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EVALUATION OF THE MICROBIAL AND CHEMICAL CONTENT IN MAGNETIZED WATER, ALKALINE WATER AND COMPARING IT WITH LIQUEFACTION WATER

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Abstract

The research included studying the microbial and chemical content in magnetized water, alkaline water and liquefaction water and by 80 samples in the laboratories of the Center for Market Research and Consumer Protection - University of Baghdad, For the period from February 2019 to June 2019. The results showed the microbial content of the study samples when the bacteria were completely counted, the samples were free from bacteria at the time period of zero and 30 minutes and at temperatures of 100 and 4 °C and the appearance of bacterial growth at the time period of 24 hours and 30 days, as well as the absence of samples from *E. coli* and *fecal coliform* bacteria. As for the acidic function PH, the liquefaction water was 9.08, distilled water 6.80, and deionized water 7.4, and magnetic water ranged between (7.85-10.02) and alkaline water ranged between (8.0-10.5). As for the concentration of the elements magnesium, manganese, copper, iron, zinc, cadmium, lead, mercury and arsenic, they were within the limits allowed by the Iraqi, Arab and international specifications for the time period of zero and 30 minutes, except for arsenic and lead. As for the time period of 24 hours and 30 days, the concentration of iron and lead has increased, and the concentration of arsenic has decreased, as is the case at temperatures 4 and 100° C. Thus, the models for magnetic water, alkaline water and liquefaction water are not suitable for drinking for all periods of time and different temperatures because they contain arsenic, mercury, lead and iron elements.

***Keywords* :** Magnetic water, alkaline water, liquefaction water, microbial contamination, chemical pollution.

Introduction

Natural water represents the blood of life and constitutes 4/5 of the globe and approximately 70% of the components of body water in most living things (Zakir *et al.*, 2013). The compound water is the most important in the body of the organism, As it regulates all vital processes in the living cell, from digesting, absorbing and transporting nutrients to tissues and removing toxins and waste from the body. It is also essential in the functions of the various enzymes and hormones that regulate the performance of vital functions in the body of the organism (Muhammad, 2015; Zakir *et al.*, 2012). However, human and animal drinking water has been exposed to contamination with insecticides, bacteria, fungi, algae, high nitrate levels and harmful microorganisms that affect human and animal health and growth. Therefore, the need to develop water purification methods and one of these methods is the magnetic treatment of life (Al-Sabaa *et al.*, 2013). As magnetic technology has recently emerged as an effective means in adapting water properties for plant, industrial and human production for the purpose of improving these properties, the magnetic field works to effect a change in the water properties, whether physical or chemical, because of its effect on the hydrogen bonds of water as the magnetic field works In its cracking and making the water more liquid, just as the magnetic field plays a role in the vital functions of all living organisms. This role appears clear through the effect of magnetized water on plant tissues, as it causes an increase in plant growth and an increase in productivity (Al-Alwani and Al-Rubaie, 2017; Al-Anbari and Jasim, 2010; Al-Talib and Al-Sanjari, 2009; Ismail, 2014; Jawad and *et al.*, 2014; Zakir and *et al.*, 2013). Also, magnetized water is considered to have good properties compared to ordinary water, which is what is called living water due to the regularity of its particles, the shortness of its chains and many other important properties in it. The magnetic water pH is basic and it is known that the pH of the cancerous cell is acidic and thus when it is used for drinking instead of ordinary water it may contribute to killing the cancer cell to transform the acidic medium in it into a base and thus its enzymes do not work in the ideal environment and facilitate the death of the cancerous cell while the healthy cell continues to live. Also, the other properties of magnetic water may also contribute to the cure of cancer, such as its anti-oxidant characteristic and the removal of free oxidizing free radicals from the body. It also works on the activity of enzymes, preserving body fluids and blood, attracting iron ions in red blood cells and increasing the proportion of hemoglobin in the blood. Magnetization of water is not economically expensive and there are no side effects, but many studies have proven its multiple benefits. An example of magnetized water is Zamzam water and other wells with distinctive benefits (Zakir *et al.*, 2015; Zakir *et al.*, 2012). As for alkaline water, it became popular and spread in Japan, where changes in the properties of water occur and plays an important role in the vital functions of living organisms, including humans. It also has an important role in industrial, agricultural and nanotechnology production, as it has a basic pH of pH through which it works in treating many pathological conditions such as stomach and intestinal problems prevalent in Japan and Korea and in the treatment of blood pressure, diabetes, cancer and a treatment mechanism as mentioned in the magnetic water above and an example of water Zamzam has many therapeutic benefits. It is also cheap water with fewer effects on the environment, safe and has an effective role in stopping the activity of pathogens (Al-Janabi *et al.*, 2016; Husseinand Naji, 2014; Ignacio *et al.*, 2012). The aim of the research is to examine magnetic and alkaline water and compare it with microbial water from the microbial and chemical aspects.

Materials and Methods

Collection of samples

Alkali water samples were brought from Salsabeel Al-Majid company in Baghdad during February 2019 with a pH (10.5, 9.5, 8.5, 8). As for magnetic water, it was obtained from the use of a magnetic mug brought from Hungary and put inside it every time tap water and the other time distilled water and in the second deionized water, also was used tap water to compare with the above samples. The samples were collected at different time periods: (zero, 30 minutes, 24 hours, 30 days) and at different temperatures are: (4,100) ºC.

pH Measurement

The pH of the water was measured using a pH- meter (PH211) made by HANNA after being calibrated with standard buffer solutions with a PH (9,7,4) before work (5), for the models prepared and shown in (Table 1) Below:

Table 1 : Samples under studying

No.	Sample	Symbol
1	liquefaction water	S1
2	distilled water	S2
3	deionized water	S3
4	magnetic water1	S4
5	magnetic water2	S5
6	magnetic water3	S6
7	alkaline water1(pH=8)	S7
8	alkaline water2 (pH=8.5)	S8
9	alkaline water3 (pH=9.5)	S9
10	alkaline water4 (pH=10.5)	S10

Detection of microbial content:

The microbial content (1) was revealed through the following:

Bacterial total count

0.1 ml of the water sample was cultivated on the medium of Nutrient agar after conducting the chain of dilution with three replicates. The dishes were incubated at 37º C for 24 hours, after which the growing colonies were counted, multiplied by inverting the dilution and extracting the average number.

Isolation and purification of bacterial isolates

For the purpose of isolating the possible bacteria in the water samples, MacConkey agar was used for this purpose and 0.1 ml of the water sample was cultivated after conducting a series of dilutions with three replications and incubated aerobically at 37º C for 24 hours.

Chemical content detection

The elements and heavy metals in the water models under study were measured using the Atomic Absorption type Schimadzue type AA7000 and the results were expressed in ppm unit as follows: As, Hg, Pb, Cd, Zn, Fe, Cu, Mn, Mg.

Results and Discussion

pH

From (Table 2), it is clear that liquefaction water with PH is within the permissible limits according to Saudi Standard No. (409) for the year 1984 (SQS, 1984), Because the permissible limits are 6.5-8.5. Note that Iraqi waters have a basic characteristic, according to what is required by it 2011 (Matlob, 2011). As for distilled water and ionic water, they are within the permissible limits of Iraq, Arab and globally (IQS, 1984; IQS, 1988; SQS, 1984). We also note from (Table 2) that magnetized water is within a PH base that ranged from weak, medium and strong base according to the type of water used and it is consistent with studies (Muhammad, 2015; Zakir *et al*., 2012; Zakir *et al*., 2013) and with Iraqi, Arab and international standards (IQS, 1984; IQS, 1988; SQS, 1984). As natural water is made up of clusters of water molecules H_2O bound together with hydrogen bonds and atoms of the water molecule are connected to each other with covalent bonds so that they form an angle of 104.5º, while water magnetically treated is water that has been exposed to a specific magnetic field of intensity that leads to a change in the angle of attachment to 103º and gets smaller. Also, the pools of water together will decrease as the field vibrates the water molecules and the bonds begin to break down. As a result, many water properties change, such as: pH, surface tension and the amount of dissolved oxygen (Zakir *et al*., 2013). As for alkaline water, we find from (Table 2) that the models have a pH range from (8-10.5) and they are consistent with studies (Al-Janabi *et al*., 2016; Hussein and Naji, 2014), and with the Iraqi, Arab and international specifications (IQS, 1984; IQS, 1988; SQS, 1984). As ionized water is functional water that shows specialized functions and is a useful healthy drinking water, it is alkaline according to the chemical and physical properties of water and is rich in hydrogen molecule. The oxidation and reduction effort has a negative and works to remove the effectiveness of reactive oxygen species, as well as its role in stopping the activity of pathogens and producing safe, cheap and important water in agricultural, industrial and nanotechnology production (Al-Janabi *et al*., 2016).

Table 2 : pH for samples under studying

No.	Sample	pH
1	S1	**9.08**
2	S2	**6.80**
3	S3	**7.4**
4	S4	**10.02**
5	S5	**8.85**
6	S6	**7.85**
7	S7	**8.0**
8	S8	**8.5**
9	S9	**9.5**
10	S10	**10.5**

Microbial Content

According to (tables 3-10), we note that at zero time, all samples are free of *E. coli* and fecal coliform bacteria, and they are applied in the Iraqi, Arab, and international standards (IQS, 1984; IQS, 1988; SQS, 1984). At the time of 30 minutes, the S3 and S8 alkaline water contains bacteria 8 and 9, respectively, while the S9 alkaline water contains large numbers of bacteria, namely: *Bacillus* and *Staphylococcus aureus*, and the previous samples are *E. coli* and *fecal coliform* bacteria. The reason for this is the high pH which provides a favorable environment for growth. As for the 24-hour time period, we notice the emergence of growth of models (S4-S2) and (S8-S7), and also due to the length of time appropriate for bacterial divisions, as well as the case for the time period of 30 days. As for temperatures 100° C, we notice the lack of growth in all models and all types of bacteria, including *E. coli* and *fecal coliform* bacteria, but at a temperature of 4° C for a period of 24 hours, we notice growth in models S7 and S8 in order to create the appropriate conditions of temperature and pH as well as the case with the temperature 4 ºC For the period 15 and 30 days (Abdel-Moneim *et al*., 2014; Al-Musawi *et al*., 2015).

Table 3 : Microbial content at zero time(cfu/ml)

No.	Sample	Bac. Total count	*E. coli*	Coliform
1	S1	Nil	Nil	**Nil**
2	S2	Nil	Nil	**Nil**
3	S3	Nil	Nil	**Nil**
4	S4	Nil	Nil	**Nil**
5	S5	Nil	Nil	**Nil**
6	S6	Nil	Nil	**Nil**
7	S7	Nil	Nil	**Nil**
8	S8	Nil	Nil	**Nil**
9	S9	Nil	Nil	**Nil**
10	S10	Nil	Nil	**Nil**

Table 4 : Microbial content at 30 min (cfu/ml).

No.	sample	Bac. Total coun	*E. coli*	Coliform
1	S1	Nil	Nil	**Nil**
2	S2	Nil	Nil	**Nil**
3	S3	8	Nil	**Nil**
4	S4	Nil	Nil	**Nil**
5	S5	Nil	Nil	**Nil**
6	S6	Nil	Nil	**Nil**
7	S7	Nil	Nil	**Nil**
8	S8	9	Nil	**Nil**
9	S9	H.G	Nil	**Nil**
10	S10	H.G	Nil	**Nil**

H.G= Heavy Growth

Table 5 : Microbial content at 24 hr (cfu/ml)

No.	sample	Bac. Total coun	*E. coli*	Coliform
1	S1	Nil	Nil	**Nil**
2	S2	9	Nil	**Nil**
3	S3	9	Nil	**Nil**
4	S4	8	Nil	**Nil**
5	S5	Nil	Nil	**Nil**
6	S6	Nil	Nil	**Nil**
7	S7	3	Nil	**Nil**
8	S8	1	Nil	**Nil**
9	**S9**	**Nil**	**Nil**	Nil
10	**S10**	**Nil**	**Nil**	Nil

Table 6 : Microbial content at 30 day (cfu/ml)

No.	Sample	Bac. Total count	*E. coli*	Coliform
1	S1	Nil	Nil	**Nil**
2	S2	6	Nil	**Nil**
3	S3	Nil	Nil	**Nil**
4	S4	Nil	Nil	**Nil**
5	S5	15	Nil	**Nil**
6	S6	15	Nil	**Nil**
7	S7	5	Nil	**Nil**
8	S8	Nil	Nil	**Nil**
9	S9	Nil	Nil	**Nil**
10	S10	1	Nil	**Nil**

Table 7 : Microbial content at 100ºC (cfu/ml)

No.	Sample	Bac. Total count	*E. coli*	Coliform
1	S1	Nil	Nil	**Nil**
2	S2	Nil	Nil	**Nil**
3	S3	Nil	Nil	**Nil**
4	S4	Nil	Nil	**Nil**
5	S5	Nil	Nil	**Nil**
6	S6	Nil	Nil	**Nil**
7	S7	Nil	Nil	**Nil**
8	S8	Nil	Nil	**Nil**
9	S9	Nil	Nil	**Nil**
10	S10	Nil	Nil	**Nil**

Table 8 : Microbial content at 4ºC for 24 hr (cfu/ml).

No.	sample	Bac. Total count	*E. coli*	Coliform
1	S1	Nil	Nil	**Nil**
2	S2	Nil	Nil	**Nil**
3	S3	Nil	Nil	**Nil**
4	S4	Nil	Nil	**Nil**
5	S5	Nil	Nil	**Nil**
6	S6	Nil	Nil	**Nil**
7	S7	4	Nil	**Nil**
8	S8	1	Nil	**Nil**
9	S9	Nil	Nil	**Nil**
10	S10	Nil	Nil	**Nil**

Table 9 : Microbial content at 4ºC for 15 day (cfu/ml)

No.	Sample	Bac. Total count	*E. coli*	Coliform
1	S1	Nil	Nil	**Nil**
2	S2	Nil	Nil	**Nil**
3	S3	Nil	Nil	**Nil**
4	S4	Nil	Nil	**Nil**
5	S5	Nil	Nil	**Nil**
6	S6	H.G	Nil	**Nil**
7	S7	Nil	Nil	**Nil**
8	S8	Nil	Nil	**Nil**
9	S9	Nil	Nil	**Nil**
10	S10	Nil	Nil	**Nil**

Table 10 : Microbial content at 4ºC for 30 day (cfu/ml)

No.	Sample	Bac. Total count	*E. coli*	Coliform
1	S1	Nil	Nil	**Nil**
2	S2	Nil	Nil	**Nil**
3	S3	Nil	Nil	**Nil**
4	S4	3	Nil	**Nil**
5	S5	Nil	Nil	**Nil**
6	S6	Nil	Nil	**Nil**
7	S7	Nil	Nil	**Nil**
8	S8	1	Nil	**Nil**
9	S9	Nil	Nil	**Nil**
10	S10	Nil	Nil	**Nil**

Chemical content

From (tables11-18), we find that the element of magnesium is within the permissible limits in the Iraqi, Arab and international standards (IQS, 1984; IQS, 1988; SQS, 1984) which are 50 parts per million for the Iraqi standard and 150 parts per million for the Saudi standard as a maximum. As for the element manganese, we note that all models are free of this element, which allows it to focus 0.1 parts per million for the Iraqi standard and 0.5 parts per million for the Saudi standard. As for the copper element, it is within the permissible limits for the Iraqi and Saudi standards, which are 0.5 parts per million and 1.5 parts per million respectively. As for the element of iron, we notice a slight increase in some of them from the Iraqi standard, which allows a concentration of 0.5 parts per million, while being in conformity with the Saudi standard, which allows a concentration of 1 part per million. As for the zinc component, we note that some models are free of it. As for the rest of them, we note that at the permissible limits of the

Iraqi standard, which is the concentration of 1 part per million, as well as the Saudi standard 15 parts per million. As for the cadmium element, we note that some models are free of it, while some of it is within the permissible limits, while the other is higher than the permissible limits, which are 0.01 ppm according to the Iraqi standard. The reason for this is due to a rise in the pH and a difference in the time period and temperatures, which is due to a difference in the solubility of the elements as a result of the difference in the pH and previous variables that lead to the breaking of the hydrogenic and covalent bonds in the water molecule, and because of the rise in the basal Iraqi waters according to what it says Matlob 2011 (Matlob, 2011). As for the lead component, some models are devoid of it. As for the remainder, it is higher than the limits allowed by the Iraqi standard, 0.05 parts per million. This is consistent with what is stated by it (Matlob, 2011), that Iraqi waters contain heavy minerals, which are not suitable for drinking and are harmful to human health. As for arsenic, we note that some and others are clearer than the permissible limits in the Iraqi standard, which is the concentration of 0.05 parts per million, and this corresponds to Matlob 2011 (Matlob, 2011). As for mercury, we found that all samples have been greater than the permissible limits in the Iraqi standard, which is the concentration of 0.001 parts per million.

Table 11 : Concentration of elements at zero time (ppm)

No.	Sample	Mg	Mn	Cu	Fe	Zn	Cd	Pb	Hg	As
1	S1	0.0000	0.0000	0.0704	0.3994	0.0000	0.0438	0.0000	21.6084	0.0000
2	S2	0.5645	0.0000	0.0494	0.3655	0.0000	0.0597	0.0000	23.1792	0.0000
3	S3	0.5549	0.0000	0.0406	0.4042	0.0000	0.0537	0.0000	22.1948	0.0000
4	S4	0.0000	0.0000	0.0126	0.2301	0.0000	0.2149	0.0000	23.2839	17.1874
5	S5	0.5479	0.0000	0.0000	0.2108	0.0000	0.1254	0.4225	23.6399	15.5569
6	S6	0.5496	0.0000	0.0231	0.2809	0.0000	0.2050	0.0000	23.0954	17.6422
7	S7	0.0000	0.0000	0.0441	0.2906	0.0000	0.1035	0.2028	23.2629	14.2279
8	S8	0.0000	0.0000	0.0109	0.2494	0.0000	0.1692	0.4592	22.2995	15.3095
9	S9	0.0000	0.0000	0.0196	0.2664	0.0000	0.2249	0.0000	21.8597	8.9051
10	S10	0.0000	0.0000	0.0091	0.2228	0.0000	0.1990	1.1915	23.3676	15.7005

Table 12 : Concentration of elements at 30 min.(ppm)

No.	Sample	Mg	Mn	Cu	Fe	Zn	Cd	Pb	Hg	As
1	S1	0.0000	0.0000	0.0651	0.4332	0.0000	0.0617	0.0000	23.1373	0.0000
2	S2	0.5251	0.0000	0.2681	0.9048	0.0006	0.0080	3.7915	25.1897	0.0000
3	S3	0.5009	0.0000	0.2611	0.8951	0.0000	0.0000	2.6030	25.2525	0.0000
4	S4	0.0000	0.0000	0.2611	0.8951	0.0000	0.0000	2.8761	25.0012	0.0000
5	S5	0.4139	0.0000	0.1841	0.6920	0.0000	0.0000	1.3380	24.3310	0.0000
6	S6	0.5469	0.0000	0.0000	0.2083	0.0000	0.1095	0.2028	22.6556	16.1459
7	S7	0.0000	0.0000	0.2699	0.8516	0.0000	0.0000	3.4264	25.0012	0.0000
8	S8	0.0000	0.0000	0.3136	0.9072	0.0000	0.0000	2.1803	25.3572	0.0000
9	S9	0.0000	0.0000	0.3084	0.8733	0.0011	0.0100	3.4324	25.1059	0.0000
10	S10	0.0000	0.0000	0.2454	0.8782	0.0000	0.0000	2.6033	24.8337	0.0000

Table 13 : Concentration of elements at 24 hr.(ppm)

No.	Sample	Mg	Mn	Cu	Fe	Zn	Cd	Pb	Hg	As
1	S1	0.0000	0.0000	0.2436	0.8032	0.0000	0.0000	1.5606	25.5667	0.0000
2	S2	0.5165	0.0000	0.2191	0.7161	0.0000	0.0000	1.1183	24.2891	0.0000
3	S3	0.4394	0.0000	0.1684	0.6243	0.0000	0.0199	1.0086	24.1635	0.0000
4	S4	0.0000	0.0000	0.2034	0.7331	0.0000	0.0000	2.1070	24.8755	0.0000
5	S5	0.5258	0.0000	0.0914	0.5154	0.0000	0.0000	1.0085	23.5352	0.0000
6	S6	0.4593	0.0000	0.2349	0.8419	0.0000	0.0000	2.4366	24.7708	0.0000
7	S7	0.0000	0.0000	0.2594	0.8661	0.0000	0.0040	2.8078	25.1269	0.0000
8	S8	0.0000	0.0000	0.2226	0.7041	0.0000	0.0000	2.2636	24.4148	0.0000
9	S9	0.0000	0.0000	0.2121	0.7524	0.0000	0.0000	1.5606	25.4201	0.0000
10	S10	0.0000	0.0000	0.1666	0.7137	0.0000	0.0040	0.8764	24.5195	0.0000

Table 14 : Concentration of elements at 30 day(ppm)

No.	Sample	Mg	Mn	Cu	Fe	Zn	Cd	Pb	Hg	As
1	S1	0.0000	0.0000	0.0809	0.5880	0.0000	0.0338	0.0000	22.6975	0.0000
2	S2	0.5416	0.0000	0.1159	0.5565	0.0000	0.0000	1.7775	23.2629	0.0000
3	S3	0.5079	0.0000	0.1544	0.6243	0.0000	0.0000	1.1183	24.3310	0.0000
4	S4	0.0000	0.0000	0.1456	0.5686	0.0000	0.0139	0.4226	24.6871	0.0000
5	S5	0.4847	0.0000	0.1124	0.5686	0.0000	0.0000	0.7887	23.9959	0.0000
6	S6	0.5231	0.0000	0.1736	0.6339	0.0000	0.0000	1.6310	24.0169	0.0000
7	S7	0.0000	0.0000	0.1824	0.7065	0.0000	0.0000	1.1916	24.3101	0.0000
8	S8	0.0000	0.0000	0.1596	0.7137	0.0000	0.0080	1.4113	24.4357	0.0000
9	S9	0.0000	0.0000	0.1316	0.6557	0.0000	0.0000	0.8264	24.3729	0.0000
10	S10	0.0000	0.0000	0.1299	0.5565	0.0000	0.0000	1.0086	23.6399	0.0000

Table 15 : Concentration of elements at 100ºC (ppm)

No.	Sample	Mg	Mn	Cu	Fe	Zn	Cd	Pb	Hg	As
1	S1	0.0000	0.0000	0.0564	0.3963	0.0000	0.0776	0.0000	22.3205	0.0000
2	S2	0.0000	0.0000	0.0266	0.2978	0.0000	0.0796	0.0000	22.0901	11.7656
3	S3	0.5463	0.0000	0.0634	0.4405	0.0000	0.0517	0.0000	22.0063	0.0000
4	S4	0.0000	0.0000	0.1176	0.6122	0.0000	0.0000	1.5211	23.0954	0.0000
5	S5	0.4404	0.0000	0.1054	0.5299	0.0000	0.0040	1.5577	23.6399	0.0000
6	S6	0.4847	0.0000	0.1246	0.5565	0.0000	0.0000	0.2028	22.8441	0.0000
7	S7	0.0000	0.0000	0.0319	0.3123	0.0000	0.3005	0.0000	21.7760	15.0196
8	S8	0.0000	0.0000	0.0826	0.4308	0.0000	0.0517	0.0000	22.7603	0.0000
9	S9	0.0000	0.0000	0.0931	0.5154	0.0000	0.0100	0.7521	23.8493	0.0000
10	S10	0.0000	0.0000	0.1036	0.5396	0.0000	0.0119	1.0085	24.0797	0.0000

Table 16 : Concentration of elements at 4ºC for 24 hr (ppm)

No.	Sample	Mg	Mn	Cu	Fe	Zn	Cd	Pb	Hg	As
1	S1	0.0000	0.0000	0.3031	0.8685	0.0021	0.0000	2.9127	25.7970	0.0000
2	S2	0.5694	0.0000	0.0000	0.2132	0.0000	0.1114	1.4845	22.6765	10.0031
3	S3	0.4907	0.0000	0.2944	0.8999	0.0000	0.0000	2.9493	25.6923	0.0000
4	S4	0.0000	0.0000	0.3171	0.9144	0.0056	0.0000	3.2789	25.4829	0.0000
5	S5	0.5188	0.0000	0.0000	0.2228	0.0000	0.1592	1.3380	22.6137	14.1078
6	S6	0.4477	0.0000	0.3731	0.8999	0.0206	0.0438	4.4873	26.3206	9.6827
7	S7	0.0000	0.0000	0.3399	0.9628	0.0196	0.0000	3.9746	25.7761	14.6096
8	S8	0.0000	0.0000	0.3749	0.9797	0.0111	0.0299	4.5606	26.2159	11.1247
9	S9	0.0000	0.0000	0.3469	0.8806	0.0000	0.0000	3.5718	25.4829	9.3976
10	S10	0.0000	0.0000	0.3486	0.8999	0.0026	0.0239	4.0113	25.9227	9.8830

Table 17 : Concentration of elements at 4ºC for 15 day (ppm)

No.	Sample	Mg	Mn	Cu	Fe	Zn	Cd	Pb	Hg	As
1	S1	0.0000	0.0000	0.2996	0.8661	0.0041	0.0000	3.3155	25.7133	10.0408
2	S2	0.5033	0.0000	0.3101	0.8540	0.0026	0.0000	2.9859	24.9384	0.0000
3	S3	0.4910	0.0000	0.3539	0.9797	0.0056	0.0219	3.1690	25.6085	12.8118
4	S4	0.0000	0.0000	0.0000	0.2253	0.0000	0.1174	0.3859	23.9331	13.4857
5	S5	0.4129	0.0000	0.4081	0.9555	0.0156	0.0716	4.2676	26.0693	11.8952
6	S6	0.4927	0.0000	0.4029	0.8782	0.0226	0.0119	5.2197	25.9436	14.5342
7	S7	0.0000	0.0000	0.3801	0.9725	0.0066	0.0637	4.3775	25.7551	15.9127
8	S8	0.0000	0.0000	0.3066	0.9628	0.0016	0.0000	3.8282	25.5038	8.9612
9	S9	0.0000	0.0000	0.3941	0.9701	0.0236	0.0338	4.3775	26.0902	14.6403
10	S10	0.0000	0.0000	0.3906	0.9846	0.0131	0.0279	4.5606	25.9855	10.5145

Table 18 : Concentration of elements at 4ºC for 30 day (ppm)

No.	Sample	Mg	Mn	Cu	Fe	Zn	Cd	Pb	Hg	As
1	S1	0.0000	0.0000	0.3696	0.9314	0.0146	0.0776	4.5972	25.9017	16.2096
2	S2	0.4940	0.0000	0.3994	0.9555	0.0146	0.0000	3.9014	26.0902	12.8849
3	S3	0.4973	0.0000	0.3346	0.8709	0.0006	0.0000	3.3155	25.5667	10.4178
4	S4	0.0000	0.0000	0.3241	0.8951	0.0021	0.0000	2.6930	25.4619	12.3123
5	S5	0.4827	0.0000	0.3766	0.9846	0.0226	0.0000	3.9746	25.7342	11.0540
6	S6	0.4768	0.0000	0.4414	0.9676	0.0286	0.0080	5.2197	26.5300	13.8556
7	S7	0.0000	0.0000	0.3609	1.0208	0.0116	0.0697	4.4873	25.8599	11.8292
8	S8	0.0000	0.0000	0.3469	0.8903	0.0036	0.0000	3.2423	25.7133	14.7981
9	S9	0.0000	0.0000	0.3696	0.9048	0.0000	0.0378	3.2789	25.9646	9.4612
10	S10	0.0000	0.0000	0.4239	0.9701	0.0181	0.0100	4.8535	26.2159	13.7590

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