A New Method to Increase the Ability of the Water for Dissolving Total Salts in Soil by Using the Magnetism

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ABSTRACT

The magnetism applications are increasing day by day. In this research the concepts of magnetism is the base of proposing a new method to find the total dissolved salts in soil. The aim of this proposed magnetism method is to accelerate the required time to determine the total dissolved salts which is expressed by the sample (TDS) ,where the standard test takes 3 to 4 day; this will cause some delay especially if there is no enough time to find the results of test by the standard method. For this, the important of this research is appeared where the proposed procedure takes 1 hr only to prepare the sample before put the sample in the oven for drying. The results of experimental tests for a large number of soil samples shows that approve the efficiency of the proposed method, which confirms the ability of magnet to dismantle salt molecules and release hydrogen ion in water. The proposed procedure needs magnets of capacity equal to 3750 (gauss) to give the desired results.

Keywords: Magnetism applications, Total dissolved salts, Hydrogen bond**.**

طريقة جديدة لزيادة قابلية الماء على إذابة الأملاح الكلية في التربة باستخدام المغناطيس

الخلاصة

إن التطبيقات المغناطيسية في تزايد يوما بعد يوم. في هذا البحث المفاهيم المغناطيسية هي قاعدة لاقتراح طريقة جديدة لإيجاد الأملاح الذائبة الكلية في التربة. والهدف من هذه الطريقة المغناطيسية المقترحة تسريع الوقت اللازم لإيجاد الأملاح الذائبة والتي يرمز لها (TDS) حيث إن الفحص القياسي يستغرق 3 إلى 4 أيام ، وهذا سوف يسبب بعض التأخير وخاصة إذا لم يكن هناك ما يكفي من الوقت لإيجاد نتيجة الفحص من خلال الطريقة المعتادة. لهذا تظهر أهمية هذا البحث ، حيث يأخذ الأسلوب المقترح ساعة واحدة فقط لإعداد العينة قبل وضع العينة في الفرن للتجفيف.إن نتائج الاختبارات التجريبية لعدد كبير من عينات التربة تظهر كفاءة هذه الطريقة المقترحة، مما يؤكد قدرة المغناطيس على تفكيك جزيئات الملح وتحرير أيون الهيدروجين في الماء. إن الأسلوب المقترح يحتاج إلى مغناطيس ذي سعة مساوية إلى 3750 (غاوس) لإعطاء النتائج المطلوبة.

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INTRODUCTION

The phenomenon of water treatment by the magnetic field, were known for many years and it was reported as being effective in numerous instances [1].

The water is a good solvent for ionic substances. The important of this property appear from its dipole and dielectric constant, these, in turn, derive from the composition and shape of the water molecule [2]. Water is an unusual substance, mostly due to it 3D network of hydrogen bond in the molecule. Its properties allow it to act as a solvent, reactant, a molecule with cohesive properties and as a temperature stabilizer. For that the water could be affected by the magnetic fields [3].

In chemistry the salts are ionic compounds result from an acid and a base. That's mean these salts composed of cations and anions, so the product is electrically neutral. These component ions are inorganic such as chloride or organic such as acetate Acidic salts that salts which are hydrolyze to produce hydronium ions in water. Neutral salts are those that are not acid or minimal salts. An electrolyte is the salts that able to conduct electricity such as sodium chloride in water. Mixtures of many ions in solution usually do not define salts after evaporation of the water. [4]

MAGNETIC WATER APPLICATION

The water possesses particular properties not found in other materials, these properties occur by the impact of the environment surrounding on the hydrogen, especially in liquid water. This hydrogen bond in liquid water, highly affected with electrical and magnetic fields [5]. It is found that some physical and chemical properties are changed when water pass through magnetic field .Therefore the so called "magnetized water" has chemical and physical properties different than ordinary water. [6]

Magnetically treated water is water which has been passed through a magnetic field prior to use. There are a lot of benefits to use such treated water, although there is considerable debate about its efficacy. Biological benefits are including: increased commercial earliness of crops; increased yield; increased vitamin C, sugar and total acid content. [7]

The zones of magnetism application are increased day by day and some of its applications are shown below. These applications are the base of the proposed method which is presented in this research:

Agricultural Application

In following below some of studies of using the magnetic technology:

- The magnetized water helps in dissolving minerals in a rate higher than non-magnetized water. There is a proportional relationship between the solubility of (sodium chloride, calcium chloride dehydrate) and the time of exposure the water to the magnetism field. It was clear, that the advantages from using magnetism solutions for these two salts will be useful in the biological and physiological systems. [8]

- Magnetism water has very active effects on seeds. Treating the water with static magnetic field will increases its solubility tendency for salts. The seeds that irrigated by magnetism water will got more nutrients from soil.[9]
- During 2004-2005 and 2005-2006 seasons a field experiment are carried out to study the effect of magnetism irrigation water and phosphorus fertilizer levels on the growth and yield of wheat. The results showed that the plants magnetic irrigated water was superior in height, flag leaf area, biological yield, and grain yield compared with plants non magnetic irrigated water.[10]

Medicinal Application

In this field the largest application appear with kidney stones treatment as below:

- Calcium oxalate is the major constituent of kidney stones. Magnetic water have a great influence on dissolving calcium oxalate which appear from Measure the parameters from the solution of the calcium oxalate ,which exposed to the magnetism fields different in intensities and different in the time of exposure ,shows that the efficiency of the dissolve are increased with the treated water . The results also show that the size and patterns of precipitate (CaC_2O_4) strongly change with the treatment conditions. [11]

Industrial Application

- As known a considerable portion of the world population is being supplied of the hard water, which have negative effect on different (domestic, industrial and agricultural) application. Recently, various research efforts have been directed towards treat this water by using the magnetic techniques. [12]

Hard water is water that has a high content of mineral. The main components of these minerals usually are ions of calcium (Ca^{2+}) and magnesium (Mg^{2+}), in addition to dissolved metals, bicarbonates, and sulfates. Calcium usually enters the water as a calcium carbonate ($CaCO_3$), in the form of limestone and chalk, or calcium sulfate ($CaSO_4$) in the form of several other mineral deposits. The main source of magnesium is dolomite ($CaMg(CO_3)_2$).The total water 'hardness' (including both $Ca^{2+}$and Mg^{2+} ions) is expressed by parts per million (ppm) or weight/volume (mg/l) of calcium carbonate ($CaCo_3$) in the water i.e. the total dissolved salts (TDS). Hard water causes deterioration of equipment and its failure, increased energy consumption and loss of money. The TDS of water could be reduced by using chemical or physical methods. The chemical method is very effective, however can cause environmental pollution through the disposal of treated water. [13]

- Applications of Magnetically treated water are abundant in industry where it is used to prevent scaling on the inner walls of pipes conveying fluids, especially water.[14]

These are some published research in this area where it the base to propose a new method to speed up the test of the total dissolved salts. In the following below, the proposed method is described in detail.

THE EXPERIMENTAL WORK

The experiments are carried out on soil specimens taken from different locations of Baghdad city.

The testing program consists of three stages. in the first stage, the total dissolved salts is tested for samples by the ordinary method and named as (series A), the second stage studying the effect of using magnetized distilled water by using magnets of capacity equal to 3750 gauss (named as series B), and in the third stage, these pieces of magnets used directly on samples, this stage named as series (C). These stages are described as follows:

Series A

The first series of (TDS) tests is done by preparing six cylinders for each sample as below:

1. In the first cylinder, the sample is prepared using the Earth Manual procedure [15]; by adding 250 cm3 of distilled water to 5 gm of soil and shaking for 3-day, and after that the (TDS) is founded for 50 cm^3 taking from the cylinder.

2. In the second cylinder, the sample prepared to follow the preceding procedure and the test time is 1 hour only after preparing the sample, and then the (TDS) ratio is founded for the sample.

3. In the third cylinder, the sample prepared follow the preceding procedure and the test time is 2 hours only after preparing the sample, and then the (TDS) ratio is founded for the sample

4. In the fourth cylinder, the sample prepared follow the preceding procedure and the test time is 3 hours only after preparing the sample, and then the (TDS) ratio is founded for the sample

5. In the fifth cylinder, the sample prepared follow the preceding procedure and the test time is 4 hours after preparing the sample, and then the (TDS) ratio is founded for the sample.

6. In the sixth cylinder, the sample prepared follow the preceding procedure and the test time is 24 hour only after preparing the sample, and then the (TDS) ratio is founded for the sample.

Series B

The effect of use magnetized distilled water, which is used to dissolved salts in (TDS) test, is studied by follow the test program, this series consists of two group of tests as follow:

1. The first group of tests in this series is done by using magnetized distilled water set-up for 12 hours before using it to prepare the samples. This group consists of 4 cylinders for each sample, they are:

1) In the first cylinder, the sample prepared for (TDS) test by using this magnetized water. These samples are tested after 1 hour only from put the magnetized water in the sample.

2) In the second cylinder, the sample prepared as previous, but the samples are tested after 2 hours.

3) The third cylinder prepared as previous and the test of (TDS) is done after 3-hours from put the magnetized water on the samples of soils.

4) In the fourth cylinder, the sample prepared also as previous, and the time to put the magnetized water on samples before the test of (TDS) was 4 hours.

2-The second group of testing in this series is done by using the magnetized distilled water set - up for 24 hours before using it to prepare the samples and this group consists of 4 cylinders for each sample, they are:

1)In the first cylinder, the sample prepared for (TDS) test by using the magnetized water. These samples are tested after 1 hour only from put the magnetized water in the sample.

2)In the second cylinder, the sample prepared as previous, but these samples are tested after 2 hours.

3)The third cylinder prepared as previous and the test of (TDS) is done after 3 hours from put the magnetized water on the samples of soil.

4)In the fourth cylinder, the sample prepared also as previous, and the time to put the magnetized water in samples before the test was 4 hours.

Series C

In this series of tests the preparation of samples is similar to series B, but instead of using the magnetic water a pieces of magnets is used directly on samples which are prepared from distilled water. For each sample, four containers are prepared as below, the containers made from stainless steel as shown in Figure (1-D).

1) In the first container, the sample prepared for (TDS) test by using magnets directly. These samples are tested after one hour only after put the magnets on sample.

2) In the second container, the samples are prepared as above, but these samples are tested after two hours.

3) The third container is prepared by using a magnet directly as above and the test of (TDS) is done after three hours from put the magnets on the samples.

4) In the fourth cylinder, the samples are prepared also by put the magnets on samples directly but for four hours before the test of (TDS).

MODIFIED PROCEDURE DESCRIPTION

Magnetized water was prepared by setup magnetic on the water jar for 12 (hrs.) and 24 (hrs.) in order to find the suitable effect on the salts in the soil. Figure (1-B) show the way that applies to make that.

As shown in this figure the amount of water is satisfied according to the extent of the domain of the magnetic which is found according to the usual method as shown in Figure (1-A).

The magnetic lines is depending on the magnetic capacity which is found by the (gauss meter), the module of that meter is (DGM-102) as shown in Figure (1-C).

The magnetic used directly on the soil samples ,the setup of the proposed procedure for series (C) will be used to determine the total dissolved salts in soil is shown in Figure (1-D) as mention before.

PROPERTIES OF SOIL

The general properties of the soil such as soil description and specific gravity for all the soil samples are shown in Table (1).

THE RESULTS OF THE MODIFIED PROCEDURE OF (TDS) TEST

The experimental results for series (A) will show in Table (2). Where the results of series (B) for 12 hour magnetized water is shown in Table (3). Table (4) shows the results for 24 hour magnetic water.
The TDS value for series C will show in Table (5).

ANALYSIS OF THE RESULTS

The results obtained from the experimental work which are illustrated in Table (2, 3, 4 and 5), is represented in Figures (2) to (13):
Figures (2, 3, 4 and 5) show the total dissolved salts by using distilled water and distilled water submissive to the magnetism for 12 hour, and the tests are performed after (1 , 2 , 3 and 4) hour from the sample preparation respectively .

Figures (6,7,8,9) show the relation between total dissolved salts by using distilled water and distilled water submissive to the magnetism for 24 hour, in both the tests are done after (one ,two, three and four) hour from the sample preparation respectively.

Figures (10,11,12,13) show the relation between total dissolved salts by using distilled water only and distilled water with submissive magnetism directly on the samples, in both the tests are done after (one , two , three and four) hour from the sample preparation respectively.

From figures (2,3,4 and 5) it could be found that the use of magnetic water (set-up with magnetic for 12 hours before use it) will increase the ability of the water on dissolving the salts that found in soil with time comparing with the amount of salts that dissolved with time by using distilled water . The correlation factor were (0.9462786, 0.9598319, 0.9625415 and 0.962357598) for (1, 2, 3 and 4) hours respectively.

The Figures (6, 7, 8 and 9) show that the use of magnetic water set-up with magnetic for 24 hours will be more effective on dissolving the salts and the correlation factor were (0.9892916, 0.9899616, 0.9899048 and 0.989845957) for (1, 2, 3 and 4) hours respectively.

From above it is obvious that the increasing the period of applying the magnetic on the water will increase the ability of the water on dissolving the salts.

Figures (10, 11, 12 and 13) show that the use of magnetic directly set-up with soil sample and the correlation factor were (0.98943629, 0.9893879, 0.98953174 and 0.989826507) for (1, 2, 3 and 4) hours respectively.

The summary of the correlation factor and R-squared value (R2) for the magnetism treatment and without magnetism treatment in finding the total dissolved salts with the ordinary period (3 day) is shown in Table (6).

The results obtained have been studied in detail to find out the efficiency of the use of magnetic technology in an examination to find total dissolved salts in the soil. Below the most important results obtained from this research.

CONCLUSIONS

The following conclusions can be drawn from the results of this research:
1. The magnetized water helps in dissolving salts by a higher rate than non-magnetized water.

2. Increasing the time period to subdue the soil sample to the effect of the magnet increases the amount of salts that dissolve in the sample.
3. By applying the proposed procedure the tests will be fast and gives a very good results comparing with ordinary method to find the total dissolved salts in soils.
4. The impact of the use of magnets directly gave better results than the use of distilled water magnetized for 12 hours. In general, both gave good results in terms of reducing the time needed for devolving the salts in the water.
5. The root square by using magnetism distilled water for 24 hour and or using the magnets directly in water, not different so much in results .so magnets could be used directly and decrease the time that we need for testing the total dissolved salts after one hour.
6. As a result from this research it is recommended to use a magnetic with 3750 gauss directly set-up with soil sample for 1 hour before finding the total dissolved salts by drying method. And this technique give a correlation factor equal to (0.98944) comparing with ordinary method (after 3-day)
7. The proposed procedure a very easy to operate, and by applying it, a large number of samples could be measured in short time.

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Table (1) The properties and the description of the samples.

sample no.	location	Gs	OR	So_3	CL	Soil Description
1	al-jadrea	2.67	0.2	1.25	40	green to brown clayey sandy silt
2	al-jadrea	2.62	0.3	0.67	40	brown sandy silt
3	al-jadrea	2.79	2.1	1.02	90	brown clayey silt
4	sahat al-wathek	2.76	0.9	0.82	90	brown silty clay
5	sahat al-wathek	2.79	0.9	1.24	135	dark brown silty clay
6	sahat al-wathek	2.8	1.9	1.46	40	brown clay
7	al-orfaly	2.77	1.9	3	250	brown silty clay
8	al-orfaly	2.73	1.7	1.6	350	black clay with silt
9	al-orfaly	2.72	0.9	2.23	40	brown clayey silt
10	al-orfaly	2.75	1.1	3.99	375	brown silty clay to clayey silt
11	al-orfaly	2.77	1.9	5.06	200	silty clay with fill material
12	al-orfaly	2.78	1.5	3.61	500	dark gray to black silty clay with fill materials
13	felesteen street	2.78	0.8	1.53	4000	brown silty clay with fill material
14	felesteen street	2.81	1.1	2.57	550	brown clay
15	felesteen street	2.77	1.1	1.06	550	brown clayey silt
16	felesteen street	2.79	0.5	1.58	450	brown silty clay with salts
17	felesteen street	2.79	1.2	4.3	700	brown silt clay
18	felesteen street	2.74	0.6	0.88	450	brown clayey silt

Table (2) The results of the total dissolved salts for the samples with time using standardtest.

sample no.	depth	location	1 hr	2 hr	3 hr	4 hr	1 day	3 day
1	18.75-19.75	al-jadrea	0.33	0.47	0.53	0.57	0.82	1.18
2	14.5-15	al-jadrea	0.18	0.2	0.34	0.39	0.47	0.63
3	2	al-jadrea	0.31	0.39	0.57	0.59	1.38	1.89
4	12	sahat al-wathek	0.88	0.91	1.13	1.14	1.16	1.17
5	15	sahat al-wathek	0.56	0.73	0.88	1.01	1.22	1.25
6	6.5	sahat al-wathek	1.39	1.45	1.51	1.55	1.91	1.92
7	2-2.5	al-orfaly	1.66	1.71	1.89	1.97	2.43	3.07
8	9.5-10	al-orfaly	1.31	1.39	1.44	1.52	1.79	1.87
9	2-4.5	al-orfaly	0.78	0.79	0.86	1.03	1.39	1.5
10	8-9.5	al-orfaly	1.32	1.41	1.59	1.71	2.29	2.32
11	0-1.5	al-orfaly	2.21	2.29	2.36	2.47	3.08	3.28
12	9.5-10	al-orfaly	1.89	1.9	2.19	2.21	2.39	2.62
13	0-1.5	felesteen street	2.02	2.05	2.28	2.29	2.35	2.51
14	5.5-7.5	felesteen street	1.21	1.25	2.2	2.33	2.6	2.68
15	11.5-14.5	felesteen street	1.04	1.11	1.83	1.84	1.89	1.93
16	2-2.5	felesteen street	1.11	1.23	2.09	2.11	2.15	2.16
17	5-5.5	felesteen street	2.66	2.69	3.43	3.44	3.52	3.54
18	11-11.5	felesteen street	0.18	0.21	1.23	1.24	1.35	1.39

Table (3) The results of the total dissolved salts for the samples with time by using magnetic distilled water for 12 hours.

sample no.	T.D.S by normal method 3-day	T.D.S by magnetic water magnetic for 12 hour			
		1 hour	2 hour	3 hour	4 hour
1	1.18	0.5	0.52	0.53	0.55
2	0.63	0.38	0.4	0.41	0.43
3	1.89	1.32	1.4	1.42	1.45
4	1.17	0.79	0.91	0.99	1.01
5	1.25	0.92	1.01	1.09	1.11
6	1.92	1.65	1.81	1.82	1.85
7	3.07	2.58	2.89	2.91	2.93
8	1.87	1.41	1.73	1.75	1.77
9	1.5	1.34	1.35	1.35	1.36
10	2.32	1.65	2.09	2.11	2.12
11	3.28	2.47	2.66	2.61	2.62
12	2.62	2.16	2.27	2.29	2.3
13	2.51	2.29	2.27	2.33	2.34
14	2.68	1.95	1.99	2.2	2.3
15	1.63	1.86	1.87	1.89	1.9
16	2.16	1.97	1.99	2.01	2.02
17	3.54	3.4	3.41	3.42	3.44
18	1.39	1.2	1.22	1.23	1.39

Table (4) The results of the total dissolved salts for the samples with time by using magnetic distilled water for 24 hours.

sample no.	T.D.S by normal method 3-day	T.D.S by magnetic water magnetic for 24 hour			
		1 hour	2 hour	3 hour	4 hour
1	1.18	0.6	0.61	0.63	0.65
2	0.63	0.5	0.51	0.53	0.54
3	1.89	1.52	1.54	1.55	1.57
4	1.17	1.02	1.04	1.06	1.09
5	1.25	1.09	1.12	1.19	1.2
6	1.92	1.8	1.83	1.84	1.86
7	3.07	2.93	2.95	2.97	2.99
8	1.87	1.73	1.75	1.78	1.8
9	1.5	1.35	1.38	1.4	1.41
10	2.32	2.11	2.14	2.18	2.19
11	3.28	2.91	2.99	3.08	3.11
12	2.62	2.45	2.47	2.5	2.55
13	2.51	2.3	2.31	2.34	2.38
14	2.68	2.43	2.48	2.49	2.5
15	1.93	1.8	1.81	1.83	1.85
16	2.16	1.9	1.97	1.99	2.09
17	3.54	3.37	3.4	3.42	3.47
18	1.39	1.19	1.21	1.26	1.3

Table (5) The results of the total dissolved salts for the samples with time by using magnetic directly on the containers.

sample no.	T.D.S by normal method 3-day	T.D.S by using magnetic directly in the sample			
		1 hour	2 hour	3 hour	4 hour
1	1.18	0.64	0.65	0.67	0.69
2	0.63	0.54	0.55	0.57	0.59
3	1.89	1.58	1.59	1.6	1.62
4	1.17	1.09	1.108	1.11	1.14
5	1.25	1.21	1.22	1.23	1.24
6	1.92	1.88	1.89	1.90	1.91
7	3.07	3.01	3.03	3.04	3.05
8	1.87	1.82	1.82	1.84	1.86
9	1.5	1.47	1.48	1.49	1.49
10	2.32	2.27	2.29	2.3	2.31
11	3.28	3.2	3.22	3.23	3.25
12	2.62	2.55	2.56	2.58	2.60
13	2.51	2.42	2.44	2.48	2.49
14	2.68	2.57	2.58	2.59	2.63
15	1.93	1.88	1.89	1.90	1.91
16	2.16	2.08	2.12	2.13	2.15
17	3.54	3.42	3.44	3.48	3.5
18	1.39	1.26	1.28	1.35	1.37

Table (6) Correlation factor and R-squared value (R^2) for the magnetism treatment and without magnetism treatment in finding the (TDS).

Time in hour	T.D.S with out treatment				Magnetic treatment											
					T.D.S by magnetism water magnetic for 12 hour				T.D.S by magnetism water magnetic for 24 hour				T.D.S by using magnetism directly in the sample			
	1	2	3	4	1	2	3	4	1	2	3	4	1	2	3	4
Correlation factor	0.887339	0.88916	0.88980	0.88917	0.94628	0.95983	0.96254	0.96236	0.98929	0.98996	0.98900	0.98985	0.98944	0.98939	0.98953	0.98983
R-squared value (R^2)	0.787	0.790	0.791	0.808	0.895	0.921	0.926	0.927	0.978	0.980	00.979	0.979	0.979	0.978	0.979	0.979

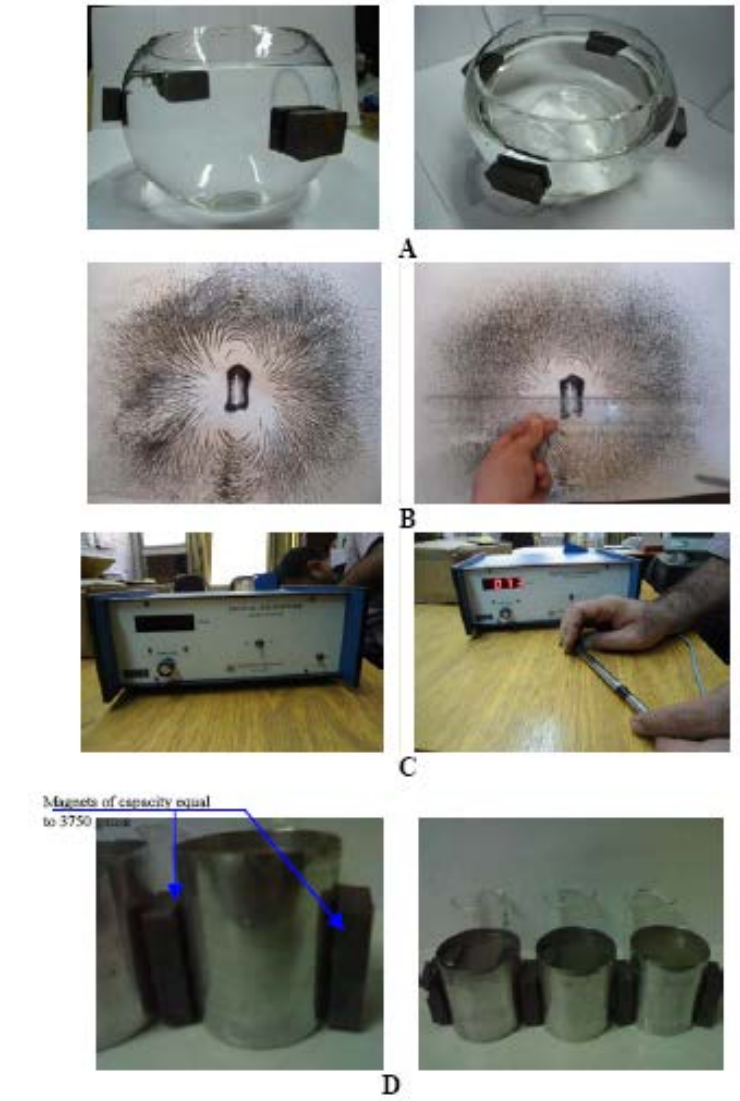

Figure (1) Setup of the (TDS) test for series (B) and (C).

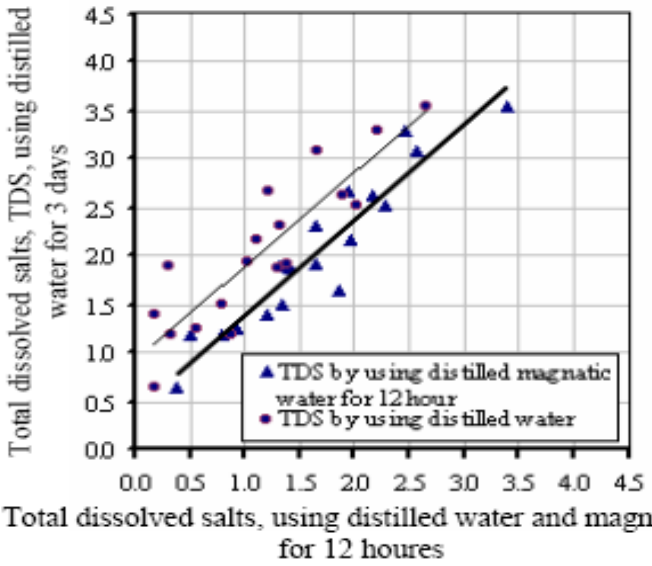

Figure (2) Total dissolved salts by using distilled water and distilled water submissive to the magnetism for 12 hour, the test are performed after 1 hour from the sample preparation.

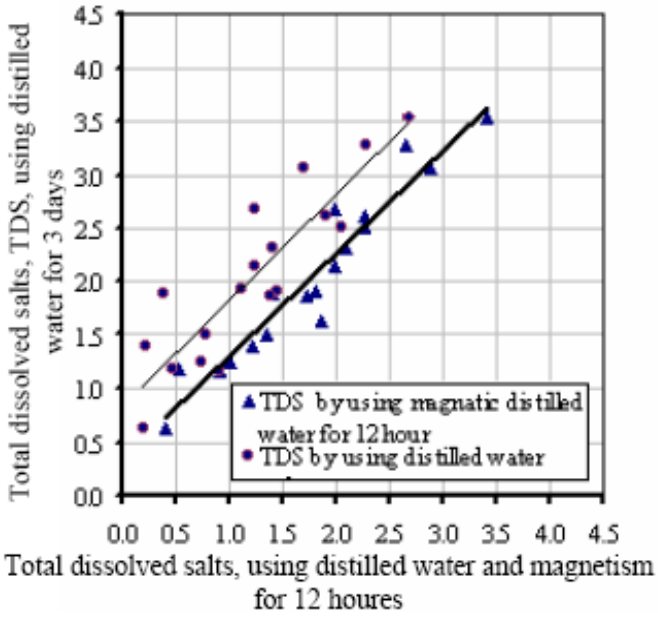

Figure (3) Total dissolved salts by using distilled water and distilled water submissive to the magnetism for 12 hour, the test are performed after 2 hour from the sample preparation.

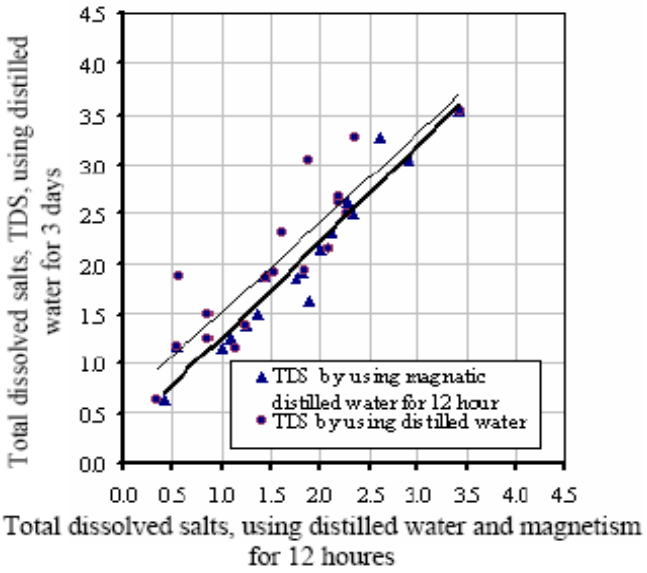

Figure (4) Relation between total dissolved salts by using distilled water and distilled water submissive to the magnetism for 12 hour, and the tests are done after 3 hour from the sample preparation.

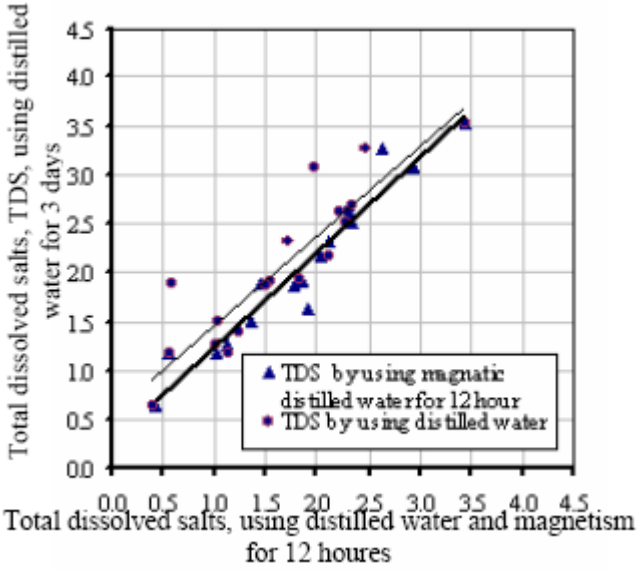

Figure (5) Relation between total dissolved salts by using distilled water and distilled water submissive to the magnetism for 12 hour, and the tests are done after 4 hour from the sample preparation.

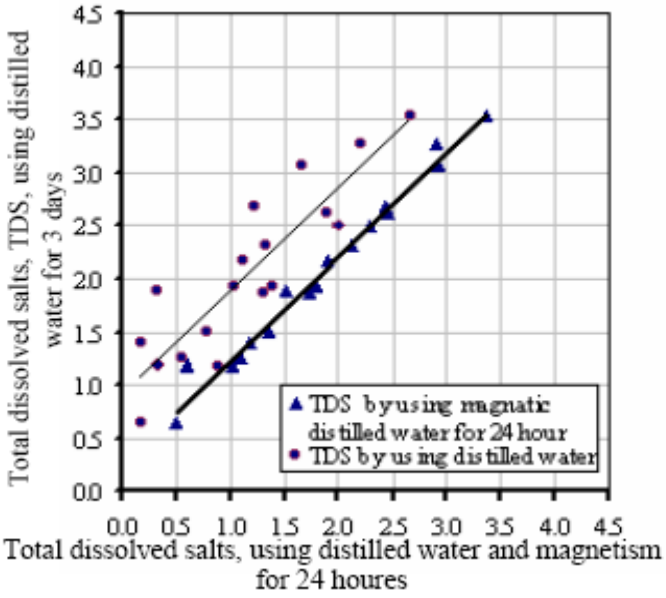

Figure (6) Relation between total dissolved salts by using distilled water and distilled water submissive to the magnetism for 24 hour, and the tests are done after 1 hour from the sample preparation.

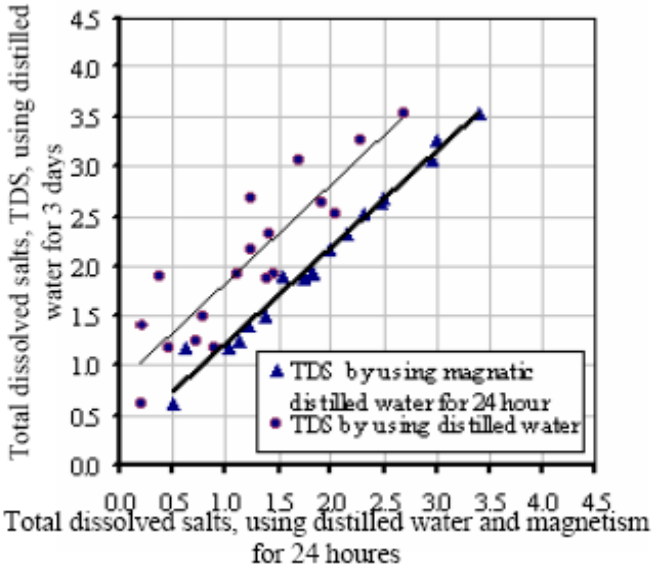

Figure (7) Relation between total dissolved salts by using distilled water and distilled water submissive to the magnetism for 24 hour, and the tests are done after 2 hour from the sample preparation.

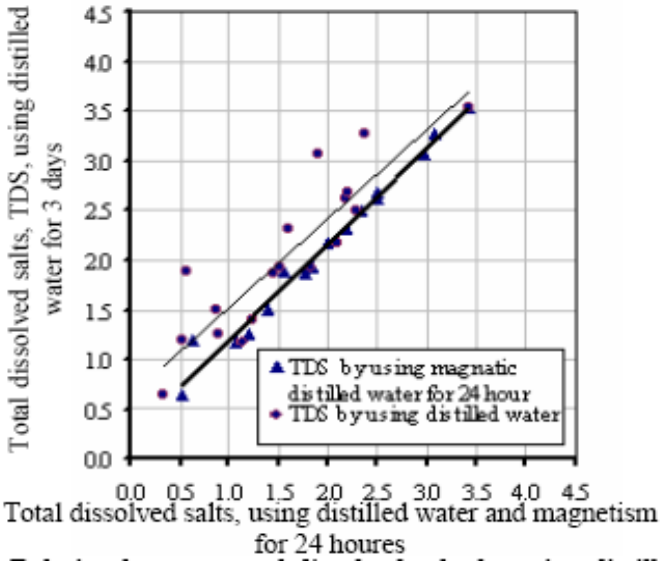

Figure (8) Relation between total dissolved salts by using distilled water and distilled water submissive to the magnetism for 24 hour, and the tests are done after 3 hour from the sample preparation.

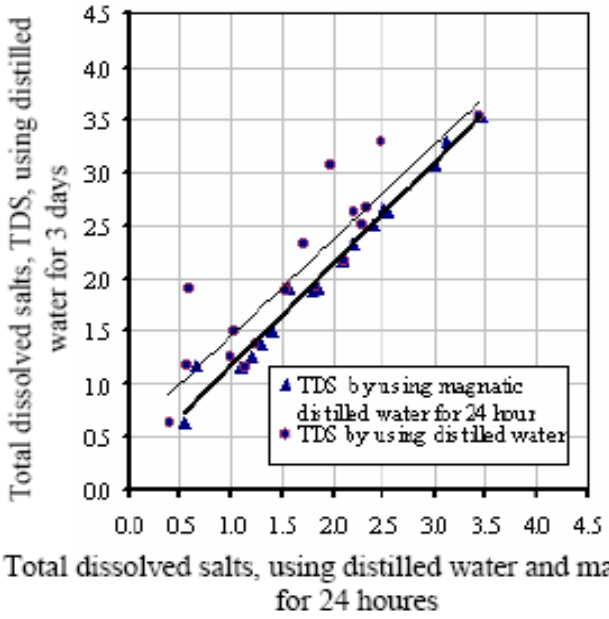

Figure (9) Relation between total dissolved salts by using distilled water and distilled water submissive to the magnetism for 24 hour, and the tests are done after 4 hour from the sample preparation.

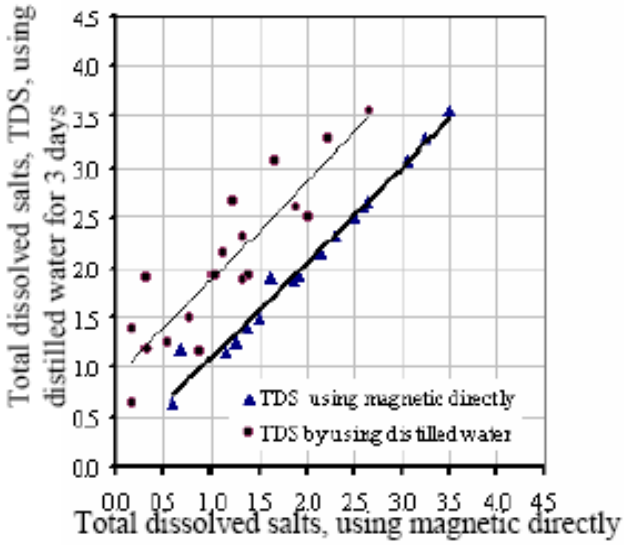

Figure (10) Relation between total dissolved salts by using distilled water only and by using distilled water and samples submissive to the magnetism directly, and the tests are done after 1 hour from the sample preparation.

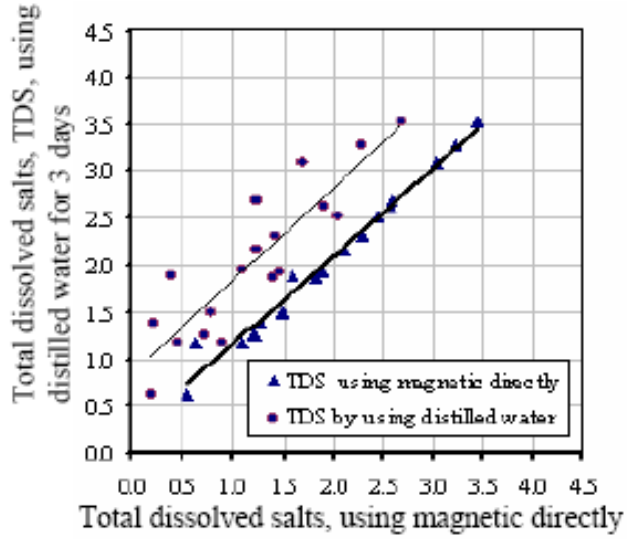

Figure (11) Relation between total dissolved salts by using distilled water only and by using distilled water and samples submissive to the magnetism directly, and the tests are done after 2 hour from the sample preparation.

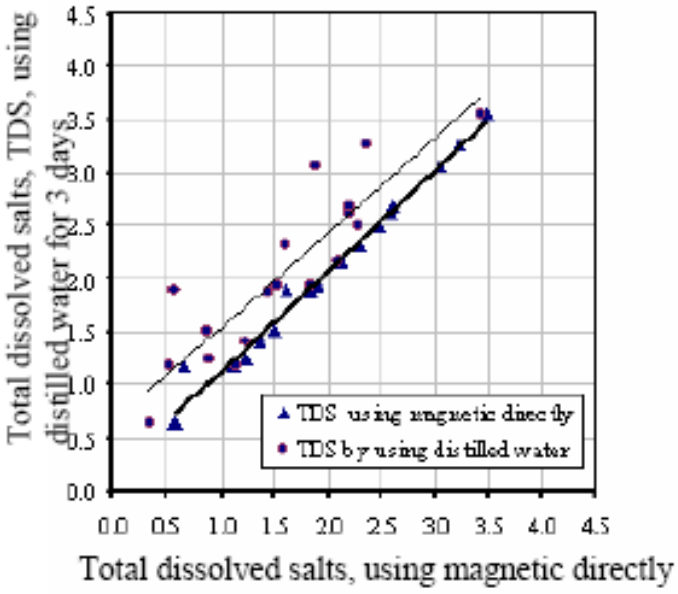

Figure (12) Relation between total dissolved salts by using distilled water only and by using distilled water and samples submissive to the magnetism directly, and the tests are done after 3 hour from the sample preparation.

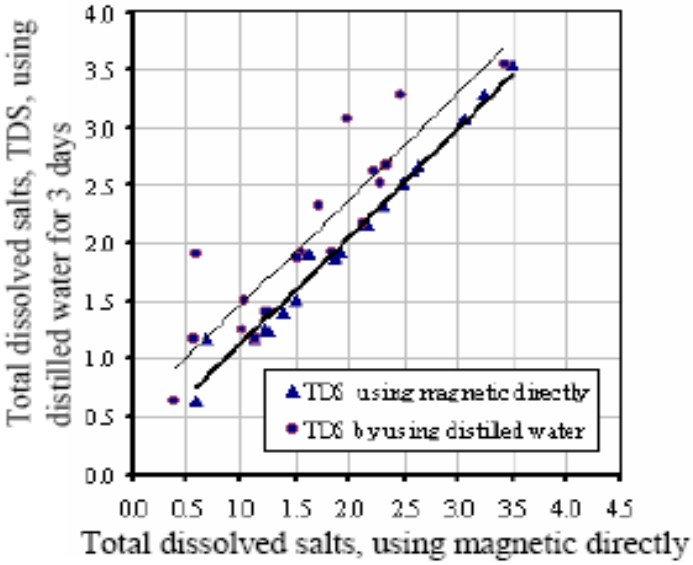

Figure (13) Relation between total dissolved salts by using distilled water only and by using distilled water and samples submissive to the magnetism directly, and the tests are done after 4 hour from the sample preparation.