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THE DETERMINATION OF SOME CHEMICAL POLLUTION PARAMETERS (Cd, Al, Fe) IN TUZLA BALIK LAKE

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Abstract. This study aims to search the some chemical (Cd, Al, Fe) pollution parameters in the Tuzla Balık Lake. For this purpose 50 water samples were taken and analysed from 5 stations in the lake, during a year period. For detecting the chemical pollution, dithizone, aluminon and 1.10 phenanthroline methods were used for analysing Cd, Al and Fe amounts respectively. APHA standart method protocols were followed during the analysis. Our results were compared with the standarts of World Health Organization, European Comittee and Undersecretary of Environment Turkish Government Primiership. Cd pollution were also very high every sample. On the other hand, Al and Fe levels were also found to be within normal limits in all samples taken the rest of the year.

1. Introduction

Tuzla Balık Lake is at the southwest of Kocaeli peninsula and surface area of Tuzla peninsula. It is a lagoon lake at the inside of the Aydınlar harbor formed as a result of seperation from the sea by artificial cords. It has all the characteristics of brackish waters and has an upmost depth of 80-90 cm. Tuzla Balık lake is under the effect of climate of Marmara sea [1]. In Tuzla Balık Lake, the water quality has decreased as a result of dispersion of Umurbey river ground water and wastewater carried by the surface waters. The floor of the lake is filled about 40-50 cm by the suspended material carried by the waste waters, excess biological production and particulate material carried by the surface flows. This media affects the fish and bird species negatively in the lake. In summer seasons, the relation of lake with the sea decreases nearly to zero. Because in this season, the depth of the water decreases, and the vent between the lake and the sea can not operate. Because of the lack of flow from the lake, the pollutants coming by the ground waters can not be removed, so many chemical and bacteriological pollutants accumulate in the lake water [2]. Environmental pollution also threats one of the most vital needs of all living

Key Words. Aluminon, Cadmium, Environmental pollution, Iron, Tuzla Balık Lake.

creatures in water. Water pollution is the discharge of some undesirable materials into water in high amounts. In other words, water pollution is an issue that comes true by artificial effects, that constraints or prevents and that desroys the ecological balance [3]. The limit values of waste waters of some industries (food, mining, coal, textile, paper, chemistry, metal industry etc.) that are found in natural landscapes of tranquility bases and rivers change with respect to the type of pollutant and function of industry.

Chemical pollutants are divided into three sub-groups [4, 5].

1. Non-spoiled: Degradation is not observed in some inorganics such as chlorine. Their concentration increases in receiver water, decreases with the rains.
2. Changeables: These are biologically degradable. They are turned into stable inorganic substances by microorganisms.
3. Permanents: Those are some which can accumulate such as mercury, arsenic, cadmium, chromium, lead, copper, some organics such as agricultural chemicals and some radioactives that has long half-lives.

1.1. Cadmium (Cd). The main sources of cadmium are some processes applied in the extraction and production of iron, steel, cadmium, zinc, lead and copper. The main uses are pigments in electrolyte coverage, paint, ink, and plastics, stabilizers for PVC, some alloys, and nickel-cadmium batteries. Also, in some industrial applications such as hardening of rubber, photography, mirrors, production of fungiside and insecticide, TV tubes, Center line production in nuclear power plants, etc., about 8,5% Cd use is valid [4]. The solubility of Cd is dependent on type and acidity of the water. The surface waters that include more than several micrograms of Cd are most probably contaminated by industrial wastes, leakage of agricultural manure, and sewerage wastewater [6, 7].

Health Effects. Poisoning of Cd is by the way of breathing and food. Poisoning by food Cd creates kidney and bone diseases and severe acute digestion problems occur. The accumulation of Cd in kidneys is a sensitive situation for health. The Cd taken in body by the potable waters accumulate in bones. Some heavy industry workers who are opposed to Cadmium oxide vapor and powder are caught to bronchides, anemia and kidney diseases. It is found out that it also causes cancer in laboratory animals [8].

1.2. Aluminum (Al). Al ion creates an important environmental problem. The Al that dissolves in water from the aluminum containers may cause failure in the nerve system. Al is found abundantly in the earth crust. It is found in rock and soil as mineral. The way of Al mixes into water by the way of industrial wastes, erosion, dissolution of mineral and salts, atmospheric dust pollution and rains [8].

Health Effects. Al is not an essential mineral for human body. Al salts can not be absorbed foods and salts, but they combine with phosphates and extracted from the body.The Al in the body mostly accumulates in the bone tissues. When Al is inhaled as dust, it is known to accumulate in lungs and lymphs. It is evident that it is related with neurologic diseases. An example for that is dotage in dialysis and Alzheimer [8]

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1.3. Iron (Fe). Iron forming about 5% of the earth crust is second after aliminum in minerals in terms of abundance in metals. The iron in natural waters is a result of dissolution of rocks and minerals, acidic sewerage waters, manured lands and leakages from sewerage and the final product of iron processing units [9, 10].

Health Effects. Iron is a basis element for humans. It is found in the structure of some biologically vital proteins such as oxidation-reduction enzymes Hemoglobin and sitochrome. It is assumed that about 7-14 mg of iron is needed dependent on the age and sex [8, 9].

2. Material and Methods

This study aims to search the chemical pollution in the Tuzla Balık Lake and made in the Marmara University, The Research Center for Nature Plants and Water Products Laboratories. In the detection of chemical pollutants, sampling of water is as following: For cadmium detection, the samples are taken in plastic or glass bottles put in nitric acid. For aliminum detection, the samples are taken in clean plastic or glass bottles. For iron detection, the samples are taken in clean plastic bottles [11, 12].

2.1. Detection of Cadmium (Dithizone method): 250 ml of sample is put into the distillation funnel. One tablet of buffer powder pillow for heavy metals is added and mixed. On the other side a dithiver metal reagent with 30 ml of chloroform is formed and well mixed. Also, 20 ml. % 50 sodium hydroxide and 0,1 g potassium cyanure is added to the funnel, after that 15 seconds of well mix and waited for 1 minutes. After that 1 minute, if any cadmium exists in the sample, it turns into pink by the effect of chloroform. The intense and dark phase seperated at the bottom of the funnel is drawn. 25 ml. of sample from the remaining pink part is taken into test bottle for Cd detection and another 25 ml is taken to use in the chloroform tube. The values are read in spectrophotometer at 515 nm. wavelength and evaluated as $\mu g/l$ [10].

2.2. Detection of Aluminum (Aluminon method): 50 ml of sample is taken into the test bottle. Into one tablet of ascorbic acid powder pillow is added and dissolved. Then, aluver-3 aluminon reagent powder pillow is added and well mixed for 1 minute. 25 ml of that solution is taken to another test bottle. On the remaining 25 ml

solution, bleaching powder pillow is put. It is very well mixed for 30 minutes and waited for 15 minutes in the reading tube. It is read at 522 nm in the spectrophotometer and evaluated as mg/l [10].

2.3. Detection of Iron (1.10 Phenanthroline method): 25 ml of sample is taken into the test bottle. One tablet of ferrous iron reagent powder pillow is added and well mixed. If it turns into orange in colour, the existence of iron is certain. The blank tube consist of water sample. After waiting for 3 minutes, it is read at 510 nm in the spectrophotometer and the values are evaluated as mg/l [10].

3. Results

This study aims to search the chemical (Cd, Al, Fe) pollution in the Tuzla Balık Lake. For this purpose 50 water samples were taken and analysed from 5 stations in the lake, during a year period. For detecting the chemical pollution, dithizone, aluminon and 1.10 phenanthroline methods were used for analysing Cd, Al and Fe amounts respectively. APHA standart method protocols were followed during the analysis. Our results were compared with the standarts of World Health Organization, European Comittee and Undersecretary of Environment Turkish Government Primiership. As seen in Table-1, Cd pollution were also very high every sample. On the other hand, Al and Fe levels were also found to be within normal limits in all samples taken the rest of the year.

Table.1- The values of Cd, Al and Fe (in 100 ml) in the Tuzla Balık Lake in a year period.

POLLUTION PARAMETERS	MONTHS	1.Station	2.Station	3.Station	4.Station	5.Station
Cd (μg/l)	February'98-March April-May	42	34	41	66	48
	June-July August-September	78	67	48	68	50
	October-November December-January	74	70	64	68	64
Al (mg/l)	February-March April-May	0.01	0	0	0.01	0
	June-July August-September	0.03	0.06	0.03	0.05	0.06
	October-November December-January	0	0.06	0	0.05	0.04
Fe (mg/l)	February-March April-May	0	0.1	0.01	0	0.01
	June-July August-September	0.01	0	0	0.01	0.01
	October-November December-January'99	0.02	0	0	0.01	0.01

Table.2- The chemical quality criteria of WHO, E.U and Holland for potable waters [13].

CHEMICAL PARAMETERS	W.H.O	E.U.	Holland
CADMIUM (μg/l)	5	5	1-5
ALUMINUM (mg/l)	0.2	0.05 - 0.2	0.2
IRON (mg/l)	0.3	0.05 - 0.2	0.2

Table . 3- The quality criteria of internal water sources with respect to classes [14].

Water Quality Classes				
Water Quality Parameters	**I**	**II**	**III**	**IV**
ALUMINUM (μg Al/l)	<0.3	<0.3	<1	>1
ARSENIC (μg As/l)	<20	<50	<100	>100
BARIUM (μg Ba/l)	<1000	<2000	<2000	>2000
BOR (μg B/l)	<1000	<1000	<1000	>1000
CADMIUM (μg Cd/l)	<3	<5	<10	>10
CHROMIUM (μg Cr^{+6}/l)	<20	<50	<200	>200
COBALT (μg Co/l)	<10	<20	<2000	>200
COPPER (μg Cu/l)	<20	<50	<200	>200
CYANURE (total)(μgCN/l)	<10	<50	<100	>100
FLORINE (μg F/l)	<1000	<1500	<2000	>2000
FREE CHLORINE (μg Cl_2/l)	<10	<10	<50	>50
IRON (μg Fe/l)	<300	<1000	<5000	>5000
LEAD (μg Pb/l)	<10	<20	<50	>50
MANGANESE (μg Mn/l)	<100	<500	<3000	>3000
NICKEL (μg Ni/l)	<20	<50	<200	>200
SELENIUM (μg Se/l)	<10	<10	<20	>20
SULPHUR (μg S/l)	<2	<2	<10	>10
ZINC (μg Zn/l)	<200	<500	<2000	>2000

4. Discussion

Heavy metal ions such as Cu, Zn, Mn, Fe, Al and Ni are essential micronutrients for plant metabolism but when present in excess, these, and non-essential metals such as Cd and Pb can become extremely direct concern to human health [15]. the purpose of the study was to determine the concentrations of heavy metals in surfacial bottom sediments and water of the harbor, to assess their potential effects and to identify their possible sources. Sediment and water samples from 21 stations throughout the harbor were analyzed for grain size, total organic carbon and metals

Al, As, Ba, Be, Cd, Cr, Cu, Fe, Mg, Mn, Ni, Pb, Se, Sn, V and Zn to assess the extent of contamination in the Western Harbour of Alexandria. The results indicated that concentrations of metals in the sediments varied widely depending on the location [16]. Concentration of Cd, Co, Cr, Ni, Zn, Fe, Mn, Pb and Cu were determined in biota, water and sediment samples collected from the Sea of Marmara in Turkey by Topçuoğlu. The levels of Zn, Fe, Mn, Pb, and Cd in the macroalgae are higher than previous studies the Sea of Marmara. The order heavy metal concentrations in the mussel samples was: Fe>Zn>Ni>Mn>Cu>Pb>Cr>Cd>Co. The metal concentrations are generally lower when compared with the Black Sea mussels except Pb [17].

Cadmium has a special importance throughout the heavy metals found in high concentrations in analysis. Cd is accepted to be 0,01 μg/l in standard in World Health Organisation Potable and Reuse Water Quality Criteria. The values found are much higher than it has to be. Al and Fe does not exceed the standards. After the combustion of oils, plastics and solid wastes, Cd diffuses into atmosphere and will diffuse into sea, lake, and soil media accordingly [18, 19].

In Japan, it is found that the concentration of Cd in rice irrigated by water contaminated by waste water of a zinc production factory is about 10 fold of the standard values, which caused 100 people to be poisoned [4]. In the studies performed in Tuzla Balık Lake, it is seen that many kinds of commercially valuable fish were abundantly found in near times. Today however, none of those fishes exist [12]. Also in 1990, in an annual observation in Tuzla Balık Lake, it was seen that there were 36 different types of birds living there as a shelter. Tuzla Balık Lake has lost all of its water in the 1999 earthquake. TUDAV, observing the ecological structure of the lake for years, has explained the reasons of lake dying-drying and submitted the report of rehabilitation to the Province of İstanbul. As a result of the rehabilitation studies, it is planned to build two canals each 25 m long, 1 m in diameter between the lake and the sea, to let the sea water into the lake [20]. The ecological estimation of Tuzla Balık Lake –for which the chemical pollution data is obtained- is also essential to be performed. The interruption of connection of the lake with Umurbey river and the prevention of the extraction from the lake fastens the death of the lake. It also loses area by soil fillings and turns into a land that may be used for settlement in the future. The lake losing its depth and area quickly, after some time, may die and dry irreversibly. As a result of this study it can be concluded that the lake should be rearranged as a clean water source and recreation area, valid for the use of human, birds, fishes and other living creatures. Also other studies should also be performed and the public should be well informed about the item.

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TUZLA BALIK GÖLÜ'NDE KİMYASAL ANALİZLERLE (Cd, Al, Fe) BAZI KİRLİLİK PARAMETRELERİNİN TESPİTİ

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Özet

Bu çalışmanın amacı, Tuzla Balık Gölü'nde bir yıllık sürede aylık periyodlarla alınan göl suyu örneklerindeki kimyasal kirliliğin kadmiyum, alüminyum ve demir (Cd, Al ve Fe) birikiminin araştırılmasıdır. Bu amaçla gölde tespit edilen 5 istasyondan Şubat-1992/ Ocak-1993 tarihleri arasında toplam 50 göl suyu örneği alınmış ve incelenmiştir. Analizler sırasında APHA standart metod protokollerine uyulmuştur. Çalışmamızdan elde edilen değerler Dünya Sağlık Örgütü (WHO), Avrupa Komitesi (EU) ve TC.Başbakanlık Çevre Müsteşarlığı standartlarıyla karşılaştırılmıştır. Bu karşılaştırmalara göre tüm yıl boyunca alınan 50 örnekte Cd değerleri çok yüksek bulunmuştur. Al ve Fe değerlerinin ise tüm yıl boyunca normal değerler içinde kaldığı görülmüştür.

Anahtar Kelimeler. Alüminyum, Çevre Kirliliği, Demir, Kadmiyum, Tuzla Balık Gölü

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