

Effect of the Magnetic Fuel Treatment Device on Some Water Properties

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Abstract: The present study occurrence of significantly increased in boiling degree rates (the temperature) for water when exposed to magnetic treatment device of water in different intensities which were 22.3, 22.6 and 22.5°C in the magnetically water with 500, 1000 and 1500 G intensities in respectively, especially in 8-10 weeks, compared with untreated water magnetically which were 17.2°C. As well as significantly increased the value of alkalinity of water (pH-value) an increase of magnetic intensity hanging over the water which were 9.82, 9.5 and 9.54 in 500 G in 9th week, 1000 G in the 2nd week and 1500 G in the 2nd week too in respectively, compared with untreated magnetized water which were 8.41, also in the 2nd week. Also, increased significantly oxygen saturation rates (oxygen dissolved in water) which were 11.8 mg/L in the 1st week, 12.1 mg/L in the 8th week and 12.2 mg/L in the 1st week for magnetized water with 500, 1000 and 1500 G in respectively an increase of magnetic intensity, especially, intensity 1500 G, compared to the rest of magnetic intensities and untreated water magnetically which was 9.2 mg/L in the 9th week. In that experience happened an increase in the electrical conductivity (specific conductance) in the treated water, it increased its value of electrical conductivity of water an increase of magnetic intensity which respectively, 794 $\mu\text{sec/cm}$ in 6th week, 797 $\mu\text{sec/cm}$ in the 6th week and 799 $\mu\text{sec/cm}$ in the 6th week also, compared with untreated water which were 651 $\mu\text{sec/cm}$ in the 3rd week. As well as those in that experience, found the highest increase in the significant in water soluble salts (total dissolved solids), especially in 1500 G intensity which were 539 ppm in the 6th week, 540 ppm in the 6th week and 545 ppm in the 6th week too of intensities 500, 1000 and 1500 G in respectively, compared with no magnetized water (untreated water) which was the less value 426 ppm in the 3rd week. All these experiences were under the level probability of <0.05 under the laboratory conditions.

Key words: Magnetic fuel treatment device, magnetic intensity, alkalinity, electrical conductivity, oxygen saturation, laboratory

INTRODUCTION

Magnetic fuel treatment, considerable portion of the world population is being supplied with hard water which has different negative domestic, industrial and agricultural effects, irrigation and medicine application. In recent times, various research efforts have been directed towards the treatment of hard water using magnetic techniques (AbdelTawab *et al.*, 2011). The magnetic fuel treatment water technique considers as recent and advanced techniques in magnetic water treatment which application in different; Ecological, transportation, land reclamation desert, livestock, breeding fish, water technical, agricultures, elimination of soil salinity, industrial, space, medical and scientific fields (AL-Ibady, 2014). Sometimes the magnetic fuel treatment also known as Anti-scale Magnetic Treatment or (AMT) is a controversial methods of assumed to reduce the effects of hardness water by passing it through a magnetic field in different intensities in a specific times as a non-chemical alternative to water softening. While the effect of magnetic treatment depends

on properties of the pipe and speed of flow of water in specific time. Also, the magnitude of the effect depends on pipe conductivity, the type of materials factory of this pipe and surface roughness (Alimi *et al.*, 2009). While the water hardness, converting brine to fresh water is one of the most important of propounded cases on water treatment, specially consumed water on industrial and in different environmental conditions. In fact, the water that is flowing in surface land or saving in subsurface land, for the reason that passing from various levels, that have contain the cations and anions of Calcium (Ca^{2+}) and Magnesium (Mg^{2+}), informing of carbonate, hydrogen carbonate or sulfate is comprising the various salts, that the part of pertain to ion Ca^{2+} and ion Mg^{2+} is call water hardness. Assuming magnetic system science has started by observation some of some mineral stones, that to be able attracting of iron particles or molecules. Origin of magnetic fuel word is Magnesia zone that is situated in Asia and knew mentioned above stone on there, that named magnetic or magnetic stone. So, the magnetic field is importing deviated force on portable electrical charge

(Alghabi *et al.*, 1998). Therefore, the magnetic fuel treatment devices installed in automobiles are similar in design to magnetic water treatment. Then the hydrocarbon fuel is pumped through a canister containing one or more magnets or a magnetic fuel treatment device is imposed to the external surface of the fuel line. Magnetic treatment of fuel, it is the demands of, results in increased horsepower, increased mileage, reduced hazardous gas emissions and longer engine life (Powell, 1998). So, the aim of this study is to change the some certain properties of water such as temperature, alkalinity, salts soluble, saturation oxygen dissolved with water and turn it into the water is valid for use in watering plants, industry and domestic use optimization.

MATERIALS AND METHODS

The samples of water were collected from Lake Amanah Baghdad/Iraq/Baghdad for period from 11/9/-12/11/2016. The magnetic fuel treatment water devices were manufacture locally. Then were calibrated and give their intensities in laboratory which 500, 1000 and 1500 G by using Gauss Meter type F.W.Bell/Gauss Model 5070, USA. Was used four bickers, these were distribution as follows: Control 500, 1000 and 1500 G. Also, the magnetic fuel treatment device for water treatment consist of the following magnetic systems (Fig. 1):

- Magnetic fuel treatment device for water with 500 G
- Magnetic fuel treatment device for water with 1000 G
- Magnetic fuel treatment device for water with 1500 G

These magnets devices contain on North pole positive and another South pole negative. This experiment contains 4 dealings which the following:

- Have been put 1 L of raw water (control) in the cylinder or beaker
- Have been put 1 L of magnetic water with 500 G in the cylinder or beaker
- Have been put 1 L of magnetic water with 1000 G in the cylinder or beaker
- Have been put 1 L of magnetic water with 1500 G in the cylinder or beaker

Then, been teaching all the cylinders or beakers with date of magnetic treatment and the amount of intensities used. Was repeated the process of magnetization force every 24 h, throughout the duration of the experiment.

The measurements of water were taken a week, for a period of 10 weeks of all beakers which treated and untreated with magnetized energy. The measurements of some properties of water include the following factors:



Fig. 1: Magnetic fuel treatment device for water with 500, 1000 and 1500 G

- The temperature (The boiling degree by degree Celsius) (°C)
- Acedic water measure (alkalinity) (pH-scale or pH-values)
- Measuring the oxygen saturation (concentration of dissolved oxygen in water) (mg/L)
- Measuring the specific conductance (electrical conductivity of the water) (µsec/cm)
- Measure the amount of dissolved solids substances in water (hardness) (ppm)

All these previous chemical measurements were taken by the device called YK-2001 pH-scale, Intelligent pH meter, UKAS. After calibration by using two calibration solution with pH 4 and 7 in temperature 25°C. To ana anali results were analyzed using SD±mean analyze the results statistically was used t-test by SAS (2010), the Statistical Analysis System-SAS (2010) was used to effect of different factors in study parameters. Least Significant Difference (LSD) test was used to significant compare between means in this study, for the level of probability of <0.05.

RESULTS AND DISCUSSION

The current study showed no significant differences between control water and the magnetic fuel treatment device for water with three types of intensities, 500, 1000 and 1500 G, in respectively, for first 7 weeks about the boiling degree factor (the temperature). But this study showed significant differences between control water and magnetically water treatment with different intensities. Because occurs increase in rates of temperature (boiling degrees) in every 8-10 weeks. But the high values which recorded in this study were 22.3 , 22.6 and 22.5°C in the magnetically water with 500, 1000 and 1500 G intensities in respectively. While the less value was 17.2°C in control water, especially in the fourth week. Generally, it gets a slight increase in the water boiling (the temperature), when increasing the magnetic forces (Table 1). Also, the

acidic water (alkalinity) (pH-scales or pH-values) it was significant increasingly in the magnetic water treatment compared with untreated magnetically water. Because the average of alkalinity in the magnetized water were 9.1, 9.0 and 8.9 in, respectively. But in control water was 7.9. While the highest values of alkalinity which recorded in this study were 9.82, 9.5 and 9.54 in 500 G in 9th week, 1000 G in the 2nd week and 1500 G in the 2nd week too in respectively, compared with untreated magnetized water which were 8.41, also in the 2nd week as highest value (Table 2). Also, this study also shows significant differences for the oxygen saturation in the treatment of magnetic water treatment compared with control water (untreated water). Then, highest concentration of oxygen saturation or oxygen dissolved in water was 11.8 mg/L in the Ist week, 12.1 mg/L in the 8th week and 12.2 mg/L in the Ist week for magnetic water treatment with 500, 1000 and 1500 G in respectively, compared with untreated magnetic water treatment which was 9.2 mg/L in the ninth week (Table 3). Also, got a significant increase in electrical conductivity with increase magnetization. Therefore, the highest values recorded in the magnetically water which respectively 794 µsec/cm in 6th week, 797 µsec/cm in the 6th week and 799 µsec/cm in the 6th week also, compared with untreated water which were 651 µsec/cm in the third week (Table 4). On the other hand got a significant increase in the amount of total dissolved solids amounts (salinity) in the magnetization water. So, the highest values were 539 ppm in the 6th week, 540 ppm in the 6th week and 545 ppm in the 6th week too, of intensities 500, 1000 and 1500 G in respectively, compared with untreated water which was the less value 426 ppm in the 3rd week (Table 5).

The results of this study to increased significantly all the previous qualities of water an increased the magnetic intensities compared with untreated water (without magnetic treatment), such as the temperature levels, pH-values, concentration of dissolved oxygen in the water, electrical conductivity and total dissolved solids, agree with the study by Hasaani *et al.* (2015) when

Table 1: Effect of the magnetic fuel treatments device of water and weeks in temperature (°C)

Weeks	Mean±SE of temperature (°C)				LSD values
	Control	500 G	1000 G	1500 G	
1	18.3±0.56	18.3±1.03	18.4±0.93	18.2±1.22	1.45 NS
2	20.1±1.39	21.1±1.25	21.3±1.22	21.4±1.54	1.92 NS
3	21.5±0.76	22.2±1.43	22.2±1.41	21.9±1.09	2.09 NS
4	17.2±0.88	18.1±0.97	18.2±0.89	18.1±0.95	1.83 NS
5	19.1±1.03	20.1±0.79	20.3±1.32	20.3±0.92	2.14 NS
6	19.4±0.82	19.6±0.84	19.6±1.25	19.8±1.23	1.67 NS
7	22.2±1.23	22.3±1.42	22.3±1.54	22.5±0.96	1.74 NS
8	19.4±0.65	21.4±0.94	22.6±1.30	19.7±0.79	1.33*
9	19.5±0.82	21.8±0.97	18.6±0.83	19.7±0.85	1.54*
10	17.4±0.78	21.9±1.02	17.5±0.78	20.6±1.23	1.48*
LSD value	1.65*	1.83*	1.55*	1.60*	---

* (p<0.05); NS = Not Significant

Table 2: Effect the magnetic fuel treatments device of water and weeks in pH-values

Mean±SE of pH					
Weeks	Control	500 G	1000 G	1500 G	LSD values
1	7.77±0.54	9.2±0.65	9.3±0.74	9.4±0.56	0.78*
2	8.41±0.61	9.3±0.81	9.5±0.66	9.54±0.47	0.81*
3	8.26±0.53	9.1±0.59	9.1±0.65	8.96±0.62	0.85 NS
4	7.76±0.45	9.1±0.59	9.2±0.65	9.2±0.39	0.79*
5	7.34±0.51	9.1±0.65	8.9±0.54	8.89±0.64	0.92*
6	8.12±0.39	9.2±0.72	9.4±0.71	9.5±0.59	0.77*
7	7.50±0.53	8.83±0.54	8.9±0.54	8.86±0.46	0.69*
8	8.02±0.44	8.81±0.65	8.07±0.72	8.13±0.60	0.85 NS
9	8.11±0.78	9.82±0.72	9.4±0.56	8.5±0.61	0.71*
10	7.93±0.61	8.87±0.67	8.88±0.63	8.08±0.55	0.68*
LSD value	0.92 NS	0.96 NS	0.77*	0.81*	---

Table 3: Effect the magnetic fuel treatments device of water and weeks in DO saturation (mg/L)

Mean±SE of DO					
Weeks	Control	500 G	1000 G	1500 G	LSD values
1	8.2±0.32	11.8±0.54	11.9±0.49	12.2±0.51	1.14*
2	8.4±0.45	11.7±0.67	11.8±0.54	11.9±0.54	1.23*
3	8.5±0.51	11.6±0.67	12.0±0.92	11.9±0.73	0.954*
4	9.1±0.72	11.5±0.54	11.7±0.52	12.1±0.50	1.17*
5	8.8±0.66	11.4±0.54	11.6±0.61	11.8±0.43	1.20*
6	8.7±0.69	11.6±0.72	11.8±0.73	11.9±0.62	1.27*
7	8.2±0.52	11.2±0.45	11.3±0.56	11.6±0.45	1.32*
8	8.3±0.78	11.7±0.54	12.1±0.61	10.0±0.59	1.15*
9	9.2±0.64	10.8±0.65	11.6±0.56	11.7±0.82	1.09*
10	8.9±0.59	11.5±0.71	11.6±0.71	11.7±0.56	1.25*
LSD value	1.44 NS	1.49 NS	1.39 NS	1.13*	---

Table 4: Effect the magnetic fuel treatments device of water and weeks in EC (µs/cm)

Mean±SE of EC					
Weeks	Control	500 G	1000 G	1500 G	LSD values
1	732±19.6	785±24.3	787±19.5	789±26.4	35.41*
2	670±16.4	696±17.5	698±23.3	701±19.2	21.58*
3	651±20.8	679±19.4	683±19.9	685±14.6	24.61*
4	747±18.5	783±22.7	779±27.4	784±23.3	19.54*
5	653±22.4	744±18.5	746±21.7	748±21.4	33.05*
6	760±26.8	794±28.3	797±23.0	799±25.0	22.96*
7	682±21.4	765±19.8	766±25.2	769±18.6	28.42*
8	756±25.8	705±16.0	699±18.5	749±22.5	25.36*
9	694±19.4	785±23.5	787±23.8	789±18.3	27.43*
10	765±22.0	698±16.4	765±19.1	770±14.7	22.15*
LSD value	33.76*	29.54*	32.57*	32.32*	---

Table 5: Effect the magnetic fuel treatments device and weeks in TDS (ppm)

Mean±SE of TDS					
Weeks	Control	500 G	1000 G	1500 G	LSD values
1	482±12.4	535±14.8	538±12.4	541±14.5	20.04*
2	449±22.7	475±13.6	478±17.2	480±16.4	18.45*
3	426±16.2	456±17.4	459±11.2	455±16.9	21.72*
4	495±22.1	528±21.8	529±19.5	530±23.7	21.89*
5	428±19.3	518±18.5	520±24.3	522±19.5	28.54*
6	508±23.8	539±16.4	540±19.6	545±22.6	21.49*
7	458±17.4	534±20.1	530±22.4	535±18.9	25.02*
8	510±22.3	469±17.2	460±16.4	505±22.5	21.56*
9	464±16.3	435±16.9	455±19.7	461±18.2	21.73*
10	460±21.5	468±14.8	471±17.4	475±20.6	19.34*
LSD value	29.43*	27.39*	29.05 *	30.61 *	---

* $(p < 0.05)$; NS = Not Significant

they found the pH-value of water is a measure of its acidity or alkalinity, therefore, its level indicate the activity of hydrogen molecules (DeZuane, 1997). When the water exposed to a magnetic fuel treatment, results have shown

an increase in the pH-values by a factor of 12% of the application of magnetic field of intensity strength 6560 G. Also, this study agree with the results by Banejad and Abdosalehi (2009) when reached to magnetic fields with intensities of 0 Tesla (as a witness), 0.05, 0.075 and 0.1 Tesla were examined. Also, it has chosen amounts of water influent each 4 and 30 L/h. With doing examination by three times and analyze the results with SAS Software, have shown that changing magnetic fields intensities, amounts of water influent and also together influence these factors have significant effects at level of 99% on reducing of water hardness. In the other way, for finding their mechanisms, analyzes done by X ray. The calcium carbonate exists in two forms, one calcite and aragonite. But the main form of sediment is calcite. The results showed that amount of aragonite in compare with calcite by attention to situation, increased 70-99.99% and ratio between calcite to aragonite had a main reducing. So, these results are consistent with results by AL-Ibady (2015) when she got a significantly increased the value of pH an increase of magnetic intensity hanging over the water, compared with control water (without magnetic field). Also, increased significantly dissolved oxygen concentration, an increase of magnetic intensity, especially in the intensity 1.5 Tesla compared to the rest of magnetic intensities and untreated water magnetically. In that experiments event an increase in the electrical connectivity in the dipolar magnetized water, increased it's value of electrical conductivity of water an increase of magnetic intensity compared with the untreated water. As well as, those in that experience, found the highest increase in water soluble salts (Total Dissolved Solids TDS), especially in 1.5 Tesla intensity, compared with control water. It all back to the effect of magnetic field on water bears a complex and multifactorial character that in the final result affects the structure of water and hydrated ions as well as the physic-chemical properties and behavior of dissolved inorganic salts (Ochkov, 2006). Also The principles of physical effects of the magnetic field on H₂O molecules as well as the parameters of physic-chemical processes occurring in water and the behavior of the dissolved in water scaling salts subjected to the magnetic treatment are discussed. It is demonstrated that the effect of the magnetic field on water is a complex multifactorial phenomenon resulted in changes of the structure of hydrated ions as well as the physic-chemical properties and behavior of dissolved inorganic salts, changes in the rate of electrochemical coagulation and aggregate stability (clumping and consolidation), formation of multiple nucleation sites on the particles of fine dispersed precipitate consisting of crystals of substantially uniform

size. There are also submitted data on constructive features of various magnetic water treatment devices produced by domestic industry, based on the permanent magnets and electromagnets (solenoids), such as Hydro Magnetic Systems (HMS), Magnetic Transducers (MT) and Magnetic Activators (MA) of water (Mosin and Ignatov, 2014). For the rising of pH refers to it's essential to bear in mind that ordinary tap water has a pH-value of around 7. Upon applying a magnetic field, many hydroxide (OH⁻) ions are formed calcium bicarbonate and other alkaline material, this helps to raise the pH-value which reduces acidity, it's essential, may be reached to 7.8 (Colic *et al.*, 1998). Most water softeners remove problematic dissolved magnesium and calcium by passing water through a bed of "ion-exchange" beads. The beads are initially contacted with a concentrated salt (sodium chloride) solution to saturate the bead exchange sites with sodium ions. These ion-exchange sites have a greater affinity for calcium and magnesium, so when hard water is passed through the beads the calcium and magnesium ions are captured and sodium is released. The end result is that the calcium and magnesium ions in the hard water are replaced by sodium ions. The sodium salts do not readily form scale or soap scum, so the problems associated with hard water are avoided (Powell, 1998). But our results of this study disagreement with the results by Hasaani *et al.* (2015) because they found when water is magnetized, chemical parameters such as the total dissolved solids and the electrical conductivity experienced degradation of 33 and 36%, respectively. On the other hand, the pH parameters showed an upgrade of 12%. Also, when water samples are exposed to a magnetic field with 6560 G, the thermal conductivity is decreased by 16%. But the Changes in hydrogen bonding may affect carbon dioxide hydration (Mohammed *et al.*, 2010). When water is magnetically treated; more hydroxyl (OH⁻) ions are created to form alkaline molecules and reduce acidity. Normal water has a pH-level of about 7 whereas the magnetized water can reach a pH of up to 9.2 following the exposure to a 7000 G strength magnet for a long period of time (Lam, 2001). The third changing which occurred on the chemical properties of water after magnetization process was increasing the dissolved oxygen. This result agreement with study by Yang *et al.* (2011) when they found that Chlorella will be affected by the dipole magnetic field during its growth. Magnetically treatment of chlorella indicates that chlorella is affected by the dipole magnetic field with weaker strength to some extent, for example, protein content of chlorella increases as well as oxygen dissolution in chlorella solution. With increasing of the dipole magnetic field strength, the effect decreases. During the treatment if the strength is 0.24

Tesla, protein and oxygen are produced properly; If it is 0-0.18 Tesla, protein content in chlorella trends to increase. As the water molecule bi-polar, consisting of oxygen-atom linked to a hydrogen atom at an angle 105 degrees. Given the high tendency shown by oxygen atom to pull electrons, it leads to localized shipped negatively charged (δ^-) and shipping positively charged hydrogen atom localized (δ^+). As the water molecule neutral charge, then the number of positive charges equals the number of negative charges. However, the positive and negative charges are far apart from each which makes the water molecule bi-polar, similar to magnets. Be responsible for the forces of attraction in the water molecules. After that water molecules tend to cluster around the polar molecules which dissolved in water does not belong to the attraction between them again, because the dielectric constant of water became high. Then, the water molecules act to weaken the bonds between the charged ions and then increase the break (AL-Ibady, 2015). While the reason for the increased solubility of the salts when exposed to the dipole magnetic fields, refers to the dipole magnetic field that modifies some of the chemical and physical properties of water. Also, it makes the water retains with dipole magnetic properties through dissolve minerals and vitamins (AL-Ibady, 2015). Then, the increase of thermal conductivity an increase the magnetic intensities during this study was refers to dissolution of the particles correlated, also lack of the preparation of clusters allowing absorb the thermal energy more. This help increase the speed up the interactions of vital for each cell, it's produced for example an increase growth of plant in shorter time compared with untreated magnetically water.

CONCLUSION

The experiments have shown that the magnetic fuel treatment device of water quality (physic-chemical properties of water), very important for the human, animals, plants and ecosystem. Because this device in different intensities advantage to treatment of environment in all aspects. For example, to rid waters of salinity, reduced the acidity of water because the cancer cells don't live in the alkalinity environments, Increase the saturation water oxygen, increase of electrical conductivity an increase electrolysis of water, increase the level of temperature with increase the efficiency of treatment for magnetic intensity resulting in an increase of thermal conductivity to increase the interactions vital thermal and increase the solubility of metal salts in the water in order to reach metal salts to all parts of the plants and rid of the soil from the salinity. That's what reached his study.

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