Journal of Green Engineering (JGE)

Volume-10, Issue-2, February 2020

Determination of the Level of Some Metals in Environment Water Sources Around Van

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Abstract

For healthy and safe drinking water supply, monitoring and controlling the water until it reaches the end consumer is very important , F,As, Cu, Fe, Mg, Ammonia analyzes were performed in the water samples taken from the villages of Van Bardakçı, Çitoren, Kevenli Gölyazı and Tabanlı at Yıldız University Faculty of Science and Van YY Central Laboratory. Thoroughly washed and rinsed with 1/50 diluted HCl and rinsed thoroughly into a transparent pet bottle. After 3-5 minutes of water to be sampled and rinsed at least 3 times with the same water, water samples were taken. According to these results, Cu level was found most in Gölyazı village, F, iron, ammonia and As in Tabanlı village, and Mg was found in the highest amount in Kevenli. The French hardness was found to be the highest in Tabanlı village. pH was found to be highest in Kevenli village and hardness was the highest in Gölyazı village. When the values obtained in this study are taken into consideration, it is seen that the composition of the waters of 4 different villages can be used as potable water, although their composition is different, except Tabanlı village that had high amount of As. It is necessary to find new water resources in this village and local authorities must give necessary importance fort this case.

Keywords: Ammonia, Heavy Metals, pH, Water Quality, Water Hardness

Journal of Green Engineering, Vol. 10_2, 287–298 . Alpha Publishers

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1 Introduction

Water; It is the name of a compound composed of two hydrogen and one oxygen atom, which occupies approximately 80% of the earth and is vital for living things. Water, which can be present in nature as solid, liquid and gaseous, is in liquid form at room temperature. Like all substances, water has a structure that expands with temperature. However, the temperature at which water reaches the highest density is +4 ° C. Freezing temperature is 0 ° C, boiling temperature is 100 °. Among the compounds, it has the highest freezing temperature after ammonia. At the same time, it has the highest surface tension in nature. The effects of water on climate and the formation of raindrops are due to these physical properties.

Addition to being the main component and constituting a significant proportion of the body, water also has important biological tasks. Water plays a direct role in the transport, digestion of the macromolecules that are connected to the water molecules by means of hydrogen bridges, metabolic events in which the resulting micro molecules enter, and the subsequent removal of metabolites from the body. In addition, water, hydrolase and hydratase group is involved in the structure of enzymes as a co-substrate is involved in metabolism. In addition, it facilitates movement with the lubrication feature in and around the moving organs. Water plays a role in maintaining the heat balance of the body. The high amount of heat consumed for evaporation is reflected in the body as heat loss, thus providing heat balance when necessary. Sweating creates a cold feeling in the body is provided in this way [1].

To be potable, drinking water must be suitable for a number of physical properties. Of these, the temperature is important for the water to be consumed easily and not to cause unwanted conditions in the gastrointestinal tract. Another criterion affecting the physical properties of drinking water is the organic and inorganic substances it contains and the physical differences caused by them. The taste, odor and color of water vary in the presence of organic matter, while turbidity results from inorganic matter.

One of the criteria affecting water quality is the chemicals it contains. A number of laboratories analyzes are conducted to determine whether the water is exposed to chemical contamination or not, and at the same time, the proximity of the chemical properties to the desired level. In these analyzes, the chemical content of water such as fluorine, manganese, copper, zinc, magnesium should be at the desired values.

In addition, ammonia and nitrite are the most important chemicals that can be counted as pollution indicators in the analyzes. Nitrite waters contain organic matter but have not yet been oxidized. In the presence of nitrate, it

is concluded that oxidation occurs. Chlorine is another substance that can be considered as an indicator of chemical contamination.

Sudden increase in the amount of chlorine in a water with a desired level of chlorine is indicative of the presence of urine [2].

Fluoride, which accumulates mostly in calcified tissues in the body, is one of the minerals supplied by drinking water. The right amount of fluoride prevents tooth decay and promotes healthy bone development. Fluoride intake at the recommended dosage in teeth affects the development of enamel positively. Inadequate fluoride intake causes caries in the teeth. However, higher fluoride intake than the recommended amount can cause dental fluorosis, staining the teeth, pitting, enamel layer damage and dark brown spots in the future [3].

In nature, arsenic is carried and spread primarily with water. Chronic arsenic poisoning may be seen in living organisms consuming arsenic mixed waters due to arsenic accumulation over time. Therefore, some restrictions have been imposed on arsenic in the quality standards of drinking water. The World Health Organization (WHO) has determined that the maximum arsenic content that drinking and potable water can contain is 10 µg / L (ppb) and that water containing arsenic above 50 µg / L (ppb) should not be used [4]. Chronic arsenic poisoning can occur with consumption of arsenic-containing waters for a longer period than recommended.

Iron (Fe): Iron is one of the most abundant metals in the earth's structure. Although iron is very rare in nature, Fe + 2 and Fe +3 iron ions combine with oxygen and sulfur-containing compounds to form oxides, hydroxides, carbonates and sulphates. Iron is the most oxidized form in nature. Its concentration in natural freshwater sources can range from 0.5 to 50 mg / L [5]. It can be found in water originating from the erosion of rocks and minerals, acidic mineral water drainage, solid waste leachate, wastewater discharges and iron-related industries. Iron concentrations of 40 µg / L (as Fe + 2) can be determined by tasting in distilled water.

Copper is the third most used metal in the world and it is a micro nutrient that plays a role in the development of many living things in nature. It is known that copper, which plays a role in seed development, immunity and water balance in plants, helps to produce hemoglobin in humans. Trace amounts of copper are necessary for the body, while high amounts of copper can cause damage to the liver, kidney and gastrointestinal tract, as well as anemia. The source of copper which can interfere with drinking water is often the pipes through which these waters pass and some chemicals used to prevent the formation of algae in the water [5].

Magnesium is the 4th most common micronutrient element in the body and an essential trace element that participates in the structure of more than 300 enzymes as a cofactor. An adult individual has approximately 25 mg in his body. It is involved in energy metabolism and nucleic acid synthesis, protein synthesis, cell replication and oxidative phosphorylation. It is also

effective in removing lipid metabolism and exercise related damage. Mg is effective and essential in many metabolic events as it directly affects the function of more than 300 enzymes that it participates as cofactor.

The fact that the chemicals in the water content are outside the recommended range can lead to a lack of toxicity or accumulation of some heavy metals. In this respect, the chemical content of drinking water can have positive or negative effects on health.

The main purpose of this study is to examine some chemical and physical properties of drinking water in villages of Van province. The fact that the chemicals in the water content are outside the recommended range can lead to a lack of toxicity or accumulation of some heavy metals. In this respect, the chemical content of drinking water can have positive or negative effects on health.

2 Method

F, As, Cu, Fe Mg, Ammonia analyzes were performed in the water samples taken from Van Bardakçı, Çitoren, Kevenli Gölyazı villages. Thoroughly washed and rinsed with 1/50 diluted HCl and rinsed thoroughly into a transparent pet bottle, the sample water is taken for 3-5 min. water and rinsing at least 3 times with the same water.

Arsenic, Copper, Iron analyses were done by Inductive Coupled Plasma and Mass Spectrometry (Thermo Scientific X II Series ICP-MS) and Mg analysis was done by Paired Plasma - Optical Emission Spectrometer (Thermo Scientific Icap 6300 DOU ICP-OES) in Van Yuzuncu Yil University Central Laboratory. The analysis was started in approximately 40 seconds by taking 4-5 ml sample with 3 repetitions. The turning power (RF Power) of the peristaltic pump was set at 40 rpm. The pressure of the nebulizer gas was determined in the range of 1-1.5 bar. The pressure of Argon gas supplied to the device was adjusted at 5.5 bar. Starting with Blank, 1, 3, 5, 10, 50 and 100 ppb values were used for the analysis. After the standards were read, the analysis of the samples was started. %0.5 Nitric acid solution was prepared using ultra-pure water for blank and washing water of the device. After each sample analysis, the tubes were cleaned with Nitric acid solution for 10 seconds.

Fluoride analysis was done after the temperature reached to room temperature in the Van Y.Y.U Central Research Laboratory by Dionex ion chromatography (Dionex ICS 3000). Samples were analyzed at 30 ° C column temperature, 1 ml per minute flow, 1500 microliter injection volume under 1599.9 psi pressure. During the analysis, a 4 mm Thermo Scientific Dionex brand suppressor was used as a supporter. For ammonia analysis, the sample water is taken into transparent pet bottle thoroughly washed and

rinsed with 1/50 diluted HCl and rinsed for 3-5 min with water and rinsing at least 3 times with the same water. Then the titration method, Nesslerization, applied directly to the samples which contain more than 0.2 mg / l ammonia nitrogen and do not contain colored ions and excess inhibitor. Water hardness (French) degree in samples: Total hardness determination by EDTA titration: 25 ml sample was diluted to 50 ml with distilled water in a flask. 1 ml of buffer solution and 1-2 drops of indicator solution were added. With EDTA solution, the color was titrated from wine red to blue and results were obtained.

3 Results

The values obtained according to the analysis results of the water samples taken in Bardakci, Çitoren, Kevenli and Gölyazı villages which presented in Table 1.

Table 1 The analysis results of the water samples taken in Bardakci, Çitoren, Kevenli and Gölyazı villages.

Parameters	**pH**	**Hardness (mg/L)**	**FH^0**	**Fluorine (µg/L)**	**As (µg/L)**	**Fe (µg/l)**	**Cu (µg/l)**	**Mg (mg/l)**	**NH_3 (mg/l)**
Villages									
Golyazı	8.03	239	23.9	0.41	1,826	120	340	27	0.12
Kevenli	8.15	273.3	27.3	0.56	4,188	153	230	32	0.19
Bardakçı	7.93	167.4	16.7	0.42	1,172	122	210	15	0.09
Citoren	8.05	211.8	21.1	0.55	2,27	145	310	19	0.17
Tabanlı	7.76	214	28.8	1,65	345,2	158	190	24	0.22

According to these results, the parameters used are (pH, Hardness, French Hardness, Fluorine, As, Fe, Cu, Mg and NH3), the highest level of Cu was found in Golyazı village and the lowest found in Tabanlı village, and the highest level of Fe, iron, ammonia and As are found in Tabanli village, and Mg was found in the highest amount in Kevenli. The French hardness (FH0) was found to be the highest level in Tabanlı village. PH was found to be the highest in Kevenli and hardness level was in Golyazı villages.

4 Discussions (Concise Discussion)

Approximately 2/3 of the human body consists of water. Water is 62,67% of the adult human organism, 80% of the child organism and 95% of a three-month fetus. 60% of the water in the human organism is in the cell and the rest is in the fluid and blood between tissues. For these reasons, 20% decrease in body water for adults and 5-10% for children cause fatal consequences. The total amount of water in the world is 1 billion 400 million km3. That is, 70% of the earth is covered with water. 97.5% of this water is composed of salty waters in seas and oceans. The remaining 2.5% is a fresh water source and is used for various purposes [6].

The quality and quantity of surface water resources depends on the combination of climatic and geological factors. With precipitation, a significant number of solids, including dust, pollen, ash (from volcanoes), bacteria, fungal spores, and even larger organisms, is sometimes transported to drinking water supplies. A wide range of chemicals, such as salt from the seas, organic solvents from domestic and industrial atmospheric discharges, or nitrogen and sulfur oxides, which cause acid rain, also affect water resources by falling to different locations during certain times of the year.

The hardness of the water is a property arising from substances such as magnesium, calcium and iron, which are dissolved in water in ion form. Since calcium and magnesium are more present in water, the sum of the concentrations of these ions is considered to be the hardness of the water. Too much spoils the taste of water and can lead to health problems. In general, when hardness in water is mentioned, only calcium level comes to mind. However, the concept of water hardness is understood as the sum of calcium (Ca ++) and magnesium (Mg ++) ions and it is indicated as calcium oxide (CaO) and calcium carbonate 3 (CaCO) in 1 liter of water. Water from natural sources takes up carbon dioxide from the air and gains acidic properties [7].

French hardness degree (FH): It is called the amount of substance corresponding to the amount of 1 mg calcium carbonate 3 (CaCO) of the hardness giving substances dissolved in 100 ml of water. The hardness of the water is a property arising from substances such as magnesium, calcium and iron, which are dissolved in water in ion form. Since calcium and magnesium are more present in water, the sum of the concentrations of these ions is considered to be the hardness of the water. Excess water can spoil the taste and cause health problems.

Ammonia is not present in the waters neither in free form nor in the form of various salts. The presence of ammonia is formed by the decomposition of organic substances, especially feces and so on. Substances are considered as a sign of mixing. Ammonia can be found up to 1 / 100mg per liter in proven water wells and some deep wells. Ammonia here is not as

dangerous as animal and human ammonia because it is of plant origin. Ammonia must not be present in the drinking water.

The presence of ammonia in the water probably indicates that the water is contaminated by microorganisms. Therefore, it is not desirable to have ammonia in the water, and the search for ammonia gives us a rough idea of the pollution of the water[13]. The presence of ammonia in water; It is an indicator of bacterial contamination, sewage and livestock waste pollution. These waters are absolutely non-potable and unusable. Non-ionized (NH_3) and ionized (NH_4+) Metabolic, agricultural, industrial processes and as a result of disinfection with chloramine, ammonia in water, possible bacterial, sewage and livestock waste pollution indicator [8]. Iron (Fe): Iron is one of the most abundant metals in the earth's structure. In drinking water sources, iron (II) salts are unstable and pass into the form of insoluble iron (III) hydroxide, precipitating in the form of rust silt. Iron is one of the essential elements for the human body, especially when it is iron (II) oxide. It does not have any negative effects on human health if iron does not exceed 3 mg / L. However, due to the fact that the taste threshold value is well below this limit, no limit value has been proposed for human health. High concentrations of iron cause the growth of iron bacteria in the water transmission lines. These bacterial masses give the water a red-brownish color. By increasing the number of iron bacteria, the problems of section narrowing of pipes, clogging of parts such as pipes, valves and water clocks occurs [1].

Copper natural water sources are usually present in low concentrations if there is no contact with metal-containing areas. It can be seen in water sources as rock erosion or industrial source. In treated drinking water, it can be welded from copper and brass pipes. Concentrations above 1 mg / L can cause staining (blue/blue-green) in laundry and sanitary ware; At concentrations exceeding 2.5 mg / L, it gives water an undesirable bitter taste [5]. At higher concentrations (4-5 mg/L) the color of the water may also change [9]. Copper; It is an essential nutrient and causes anemia, skeletal disorders, nervous system deterioration and reproductive abnormalities. In high doses of copper, digestive system disorders (with nausea), liver and kidney damage can cause such effects [10].

Mineral water consumption has been increasing for a decade all over the world [11]. The increase also took place in countries where tap water was used as drinking water[12]. Causes may depend on the number of factors. These factors are primarily related to safety and health benefits. According to the World Health Report, more than 3.4 million people die each year due to waterborne diseases, which are the leading cause of illness and death in the world [11]. In a study studied in Van, Fluoride levels in water samples from surrounding villages were found in the range of 0.22-0.61 mg / L and Fluoride in water samples [1]. Bitlis province and Adilcevaz, Ahlat,

Güroymak, Hizan and Tatvan districts in November 2006 and May 2007 was calculated as 0.35 ± 0.03 ppm. The mean fluoride level was found to be 0.35 ± 0.03 ppm in 51 storage water samples and 0.35 ± 0.03 ppm in 115 tap water samples. The highest Fluoride level in the region was found in Ahlat and the lowest Fluoride level in Bitlis [14]. Although the average fluoride values in the province of Van are within the limits of the volcanic nature of the region, it can reach levels above 1.5 µg / L which is acceptable in some villages (Bezirhane and Based villages).

Although arsenic can be beneficial in areas such as agriculture and industry, it has a toxic effect on many living things in nature and is carcinogenic [15]. Arsenic exposure affects many different organs in the body, including the skin, heart, vessels and lungs, as well as the immune system, genital and urinary systems, gastrointestinal system and nervous system [16].

In a study conducted in the Van region [17], the Arsenic level of the drinking water of the region was taken by taking 77 water samples from İpekyolu, Tusba, Başkale, Çaldıran, Çatak, Edremit, Erciş, Gevaş, Gürpınar, Muradiye, Özalp and Saray districts and connected villages. It was investigated. The amount of Arsenic in the Çaldıran district and the connected villages was found to be between 9.440 - 12.040 ppb and the average Arsenic ratio of the region was 10.772 ± 0.434 ppb, which is the highest value among the other districts and connected villages. Arsenic levels of the samples taken from Özalp and Saray districts central and affiliated villages were calculated as 3.584 ± 0.369 ppb for Özalp and 4.741 ± 0.33 ppb for Saray. The lowest Arsenic level was found in Edremit district with a mean of 0.569 ± 0.005 ppb. Arsenic content of 77 water samples analyzed in the study was read in the range of 0.378 - 14.210 ppb, Arsenic average of these samples taken from the province was calculated as 5.027 ± 0.368 ppb. The amount of arsenic is a serious problem in some village waters of Van province. While the Arsenic value is measured 80 times more than the limit value in the old network of ZiraTabanlı village, arsenic levels of Yassıtepe, Yukarı Kuyucak and Hanköy are 2-4 times higher than normal. Local authorities should seriously address this issue.

In a study on the quality of spring waters used in animal husbandry in Van, Copper concentrations of water samples taken from 20 points were determined in the range of 0.0033-0.031 mg / L [1].

Magnesium concentration determined in water samples taken from 18 points known to be used as drinking water in Erciş district of Van province is in the range of 3.2-45.4 mg / L. Magnesium concentration values of the water samples were calculated as 24.5 ± 2.25 mg / L. The results were evaluated according to the limit values determined by TS ‘&& and water samples taken from the region were found suitable for consumption with regard to magnesium content [18]. Magnesium concentration values of 20 different water sources in villages connected with Van were determined in the range of 5.645-30.07 mg / L [1].

The pH values of water samples taken from 18 points commonly used as healing water in Erciş district of Van were determined in the range of 6.03-7.98 and the mean pH level of the waters was calculated as 6.95 ± 0.12 [18]. The pH levels of different water sources used in animal husbandry in Van were found in the range of 7.73-8.09 [1].

5 Conclusion

Van is a city in the region of Eastern Anatolia which is not very poor in terms of water resources. Water supply problems are observed in some villages and residential areas far from the centers. With this study, it was aimed to examine the quality of water provided to humans and animals in some villages. Considering the values obtained in this study, it was seen that the composition of the waters of 5 different villages could be used as potable water, although their composition was different. The As was high in Tabanli village must be taken into consideration. The level of arsenic in waters has been found to be high and it is recommended to take necessary prevention in terms of human and environmental health. Therefore, selecting the appropriate treatment method by evaluating the existing raw water quality pollutants and the desired water quality together will both protect human health and prevent unnecessary costs by using unnecessary treatment processes or chemicals.

Acknowledgement

This research was supported by the Van YYU Directory of Scientific Research Project as (TAP-2016-5653) Project number.

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Biographies

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