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Detecting and Monitoring The Magnetic Effect in Salty Water via Remote Sensing Technology using AQUA Device

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Abstract. Magnetic water is an important tool to improve and modify the properties of materials and bodies that use water in their composition. It has been found that using magnetic water in agricultural, industrial, and domestic purposes is better than using non-magnetic. This study concentrates on using AQUA remote sensing device to compare the difference between non-magnetic and magnetic salty water, also detecting and monitoring the existence of this effect in water after getting out from magnetic field. AQUA is a remote sensing device, which has been used to detect quality of water. It has been used in this study to detect and monitor the behavior of salty water after exposing to magnetic field and getting out from this field for different periods. AQUA dealt with this water after magnetism as natural water despite that its dissolved solids haven't changed significantly and this behavior as natural water continued for different periods after leaving the magnetic field. The splitting and ordering of particles in salty water after exposing to the magnetic field changed the choice of remote sensing device from "salty" to "natural" because the wave length of this salty water approached to the range of natural water.

Keywords. Magnetic salty water; remote sensing; AQUA device; wave length; electromagnetic radiations.

1. Introduction

Conditioning water by passing it through strong magnetic field works to improve its physical characteristics, making it softer and lighter. This water is named "magnetic water". Recent studies found that using magnetic water instead of non-magnetic improves final products of different applications.

It has been found that magnetic field works to decrease calcium scaling by 15% in municipal network [1]. Magnetic water could improve also cooling and power generation efficiency in different industrial plants by decreasing of specific heat and boiling point [2]. It can also use magnetic water to change the distribution of salts between agricultural soil layers by reducing the content of salts in the upper layers (30 – 60 cm) of soil depth, which are more important for agriculture and increasing the salt content at the 90 cm depth, which is less important for growing crops [3]. It has been found that fresh concrete made with magnetic water are more workable than that made with tap water (up to 35%), compressive and splitting strengths improved too (20%) when mixing magnetic water with dry mixture of concrete instead of tap water [4]. When using magnetic water, the strain rate factor and the total cracking area of concrete have been decreased, this means the early-age shrinkage cracking resistance of concrete, which has been mixed with magnetic water, is better than that mixed with tap water [5]. Magnetic water has been used to improve Chick-pea production by increasing growth parameters (3.29 – 36.65%) and other growth parameters under newly reclaimed sandy soil conditions [6].

2. Detecting the magnetic effect in salty water

There are three factors affect transforming salty water into magnetic. These factors are magnet force, water velocity, and water salinity. It is not easy to detect the magnetic effect in water, especially in the field. When farmers want to improve their salty irrigation water by passing it through magnetic field, they need to know if the magnetic effect happens in their salty water or not. If they measure the concentration of total dissolved solids before and after magnetism, they won't discover clear change in water salinity (Table 1).

Table 1. Magnetism period vs. total dissolved solids (TDS) of tap and well water (magnet force = 11,000 gauss).

Magnetism period (day)	TDS (mg/l)	
	Tap water	Well water
0	594	1900
1	588	1900
2	582	1900
3	585	1860
4	598	1900
5	599	1900
6	587	1920
7	588	1970

Also the devices of measuring magnetism, which are known as Teslameter [7] or Gaussmeter [8] couldn't measure the magnetic effect in water because they are only used to measure the magnetism value on real magnets or magnetized ferrous objects such as iron and nickel. So there is a need to search for a fast and easy methods to detect and monitor the magnetic effect in salty water for the sake of selecting the optimal magnet force or water velocity to be appropriate with the water salinity.

This study proves that it is possible to use remote sensing technology as a fast and easy method to detect and monitor the magnetic effect in salty water by using AQUA device.

3. Remote sensing technology

All objects in nature emit and reflect electromagnetic radiations. Remote sensing technology uses sensors to record this electromagnetic radiation emitted or reflected from the target object. The major categories of electromagnetic spectrum are listed and represented in Figure 1 [9].

Category	Range
Gamma Rays	<0.03nm
X-rays	0.03 - 300nm
UV	0.30 - 0.38μm (300-380nm)
Visible light	0.38 - 0.72μm (380 - 720 nm)
Blue	0.38 - 0.5μm
Green	0.5 - 0.6μm
Red	0.6 - 0.72μm
Infrared	
Near	0.72 - 1.3μm
Mid	1.30 - 3.00μm
Far	7 - 1000μm (1mm)
Radio waves	1mm - 100km
Microwave	1mm-30cm

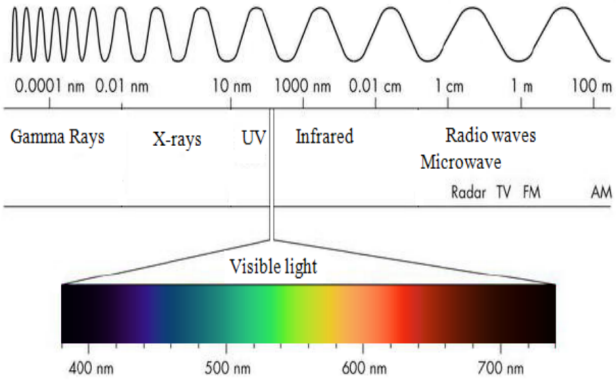

Figure 1. Electromagnetic Spectrum.

AQUA device is one of this remote sensing technology that has ability to record long waves electromagnetic radiation reflected from different types of water. It could detect type, depth, and location of surface and ground water (Figure 2) using long distance sensing system (LDS) [10].

It has been found in this study that AQUA device records the "salty" water as "natural" when exposing the salty water to strong magnetic field, this discovery can give the farmers a quick and easy way to check that their irrigation water has the available magnetic effect to make it more appropriate for irrigation. It could also use this device to monitor the retention period of this property in water or when it disappeared, this retention period is important for the farmers to insure that magnetic water will arrive to all far crops in their fields. This test is important to select magnet's force, its number, and its position on the irrigation pipes.

4. Experimental work and results

Many experiments were carried out in this study to detect and monitor the behavior change of salty water into natural water via using AQUA device:

4.1. Seven days exposing to magnetic field

A salty water (1900 mg/L) was contained in a (2.25 L) plastic bottle and exposed to magnetic field for seven days by fixing the two poles of strong permanent magnet (11,000 gauss) at the two equal sides of the bottle as shown in Figure 3. After the water had been exposed to the magnetic field for seven days, the magnet was removed and the behavior of water was recorded using AQUA device as shown in Table 2.

Figure 2. AQUA device, used to detect location, quality, and depth of water.

Figure 3. Method of preparing magnetic water.

It could be known from this experiment that when exposing 2.25 L of salty water (1900 mg/L) to strong magnetic field for seven days, this water could be dealt as natural water for at least 45 hours. The effect of magnetism on water vanished after 48 hours, so that AQUA began to record the water as "salty" only and didn't respond to the "natural" choice.

4.2. Making and monitoring the magnetic effect

In this experiment, a 500 ml of high salty water (3310 mg/L) was contained in plastic bottle and exposed to (11, 000 gauss) magnetic field until change its behavior from "salty" to "natural' water according to AQUA reading (Figure 4), this change happened after two days of exposure to this magnetic field. The magnet was removed and AQUA began to record the periods of retaining the magnetic effect in this water as shown in Table 3.

Table 2. Monitoring the behavior of salty water after exposing to magnetic field for seven days.

Period (hour)	AQUA rotation (non, fast, very fast)	
	Salty water	Natural water
0	Fast	Very fast
1	Fast	Very fast
7	Fast	Very fast
10	Fast	Very fast
18	Fast	Very fast
22	Fast	Very fast
28	Fast	Very fast
34	Fast	Very fast
45	Fast	Very fast
48	Very fast	Non

Table 3. Monitoring the behavior of high salty water after exposing to magnetic field for two days.

Period (hour)	AQUA rotation (non, fast, very fast)	
	Salty water	Natural water
0	Non	Very fast
0.75	Fast	Fast
2	Very fast	Fast
2.25	Very fast	Fast
3	Very fast	Fast
3.75	Very fast	Fast
4	Very fast	Fast
4.25	Very fast	Non

This experiment clarified that when the salinity increased, the transforming period of salty water into natural water decreased. The device dealt this water as salty and natural in the same time, and this continued for at least four hours. Also it is seen from the table that the salty behavior began to get stronger after the second hour.

4.3. Passing through magnetic field

A salty water (1900 mg/L) was passed through strong magnetic field with discharge equals (16 L/min) as shown in Figure 5. According to AQUA record in Table 4, the behavior of this water changed to "natural". This state continued for less than two hours.

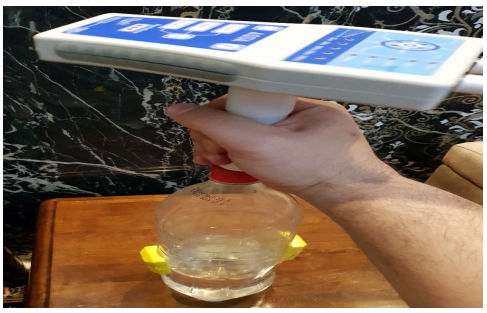

Figure 4. Detecting and monitoring the magnetic behavior of water by AQUA device.

Figure 5. Passing of salty water through strong magnetic field.

Table 4. Detecting and monitoring the behavior of salty water after passing through magnetic field.

Period (min.)	AQUA rotation (non, fast, very fast)	
	Salty	Natural
1	Fast	Very fast
13	Fast	Very fast
38	Fast	Fast
60	Very fast	Fast
75	Very fast	Fast
102	Very fast	Fast
120	Very fast	Non

5. Conclusions and discussion

It has been concluded from this work that it is possible to detect and monitor the magnetic effect in salty water after exposing to strong magnetic fields by using remote sensing device AQUA. This device, which can record the reflected electromagnetic radiations from objects, senses the magnetic effect in salty water and read it as "natural". Also it can monitor the retention period of this effect in water and decide whenever it weakens or vanishes.

This detecting and monitoring happens because the wave length of salty water changes and approaches the wave length of natural water after exposing to strong magnetic field, therefore the remote sensing device AQUA has read it as "natural" despite its total dissolved solids (TDS) concentrations hasn't changed significantly.

This state of water can explain as follows: when exposing water to strong magnetic field, its physical characteristics will change. Its suspended and dissolved particles will split and organize making the water softer and lighter, this state can be seen in the lab by using electronic microscope as illustrated in Figure 6.

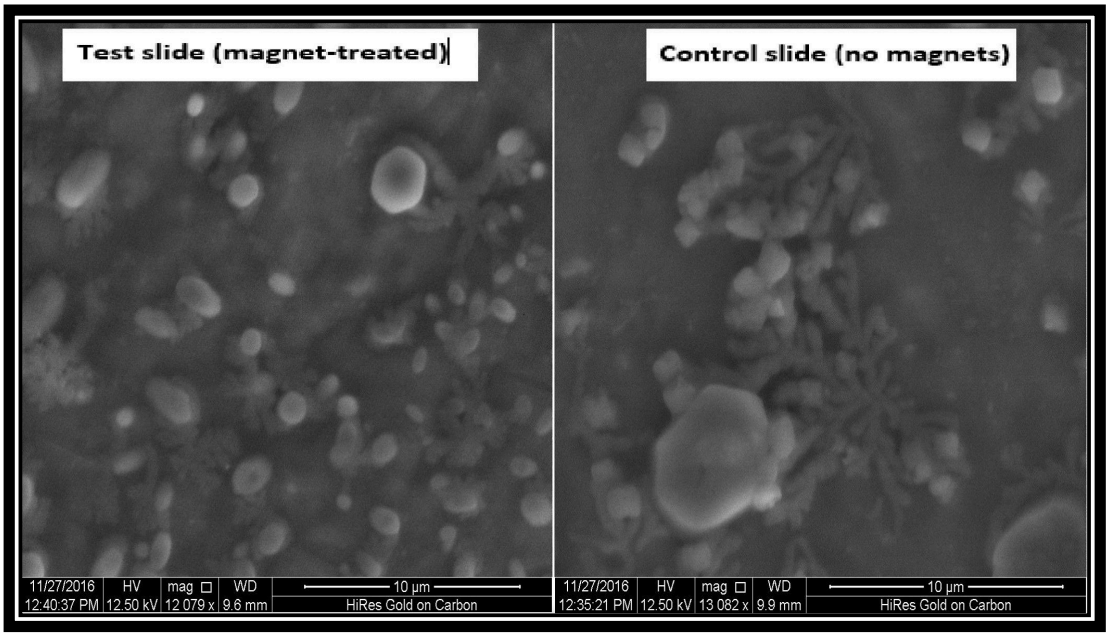

Figure 6. Microscopic photos of magnetic and non-magnetic water.

It can also measure this splitting in magnetic water by compare its turbidity with non-magnetic water, the turbidity in magnetic water will be more than that in non-magnetic and the increment will continue as shown in Table 5 for five days.

Table 5. Turbidity of magnetic and non-magnetic water.

Water type	Turbidity (NTU)	Increment (%)
Non- magnetic water.	1.05	0
Under 7 days magnetic field.	2.42	131
After (20 hrs.) from 7 days magnetic field exposing.	3.95	276
After (5 days) from 7 days magnetic field exposing.	1.53	46

6. Recommendations

This study recommends use AQUA device as a remote sensor to detect and monitor the magnetic effect in salty water after exposing it to strong magnetic field. This procedure is very important know that the water has the magnetic property and know the period of retaining this property in water after leaving the magnetic field. Using this technique for detecting and monitoring the magnetic effect in water, help decision makers select the correct number and power of magnets they will use in their product operations to keep the magnetic effect in water continues for proper time until finishing these product operations.

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