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Evaluation of the effect of water treated with a magnetic field on the selected technical and biological systems

Abstract

The behavior of water in the presence of magnetic fields has been a subject of scientific interest for a several decades. Numerous studies have demonstrated the influence of weak and super-weak constant and variable magnetic fields on aqueous systems that do not contain magnetic-field-sensitive admixtures. Many studies have also demonstrated beneficial effects of magnetized water on biological systems including living plants and animals. A problem in application of the technology to everyday use was to find a way of evaluating effects of magnetic fields on water. The authors have developed a technology that leverages the combined effects of impulse magnetic fields and vortex gravitational forces on flowing water. The purposes of this study were to measure the effects of impulse magnetic fields on water, and effects of that water on technical and biological systems. Measurements were performed using the Bio-Well Element device, which allows quantitative evaluation of the luminescence of water drops in a strong electromagnetic field. The biological effects were evaluated by measuring the effect of magnetized water on seed germination and seedling growth compared with control water. Results demonstrated that processed water had significant stimulating effects on different technical and biological systems. The differences in the parameters of the Bio-Well images for control and processed water were reproducible and statistically significant. Germination of oat, wheat, sunflower and watercress seeds, growing of yeasts, and development of live bloodworm demonstrated stimulating effects of the processed water. All the effects were statistically significant. The obtained results indicated that the developed method of influencing water with a pulsed magnetic field changed the nature of water, which was revealed during physical and biological tests.

Keywords: magnetized water, impulse magnetic field, Bio-Well, myoblast cells

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Introduction

In the last few years, several studies have demonstrated the influence of weak and super-weak constant and variable magnetic fields on aqueous systems that do not contain magnetic-field-sensitive admixtures.[1–6] An extensive series of studies was conducted at the Institute of Cell Biophysics in Russia. The studies provide definite results regarding the effects of magnetic fields on biochemical processes, both through direct magnetic-field effects and through their influence on water solutions in which biological organisms were developed. For example, a combination of a weak static magnetic field (42 μT) and a low-frequency variable magnetic field (40 nT, 3-5 Hz) can alter the fluorescence intensity of specific proteins and their functional activity. Exposure of *Dugesia tigrina planarians* to a combined magnetic field increased the intensity of their motor activity. Even more surprising was that water treated with a magnetic field transferred this effect to untreated planarians.[7,8]

When human subjects used magnetized water for 3 months there was a significant 44% reduction in dental plaque with reductions in calculus and improved gingival health compared to the control group.[9]

Significant effects for different biological subjects have been demonstrated using magnetized water.[10,11] For example, a permanent magnet with a 600 Gauss magnetic field was installed on the pipe through which water for the chicken feeder flowed. One month later, 50 chicks in the experimental group showed an increase in weight by 200 g compared with 50 chicks in the control group.[12] In Israel, using magnetized water for 85 cows increased their daily milk yield by 1 liter. The cows also appeared healthier, and their calves gained more weight than the control group.[13] A statistically significant increase in seed germination of rice, beans, and tomatoes has been demonstrated.[14–16] Carefully controlled experiments conducted in Australian greenhouses showed that magnetic water increased yields by 23% for celery and 6-8% for beans, but had no noticeable effect on others. The effect strongly depended on the type of water used.[17] - Studies on the effect of magnetized water on goatsshowed that drinking magnetized water (constant magnets at 2000 and 4000 gauss) improved growth performance, carcass traits, blood metabolites, and immunity in Zaraibi kids without adverse effects, and increased goat's milk yield and composition.[18]

At the end of the last century, scientists discovered conditions under which the influence of magnetic fields upon water was stable and reproducible. It turns out that the influence must always be dynamic. This means the water must flow through the field area and the field must be orthogonal.[19] Recently, a systematic review[20] presented numerous results on magnetic water treatment.

The purposes of this study were to measure the effects pulsed magnetic fields on water, and effects of that water on biological systems. Measurements were performed using the Bio-Well Element device, which allows quantitative evaluation of the luminescence of water drops in a strong electromagnetic field. The biological effects were evaluated by measuring the effect of magnetized water on seed germination and seedling growth compared with control water.

Methods

Water preparation

Twice distilled water served as a Control. One liter of this water was passed one time through the magnetic system -this water is referred to as Processed water.

Magnetic system

The structural diagram of the device is shown in Figure 1. The external appearance of the magnetic part is shown in Figure 2. The range of the supplied impulse current is from 0 to 5 watts, and the oscillation frequency is from 0 to 2 Hz; the intensity of the magnetic field is from 2 to 4 μT.

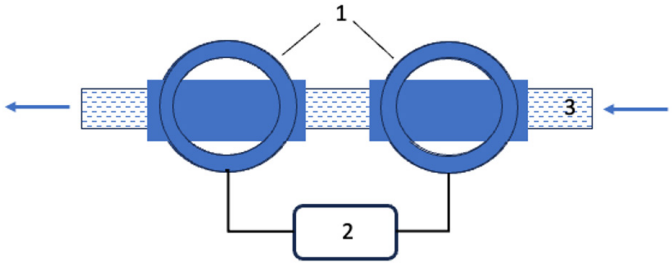

Figure 1 Structural diagram of the installation for the effect of a magnetic field on water in a tube. 1 – Helmholtz coils; 2 – power source; 3 – water tube.

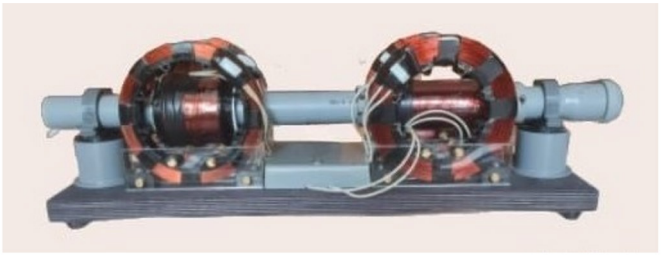

Figure 2 The external perspective of the magnetic component of the apparatus.

Bio-Well Element device

The picture of the Bio-Well Element device and the schematics of the water-testing principle are presented in Figure 3. The analysis principle is based on the visualization and computer processing of the glow of objects, particularly water drops, in a pulsed electromagnetic field. The glow is recorded by a specialized CCD camera and processed using a program that allows the user to obtain more than 20 parameters.[21] A program has been developed that utilises machine learning methods for classifying gas-discharge images of liquid solutions.[22]

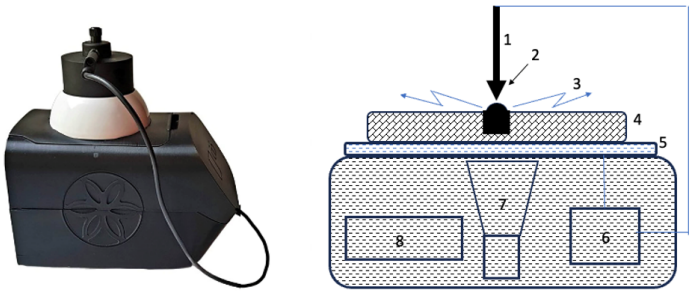

Figure 3 Bio-Well Element device with installation for water testing and schematics of the water testing principle. 1 – electrode, 2 – water meniscus, 3 – gas discharge, 4 – glass container, 5 – Bio-Well electrode, 6 – Power source, 7 – Special CCD camera, 8 – electronics.

Biological tests

The following test systems were used:

1. Germination of oat, wheat, sunflower and watercress seeds.
2. Growing of yeasts.
3. Development of live bloodworm.

The seeds of different crop species were used under identical conditions. Seeds were placed in a Petri dish and 20 ml of control or processed water was added, then covered with a second dish to create a greenhouse effect.

To see the difference in the yeast grows 4 g of dry yeast and 8 g of sugar were added to 20 ml of control and processed water.

Statistics

Raw data was captured using Microsoft Excel (version 16.83) and stored both offline and online as backup. All data were expressed as the mean and standard error of the mean (SEM). Differences between means were determined using ANOVA.

Results

Bio-Well results

Figure 4 demonstrates examples of Bio-Well images of control and processed waters, and Table 1 presents the results of the statistical analysis for 50 images of control water and 50 images of processed water. There were statistically significant differences for several parameters of the images, and notably there was lower variability of the parameters for the processed water.

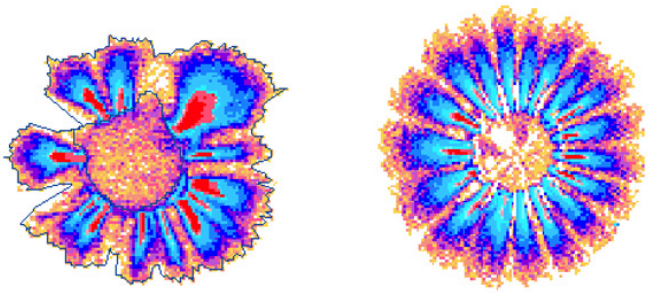

Figure 4 Glow patterns of water droplets for the control and processed water.

Figure 5 Compare of control and processed roots for wheat.

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Table 1 Difference in GDV parameters of control and processed samples of water ($p < 0.001$)

Parameter	Area	Energy	Outer contour radius	Number of petals
Control	6541.73 ± 210.86	3.44 ± 1,12	46.20 ± 0.86	11.00 ± 1
Processed	7056.10 ± 95.50	3.84 ± 0.8	48.07 ± 0.28	18.00 ± 2
T-test probability	0.001	0.001	0.05	0.001

Figure 6 Easts in control and processed water.

As shown in the results, the Bio-Well images of the processed water had statistically significant reproducible differences in the parameters compared with the control water. This correlates with our previous results demonstrating dependence of the parameters of water glow in the electromagnetic field on the type of water (Tables 2,3).[23–25]

Table 2 Seed germination dynamics in the first three days, cm

	Control	Processsed	T-test
oat	4 ± 0.2	10 ± 0.3	0.002
wheat	6 ± 0.1	11 ± 0.3	0.002
sunflower	7 ± 0.3	12 ± 0.3	0.002
watercress	8 ± 0.4	14 ± 0.4	0.002

Table 3 Sprout length dynamics, cm

	Control	Processsed	T-test
oat	1.2 ± 0.1	2.8 ± 0.2	0.05
wheat	2.5 ± 0.2	6.2 ± 0.3	0.05
sunflower	3.4 ± 0.1	5.8 ± 0.3	0.05
watercress	4.4 ± 0.2	6.7 ± 0.4	0.05

Biological test results

The experiments were conducted at various times; the results are a summary average. The stability and repeatability of the results was 73%. Factors influencing the results include average daily temperature and time of the year (possibly moon phases).

Sprouts

It was noted that the seeds imbibed faster in the processed water compared to control water, resulting in greater increases in weight and volume, while the amount of water remaining in the dish was significantly reduced. When the germination experiment was conducted without adding water, the sprouts differed significantly in size after 7 days in the treated water, but began to dry out after consuming all the water.

In the control samples, the seeds remained moist, not having consumed all the water. Therefore, the weight of the sprouts in the processed water were significantly greater by 30 to 70% compared to controls, while the weight of the sprouts remained the same.

When conducting the experiment with a constant supply of water (rinsing every half hour), the growth weight and color of the shoots varied significantly.?? Meaning what

NB! We were also interested in determining if distance from treated water[26] had an effect on growth of sprouts. The main condition for conducting the experiment was the distance between the control and treated water.

Note that when the trays with sprouts were placed next to each other (less than a meter apart), the sprout length of the control sprouts closer to the tray with treated water increased by 30%.

Watercress rot did not occur in the experiment with treated water, but in the control water, the "green cap" of the watercress began to rot on the 9th day.

Observations of the growth of wheat sprouts showed that processed water accelerated shoot growth - the first 3-5 days there is a slowdown, and then a sharp acceleration.

Yeast experiment

After 4 hours of fermenting in the test tube the grows of yeasts demonstrated statistical difference:

Foaming with the control water – 8 ± 1 cm.

Foaming with the treated water – 20 ± 2 cm. $p < 0.001$

Experiments have shown that after an hour of placing the container of original water next to the treated water, the results are absolutely identical. That is, foaming is 20-24 cm, which never occured under normal conditions.

Bloodworm experiments

Live bloodworms genus Glycera were placed in equal amounts of control and processed water and were not fed.

The bloodworms were more active in the treated water, with mortality in the treated water being less than 50%. On the fourth day, bloodworms in the control water were almost completely unresponsive, while in the treated water, they actively swam and ate the remains of dead worms. On the seventh day, the bloodworms in the control water had completely died, while in the treated water, 30 to 57% remained active.

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Storing processed water

Storing processed water for 15 days in various bottles (glass, plastic, transparent, and dark) did not change its Bio-Well luminescence patterns. Boiling the processed water did not change the recorded properties.

Discussion

As shown in the results, processed water had significant stimulating effects on different technical and biological systems.

The differences in the parameters of the Bio-Well images for control and processed water were reproducible and statistically significant. Germination of oat, wheat, sunflower and watercress seeds, growing of yeasts, and development of live bloodworm demonstrated stimulating effects of the processed water. All the effects were statistically significant.

The obtained results indicated that the developed method of influencing water with a pulsed magnetic field changed the nature of water, which was revealed during physical and biological tests.

We hypothesize that the developed method of conditioning water leads to its re-structuring, i.e., the formation of systems of coherent domains.[27,28] The resultant structural formation is evident in the geometric parameters of the glow of a water drop in an electromagnetic field, resulting in the emergence of radially symmetric figures (i.e., Figure 4). These figures are distinguished by their characteristic geometric and energy parameters. The development of a system based on artificial intelligence [AI] has enabled the establishment of a methodology for clustering images and the subsequent classification of their characteristics.[22]

At the same time, obtained results suggests that the Bio-Well method can be used as a first-line test for water samples treated with a magnetic field or another method. The process of recording and processing the results takes just a few minutes, making it a rapid analysis method. However, this analysis reveals nothing about the composition of impurities or the water's biological activity. It only serves as a method for comparing multiple samples of the liquid being tested.

Limitations of the work

The data obtained thus far constitute the initial research stage and should be regarded as preliminary findings rather than definitive results. The subsequent phase of the research will involve organizing a multicentre study to expand the biological experiments and to conduct clinical trials with groups of volunteers.

Conclusion

The purpose of this study was to evaluate the effect of water that has been exposed to an impulse magnetic field on specific technical and biological systems. This was done using the Bio-Well Element device; the biological effects were evaluated by measuring the effect of processed water on different biological systems compared with the control water. Results demonstrated the possibility of assessing the influence of magnetized water on the technical and biological systems.

Acknowledgments

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Conflicts of interest

Author declares there is no Conflicts of interest.

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