Findings

Results of analysis chemical and bacteriological parameters studied to separate stations case Based on the sampling time shown in Table (1) and (2)

Table 1: The results of physicochemical and biological parameters of surface water and groundwater physicochemical parameters studied at selected stations - The first

	Station code	EC µs / cm	pH	TDS (Mg / l)	COD Mg / l)	BOD (Mg / l)	Turbi (NTU)	DO (Mg / l)	T (° c)
Surface water	1	498	6.4	343	7	2	0.44	2.5	18.3
	2	558	6.8	390	4	1	0.82	5.9	19.6
	3	483	6.9	338	4	1	0.55	5.1	19
	8	600	6.6	420	6	2	0.38	3.2	21
	9	1051	6.7	735	5	5	9.13	4.9	22.3
Groundwater	4	572	7.7	400	-	-	-	-	16
	5	262	6.2	1844	-	-	-	-	18.1
	6	352	6.5	247	-	-	-	-	16
	7	368	6.4	257	-	-	-	-	15
	10	277	8.3	1924	-	-	-	-	17

Sign stations based on the number in the table:
1: Khalaj village (km 2) 2: Khalaj village (Km 2) 3: Khalaj village (km 2.5) 4: Khalaj village (km 3) 5: Taleb Gheshlaghi village (km 3 SE) 6: Taleb Gheshlaghi village (km 3 South) 7: Taleb Gheshlaghi village (km 3 SW) 8: between the Khalaj - Jamayran village (km 4.5) 9: Jamayran village (km 5) 10: Jamayran village (km 5.5).

Table 2: Results of physicochemical and biological parameters of surface water and groundwater at selected stations studied the physicochemical parameters - the second time

	Station code	EC µs / cm	pH	TDS (Mg / l)	COD Mg / l)	BOD (Mg / l)	Turbi (NTU)	DO (Mg / l)	T (° c)
Surface water	1	496	6.5	347	6	2	0.68	2.9	19.1
	2	557	6.7	4.3	4	1	0.59	4.7	17.6
	3	449	7.1	326	3	1	0.77	4.9	18
	8	605	7.2	423	4	1	0.65	5.4	18.2
	9	1074	6.9	752	6	2	9.48	5.1	18.4
Groundwater	4	573	7	401	-	-	-	-	16
	5	216	6.8	1511	-	-	-	-	15
	6	374	7.2	262	-	-	-	-	14
	7	299	6.6	209	-	-	-	-	14
	10	286	7.8	256	-	-	-	-	13

Table 3: Comparison of the results T-test test parameters in the study of groundwater with international standards

Standard	Parameter	Turn	Average	t-Test	Degrees of freedom	Significance level	Mean difference	About the 95%	
								Lowest	Maximum
WHO 500	EC	1	366	-2	4	0.073ns	-133	-287	20
		2	365	-2	4	0.085ns	-134	-298	29
WHO 6.5	pH	1	6	0	4	0.00**	0	-1.491	1
		2	6	4	4	0.016*	0	0	0
WHO 1500	TDS	1	934	-1	4	0.00**	-565	-1645	513
		2	527	-3	4	0.017*	-972	-1660	-283
**, * And significant ns, respectively, at 1%, 5% and non-significant shows.									

Table 4: Results T-test test parameters of surface water by international standards

Standard	Parameter	Turn	Average	t-Test	Degrees of freedom	Significance level	Mean difference	About the 95%	
								Lowest	Maximum
FAO 700	**EC**	1	639	6.048	4	0.004**	637	344	929
		2	636	5	4	0.005**	635	322	948
FAO 6.5	**pH**	1	6	2.092	4	0.00**	0	-0.0588	0
		2	6	2	4	0.00**	0	0	0
FAO 450	**TDS**	1	445	-0.065	4	0.00**	-4	-210	200
		2	450	-0.003	4	0.00**	0	-214	215
EPA 2	**Tiff**	1	3	0.00	4	0.00**	0	-4	0.0339
		2	3	0.00	4	0.00**	0	-4	5
EPA 5	**DO**	1	4	-1.075	4	0.00**	0	-2	1.761
		2	4	0.00	4	0.00**	0	-1	0
EPA 30	**BOD 5**	1	1	-115	4	0.00**	-28	-29.0801	-27
		2	1	-116	4	0.00**	-28	-29	-27
EPA 120	**COD**	1	5	-196	4	0.00**	-114	-116	-113
		2	4	-192	4	0.00**	-115	-117	-113
** Ns, respectively significant and non-significant at the 1% level and shows.									

Discussion and Conclusion

According to the results of the evaluation for the heavy metals lead and cadmium in water surface and ground zero was regardless of the statistical analysis. According to the Environmental Protection Agency standard 1053 America and Iran, the maximum allowable concentration of cadmium in drinking water 5 and 3 micrograms per liter set. World Health Organization guide about the element 3 micrograms per liter. Cadmium concentrations in the study area micrograms per liter less than zero and less than the values of America Environmental Protection Agency standards, national standards and guidelines set by WHO is the value. Cadmium concentrations in samples of irrigation, less than the standard UN Food and Agricultural Organization of Iran and the 1053 standard of 10 micrograms per liter guidelines set by WHO that has been set. In the case of lead America's Environmental Protection Agency maximum allowable concentration in drinking water is 15

micrograms per liter, it has set. Iran and directive 1053 according to the World Health Organization maximum is allowable concentration of 10 micrograms per liter (Mibrahti et al., 2013). For irrigation, the United Nations Food and Agriculture Organization standards and guidelines set by WHO standard 1053 of Iran and the amount of about 5000 micrograms per liter of lead. The average lead concentration in the study area to zero micrograms per liter lower than the standard values of America Environmental Protection Agency, the national standard, the standard Food and Agricultural Organization and World Health Organization guidelines for drinking and irrigation.

In this study, to evaluate the chemical quality of groundwater in the landfill area was the city of Yazd. Samples of alkaline concentration and other chemical parameters, was tested and showed a significant increase the alkalinity in water downstream showed (Ebrahimi et al., 2009) and according to the Food and agricultural organization for irrigation. Groundwater has been studied, according to WHO guidelines, standards and national standard Food and Agricultural Organization of Iran at an optimal level that is consistent with the results of this study. Emadi 2007 to investigate groundwater contamination in Surrey Semeskandeh by entering landfill leachate and them finally concluded that the leachate from the landfill many causes of groundwater pollution are sent downstream sectors.

In another study by Rajaei et al water resources that are considered reliable sources. This study also yielded this result. In studies conducted in 2002 by Jose Landfill on groundwater resources adjacent areas of the metropolis in Spain showed pH, electrical conductivity and concentrations of trace elements have increased significantly. National and international, which represents the non-contaminated surface water in terms of physicochemical and microbiological parameters are. Also analysis of variance groundwater parameters other than the parameter of total dissolved solids in the first few stations was lower than the national and international standards. According to Table 3 compares the T-test groundwater test results showed that the average value of the parameters compared to international standards difference was statistically significant at 1% level. Values are lower than international standards. In a study entitled factors sprawling city landfill pollution of groundwater resources physicochemical from four wells around the landfill was carried out in different seasons, allowed values electrical conductivity and total dissolved solids higher than the standard limits the WHO has (Dehghani et al., 2010). According to Table 4 compares the results of T-test surface area with international standards and according to test results obtained showed a lower level than the parameter turbidity (3 nephlometry Nephelometric Turbidity Unit (NTU)) whose value is determined from the standard Environmental Protection Agency (EPA) (2 nephlometry) above indicates that the region is the high concentration of water turbidity.

According to the results of the statistical description of groundwater in the first and second non-parameter data average total dissolved solids is normal.

The study area with an average electrical conductivity (366) cm in the first innings and (365) cm in the second, which is less than the standard (WHO) world Health Organization (500) cm and the average electrical conductivity in drinking water (639) cm in the first innings and (636) cm in the second, which is less than the standard Food and Agricultural organization (FAO) (700) water and agricultural cm (World Health organization 2003 the UN Food and Agriculture organization, 1999). Potential of hydrogen in the study area equal to 6 in the first and second America Environmental Protection Agency standard (8.5 -6.5) and standard 1053 of Iran (9-6.5) is acceptable for drinking purposes (Mibrahti et al., 2013). About this parameter in irrigation water according to Standard 1053 of Iran and the Food and Agricultural Organization and World Health Organization guidelines by 8 to 6.5, 8.5 to 6 and 9-6 according to which groundwater resource to be within the standards set behalf (Baychi et al. 2013). Maximum total potential of hydrogen in drinking water according to World Health Organization is (1500) milligrams per liter. The study area with an average total dissolved solids (934) ppm mg queued first and second (527) is lower than national standards, as well as the Food and Agricultural Organization standards for maximum allowable total dissolved solids in the

water and Agricultural (450) mg the first queued (445) and second queued (450) ppm were obtained for surface water area given that under international standards, but above the mean of total dissolved solids the recent drought, reduced rainfall and indiscriminate harvesting of groundwater resources due to that population growth.

Turbidity in the study area (3 nephlometry) which is higher than the standard guidelines Environmental Protection Agency (2 nephlometry) is in the irrigation water. Dissolved oxygen parameters of biological oxygen demand and chemical oxygen demand, in the region of irrigation water, respectively, in the first 4, 1, 5 mg and in the second innings, 4, 1, 4 milligrams per liter less the environmental protection agency standard values, respectively 5, 30, 120 mg. Recent work on groundwater resources downstream sanitary landfill Yemen in 2009 was one of the cities, and chemical oxygen demand of the parameters that the results showed that in most the study, concentrations of this parameter above the acceptable standards set by the Ministry of water and environment of Yemen as well as international standards and cause it to leak leachate from the landfill have detected underground (Alsabahi et al. 2009).

Conclusion

In general, it can be concluded that the further away from crowds landfill (study area) similar metals groundwater and surface water area of heavy and non-polluting cadmium and the average results in all parameters except for parameter opacity that last station (Station 9) surface water every two times higher than the environmental protection agency and parameter total dissolved solids in groundwater, which in the first queued station showed a higher rate than normal and the second is significant at 1%.

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