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Study and Analysis of Laser Spot Images Passing through Electromagnetic Water

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Abstract

In this paper, a remote monitoring system for desalination of magnetized water was constructed by studying images of laser intensity passing through magnetized water. As the lack of change in the intensity of the image of the external laser spot means the water arrives in complete purity and can, at the ear, stop the system from operating without the need to spend more energy. Where two types of magnets were used to obtain magnetic water, electromagnet and permanent magnet (continuous), a helium neon laser spot image was studied computerically and analyzed using various methods and programs such as MATLAB, Image J, Curve Expert Professional and Origin lab 9.0, and through the use of a digital camera. Its passage in different physical media (regular water and magnetized water) to study its properties as well as formulating equations that describe this behavior for several readings by calibrating it with the TDS and the PH device.

Keywords: Image Processing, Laser Physics, Water, Permanent Magnet, Magnetic Water, Laser Spot Image.

Introduction

Laser physics is one of the fundamental and important branches in the branches of modern physics, because of its important properties and uses of lasers in various operations applications [1]. The word "laser" is written in the English language as follows (LASER, which is an abbreviation for the prefix of the following words: Light Amplification by Stimulated Emission of Radiation). Its waves turn into a high-energy light pulse of high-resonance temporally and spatially, with a very small detonation angle [2]. The term Digital Image Processing refers to computer image processing, and digital image processing is one of the topics of the information revolution that has facilitated the reception and transmission of complex and accurate digital information [3].

The first appearance of the digital image was in (1920), when it first sent digital news images of the events of World War I via a sea cable between the cities of London and New York. The use of digital images has increased and advanced image processing techniques have been advanced with it for the purpose of analyzing information and extracting important features from it in order to benefit from it in many applications, including in the military fields and many medical and space science and astronomy fields, especially in what is known as remote sensing - remote sensing. The history of digital image processing technologies as they are currently known dates back to the mid-1960s, when third-generation computers began to employ the speed and storage capabilities needed to deal with the vast amount of data contained in a single digital image [3].

There is a need to perform image processing to improve its clarity and facilitate its interpretation process for the purpose of providing image information when it is difficult to obtain it from its sources free from defects and noise, due to the deterioration that occurs in some imaging systems, which is due to either the limited ability of the analysis of sensors and caused by many visual and ability of the analysis of sensors and caused by many visual and chemical effects, or The deteriorations due to measurement errors, which are referred to as noise [4]. The field of digital image processing has witnessed a rapid growth in our time, as various and various techniques and methods are used for the purpose of improving image information for interpretation and analysis, given the importance of these images and their wide spread in many areas of daily human life, for example in the field of medicine, these technologies are used for purposes of improving images X-rays and ultrasound images and in military fields to improve thermal images, infrared images and radar images. It is also used to improve space and air images, fingerprint prints and images used in the process of drilling for metals using waves, Seismic t.

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Theory

Magnetism originated from the observation of stones, called the iron particles, and the word magnetism derived from the Magnesia region of Asia Minor, where these stones are found. Magnetic energy is a shield to protect the planet from destructive cosmic rays such as

x-ray and gamma ray. The earth's magnetic energy is due to its content on metals, especially iron, where the amount of iron in the earth plays an important role in the magnetic field that holds the gas, water, and biological atmosphere of the earth [5]. The area surrounding a permanent magnet or freely connected to a magnetic field and the word of field its mean the physical effect that takes different values in space. Therefore, the magnetic field is the space in which a magnetic force affects its charge [6].

The magnetic field is a directional quantity of imaginary lines called magnetic flux lines. The number of vertical magnetic lines on a unit of space is known as magnetic flux, so the magnetic field is the space in which a magnetic force affects a moving electrical charge or magnet in that space. The magnetic force is an imaginary line that flows from the North Pole and enters the South Pole and is called Maxwell's magnetic force line. The number of magnetic lines passing through area A of the space is called the magnetic flux Q and is measured in the Weber unit, while the number of magnetic lines Passing vertically through the unit area is called magnetic flux density, which is measured by unit called Guass, which represents a line magnetically one passes vertically through the unit area [7].

Methodology

A study has been made to study the behavior of a helium neon laser spot using a computer through the use of a digital camera and its passage in different physical media to study its properties as well as formulating equations that describe this behavior for several readings by calibrating it with a TDS device to calculate the equation coefficients through which it is possible to create a system that predicts the behavior of the laser spot By calculating the intensity of the laser spot, a relationship is found between the intensity of the laser spot and the amount of concentrations of the fluid-dissolving particles and calculating the time of precipitation of suspended matter.

The diagram below shows the steps of the work and is shown as Fig.(I)

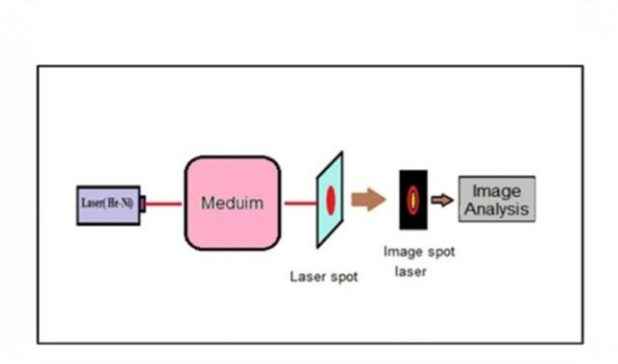

Figure I. A diagram showing the steps of work

Preparation of samples of physical media

- **The system of Magnetic Water**

The work system shown in Fig. (I) is composed of the following parts:

•The source of helium-neon laser beam, the wavelength is (632.8nm)

•Glass basin dimensions (28*28 cm) thickness 6mm.

•A white screen with a red spot

•Nikon D3300 digital camera with 18-55mm lens with a resolution of up to 24.2 megapixels and sensor (CN05 = 23.5 * 15.6mm) that allows for detailed shooting and good performance even in low or low light conditions. ISO sensitivity in the camera up to ISO = 12800

• Amount of normal water.

• Electric Magnetic the intensity of his magnetic field is equal to 100 Gauss and Permanent magnet, his power (150 Watt (equal to 639 Gauss) & 200 Watt (equal to 724 Gauss).

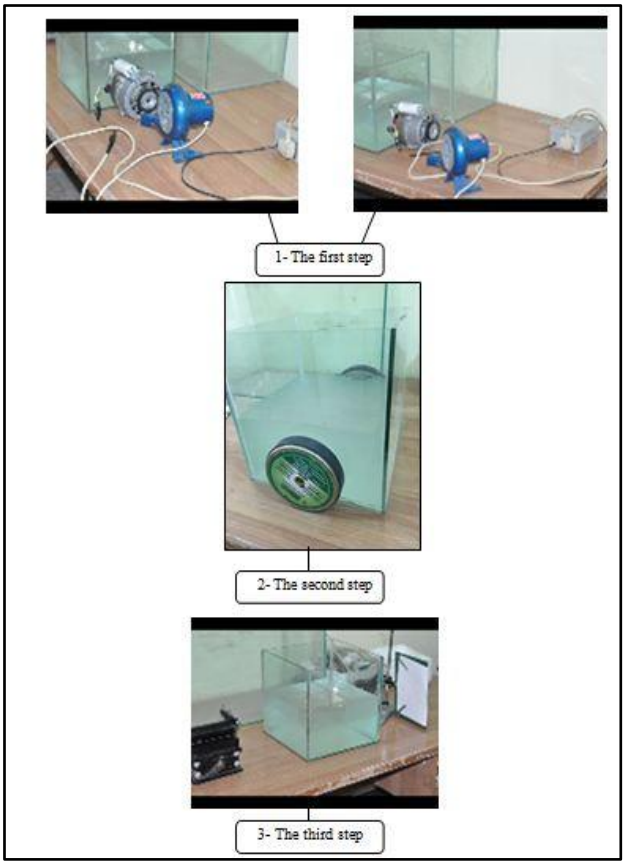

Figure II. 1-The step represents the magnetization of water with an electromagnet , 2-The step represents the magnetization of water with Permanent magnet, 3-The step represents taking pictures of the laser spot as it passes through the liquid medium

In this way we used two types of magnets (magnetic coil - self-magnet) at certain times to obtain magnetic water. The distance between the source and the basin (20 cm) was determined, the distance between the basin and the screen (10 cm), and (10 liters) of water were placed in the sink. Fix the camera angle to the screen and take a picture of the resulting location during different magnetic times.

PH was measured using the device and the concentration of dissolved salts was measured using a TDS device more than ten points within the same medium and the rate was taken to ensure that the reading was not taken in an area that may be less or more focused at the moment the image was taken.

Results and Discussion

Where image of the resulting laser spot was taken after the water magnetization to calculate the intensity for each spot after the solution is homogeneous through the Histogram, and when collecting data and applying the Curve Fitting as show in Figure (III).

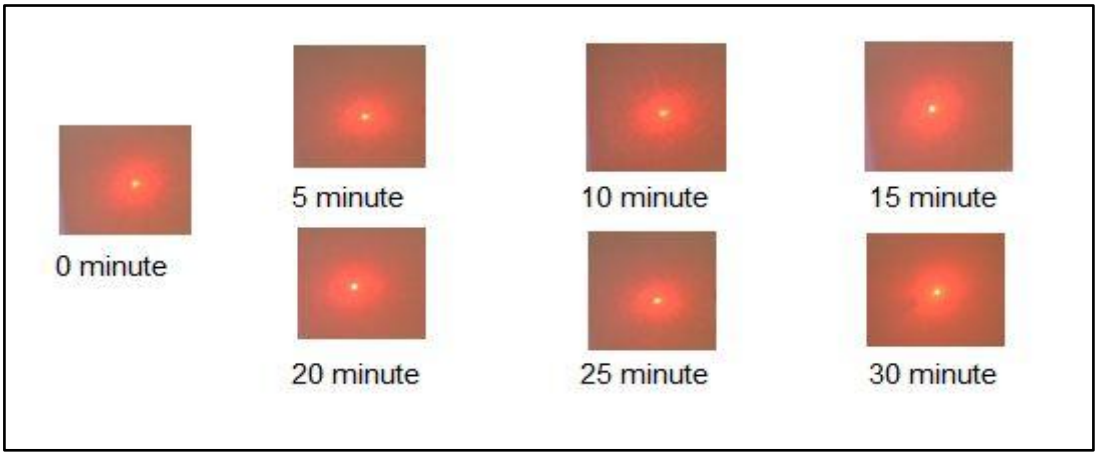

Figure III. Seven images of laser spot taken in different exposure time for magnetized water

Curve Fitting was also applied to the resulting data to describe experimental data theoretically,also to study the behavior of the water depend on the intensity of magnetic field and the time of magnetization and predict the result. Table (1) shows the intensity of the laser spot during regular times of magnetization of water and similar ones from Curve Fitting.

Table 1. *Measured values of Intensity, TDS and PH with time after the laser passes through magnetic water for a certain period of time*

Time (min)	Intensity(a.u)	TDS(ppm)	PH
0	180	515	7.56
5	196.8	510	7.87
10	204.6	498	7.94
15	208.9	484	7.98
20	213.4	475	7.98
25	218	466	7.98
30	224.9	460	7.99

We note from Table (1) that the diagram illustrates the relationship between the intensity of the laser spot and how much time in Figure and the TDS , PH reading as in figure (IV).

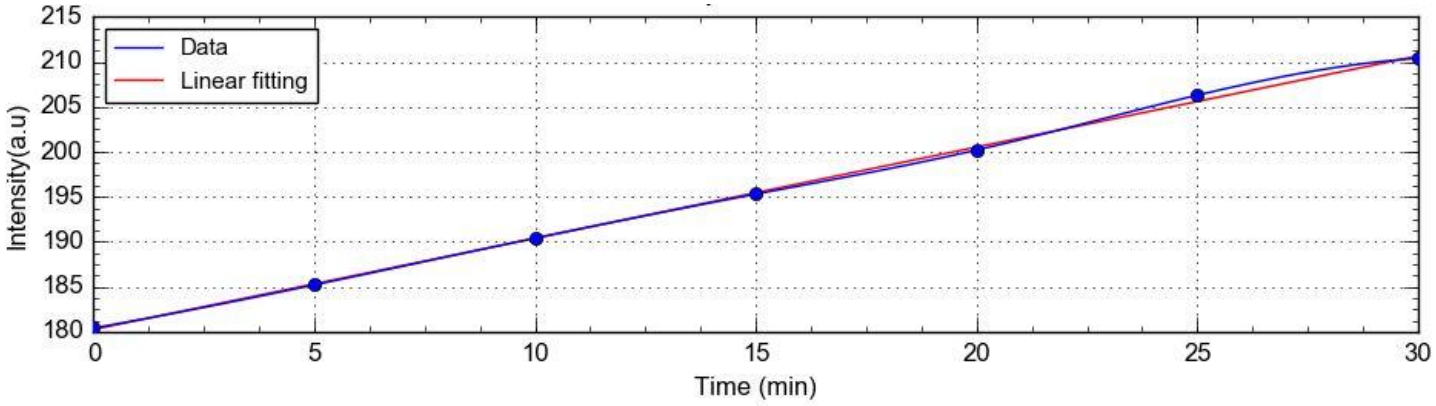

Figure IV. The relationship between the intensity and the time

Whereas, the equation resulting from the application of Curve Fitting, which describes the relationship between the laser spot intensity and time, is as follows:

$Y = a + (b * x)$ (1)

a = 180.2428 , b = 101.4285

where as

Y: represents the intensity of the laser spot

X: represents time

a, b: polynomial coefficients and their values depend on the type of medium

A diagram showing the relationship between TDS reading and magnetization time, as shown in Fig. (V)

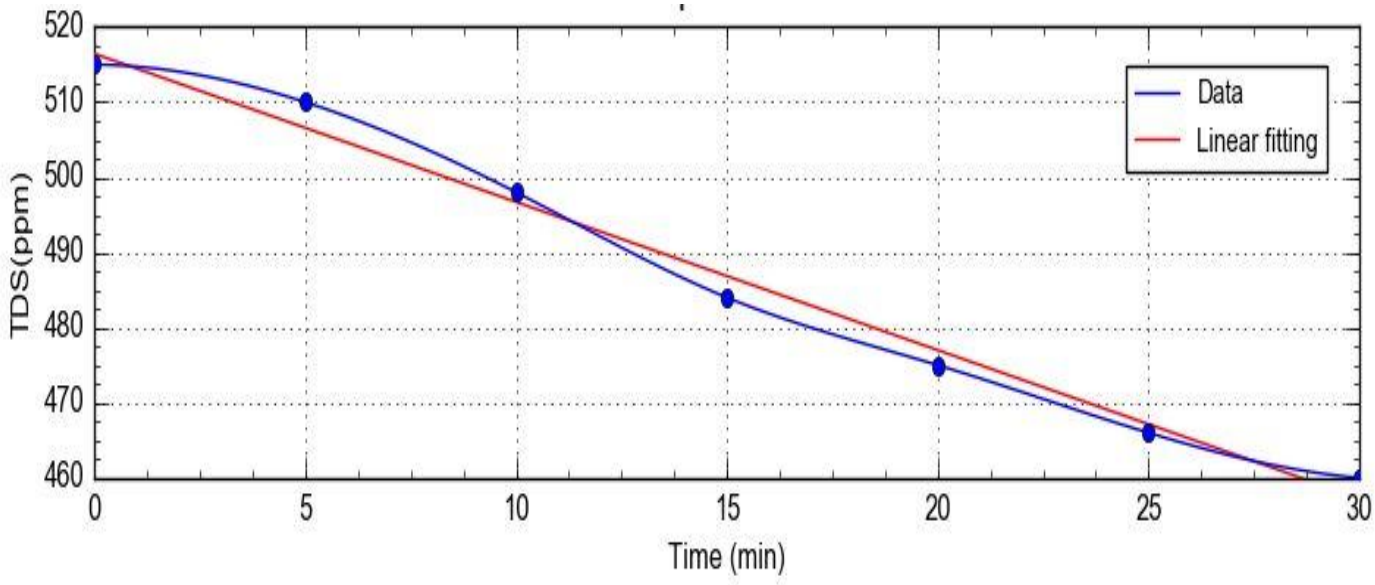

Figure V. The relationship between TDS and the time

The equation describing the relationship between TDS device reading and the time resulting from the Curve Fitting application is as follows:

$y = a + bx$ (2)

a = 516.4285 , b = - 197.1428

Whereas, Y: represents the TDS reading

X: represents time

a , b : polynomial coefficients whose values depend on the type of medium

The diagram that shows the relationship between pH and time, as in Fig. (VI)

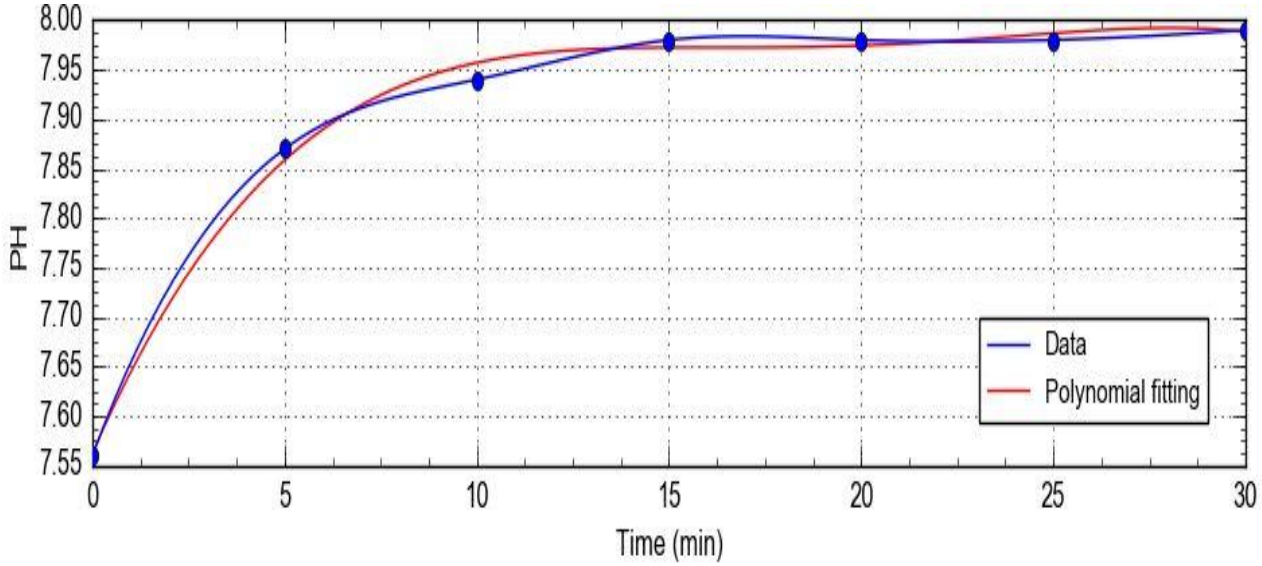

Figure VI. The relationship between PH and the time

We notice from Table (1) and from Fig. (6) an increase in the pH due to water magnetization during regular time periods, and the following equation describing this relationship was obtained using the Origin Lab program.

$$y = a + bx + cx^2 + \cdots \quad (3)$$

a = 756.2640 , b = 0.08890 , c = - 0.00708

Whereas,
Y: reads the PH device
X: time
a , b , c : polynomial coefficients whose values depend on the type of medium

Conclusion

By building a system that predicts the behavior of the laser beam passing through the media used, processing the resulting images, calculating the amount of each laser beam intensity and the concentration of plankton present in the various media, and calculating the precipitation time of these plankton, the following conclusions have been reached:

1. Improving water quality by reducing concentrations of dissolved salts in it, such as chlorides and sulfates, and increasing oxygen absorption.
2. Magnetic treatment had a pronounced effect on all physical and chemical properties of water types.
3. The intensity of the laser beam resulting from its passage was calculated through different media that suffer from attenuation, as this attenuation can be studied and it is used to study some properties of the medium.
4. The laser spot behavior and changes can be explained and described by equations through which the properties of the medium can be predicted.
5. In the case of the electromagnet, the relationship between the time of water magnetization and the intensity of the resulting laser spot is described as a linear relationship, where we note a decrease in the percentage of dissolved salts from (515 ppm) to (460 ppm) through (30 min) in addition to increasing the intensity from (180 au) To (224.9 au) for the water, as we note the increasing in the PH of water from (7.56 to 7.99) during (30 min), Due to the difference in the sedimentation velocity of plankton, these plankton act as a dark impediment causing attenuation of the passing laser beam , Where we have noticed the change in the intensity of the image of the laser spot, that is, the water has reached its full purity.
6. This study presented an important relationship between the use of digital images and some of their treatments in calculating some properties of the medium and using the laser beam passing through it.
7. An integrated system was built for the purpose of this study and it was at a low cost, as it performed the desired purpose.

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