

## Effect of Bio-Availability of Magnetized Water on Different Biological Systems

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Water is the most important part of life. It is one of the things that make our planet suitable for existence of life. Water exhibits special properties that make it unique from other substances. The property of water changes when treated with magnet. The aim of the present study is to investigate the effect of magnetically treated water on *Vigna radiata* germination, pH and osmosis. The results obtained with respect to magnetically treated water were compared with the results of Aquaguard RO and Bore well water. The results revealed that, the magnetically treated water had positive impact on seed germination. With reference to the ratio calculation, it was evident that the number of seeds germinated from treated water was more than the number of seeds germinated from RO and tap water. Similarly, the osmotic ratio was found to be higher when compared with the non-treated water. It was also noted that the weight of the seed increased from 2.04 gm to 4.26 gm in the case of magnet treated water. However, the pH value of the treated water did not show significant increase. On the basis of obtained results, further research was carried out by changing the pole of the magnet. The water was made to pass through North Pole and South Pole.

**Keywords:** Magnetic field, Seed germination, Osmosis, pH.

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The role of magnet in the water purification process is not proved by means of data until recent time. There are many claims with respect to magnetically treated water such as passing of water through magnet will improve the physical, chemical, and bacteriological property of water. Some manufacturers claim that such magnetic treatment ensures basic level benefits like prevention and elimination of lime scale deposited in pipes, while some others make additional and unproved claims like softening, increase growth of

plant, preventing the occurrence of diseases, etc. The chemistry aspect of magnetic water is that the magnetic field changes the water property due to the displacement and polarization of water atom. Therefore, the solid soaking capacity of the water will be increased due to magnetization of water (Pang and Deng, 2008).

The study of magnetic field on the calcium carbonate was done and it proves to have the beneficial claims on for reducing the scale formation. The beneficial claims are they increase the performance of domestic water heater by reducing the scale formation (Alim *et al.*, 2006), improved crop yields (Lin and Yotvat, 1990), health benefits (Yue *et al.*, 1983), change in the pH (Busche, 1985), water tension reduction (Cho

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and Lee, 2005). The supportive document on scale reduction found in Britain proves that the removal of scales was successful, though the cost for scale removal and heat transfer inefficiency was high (Smith, 2003). Later, another experiment performed by Smith (2006) has proved that scale reduction in domestic hot water storage tank was up to 70%. It has been proved by a Japanese named Fujio Shimazaki Wojcik (1995) that the stationary magnetic field can improve germination of seed and speed up the growth process of plants. According to Bogatin (1999), the crop yield was increased by 10 - 15% using magnetized water. A significant increase in germination percentage showed that the germination rate was faster for seeds exposed to the magnetic field than those exposed in control group (Chao and Walker, 1967; Muraji *et al.*, 1998; Celestino *et al.*, 2000). The results of Grewal and Maheshwari (2011) showed magnetic treatment of irrigation water and seeds have the potential to improve the early seedling growth and nutrient content of seedlings. As a supporting data Ijaz *et al.* (2012) also studied and reported the irrigation magnetized water increased the seed germination. Against these points, the present study as aimed to investigate the effect of magnetic water on seed germination and osmotic effect of magnetised water.

## MATERIALS AND METHODS

### Sample Collection

The water samples were collected from three different sources such as Tap water (TW), Aquaguard water (AW), Aquaguard with biotron (2500 gauze magnet multiple ring magnets cartridge) water (ABW), To create the magnetic set up, the magnets were made as rings and packed in plastic containers. Each container was set with 5 rings of magnet. To check the magnetic effect,

the demonstration was carried out applying seed germination, pH and osmosis test.

### Seed Germination Test (Geetha *et al.*, 2014)

The seed germination study was conducted to check the effect of water on seed germination. For this study, *Vigna radiata* seeds were selected based on their weight and shape. Experiment was done in triplicates with 9 seeds in each plate. Once the set up was ready, equal quantity of water from three different sources were added to respective plates. The germination rate was checked at different intervals of 18 hrs, 24 hrs and 48hrs.

### Osmosis Assay (Bhagyashree *et al.*, 2008)

Good quality grapes were selected to understand rate of absorption and its initial weight is noted for Osmotic process. The grapes were immersed in all the three types of water used for this study and their weight change was noted after different time intervals such as 2 hrs and 5 hrs.

### pH Variation

The pH variation study was done to check the effect of magnetization in pH. The Aquaguard water was passed through the magnet and the pH variation was noted. The initial pH and the final pH were noted at every 2 hrs until 24 hrs.

## RESULT AND DISCUSSION

### Seed Germination

Parameters like number of germinated seeds and time taken for germination are noted. The number of seeds germinated was calculated at different time interval such as 18 hrs, 24 hrs and 48 hrs. The percentage was calculated as follows:

$$\text{Germination percentage} = \frac{\text{Number of strongly germinated seed}}{\text{Total number of seeds tested}} \times 100$$

With reference to the ratio calculation, it is evident that the number of seeds germinated by

**Table 1.** Seed germination test with Aquaguard RO water with Biotron (ABW)

Sample	Seed Condition	Plate 1			Plate 2			Plate 3		
		18 hrs	24 hrs	48 hrs	18 hrs	24 hrs	48 hrs	18 hrs	24 hrs	48 hrs
ABW	Germinated	7	8	8	8	8	8	6	8	8
	Non-germinated	2	1	1	1	1	1	3	1	1
	Ratio	3.5	8	8	8	8	8	2	8	8
	Percentage	77.78%	88.89%	88.89%	88.89%	88.89%	88.89%	66.67%	88.89%	88.89%

the magnet treated water is high when compared to other two sources (Tables 1-3). Results prove that rate of seed germination and seedling emergences are higher for magnetized water than the normal water (Figs. 1-5). Many researches finding also proves that the magnetized water enhances the seed germination (Murphy, 1942; Walleczeh and Budinger, 1992; Martines *et al.*, 2002; Ahmad Majd and Azita Shabrangi, 2009). The detailed study on the development of seed and the change in the rate of germination was studied and reported by many researchers. It was detected that the magnetic field stimulated the shoot development and led to the

increase in germinating energy and fresh weight, and shoot length of maize (Aladadjjian, 2002).

According to Waleed *et al.* (2013), at a magnetic field of 50 mT, the root length, radicle length and weight of radicle increases. Studies which showed increased crop yield in Cereal, sunflower, flax, pea, wheat, pepper, tomato, soybean, potato and sugar beet made the magnetic treatment consistent supplemented with significant improvement (Pittman, 1972; Gubbels, 1982;

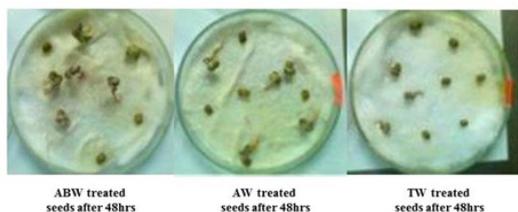


Fig. 1. Seed germination test in petridishes



Fig. 2. Plant growth in pot trials

Table 2. Seed germination test with Aquaguard RO water without Bitron

Sample	Seed Condition	Plate 1			Plate 2			Plate 3		
		18 hrs	24 hrs	48 hrs	18 hrs	24 hrs	48 hrs	18 hrs	24 hrs	48 hrs
AW	Germinated	4	4	4	4	4	5	6	6	7
	Non-germinated	5	5	5	5	5	4	3	3	2
	Ratio	0.8	0.8	0.8	0.8	0.8	1.25	2	2	3.5
	Percentage	44.44%	44.44%	44.44%	44.44%	44.44%	55.56%	66.67%	66.67%	77.78%

Table 3. Seed germination test with Tap water ( non purified )

Sample	Seed Condition	Plate 1			Plate 2			Plate 3		
		18 hrs	24 hrs	48 hrs	18 hrs	24 hrs	48 hrs	18 hrs	24 hrs	48 hrs
Tap Water	Germinated	3	3	3	3	4	5	4	4	5
	Non-germinated	6	6	6	6	5	4	5	5	4
	Ratio	0.5	0.5	0.5	0.5	0.8	1.25	0.8	0.8	1.25
	Percentage	33.33%	33.33%	33.33%	33.33%	44.44%	55.56%	44.44%	44.44%	55.56%

Table 4. Osmosis Test Data

Water Condition	initial weight(gm)	1 hrs(gm)	24 hrs(gm)
Aquaguard RO water with biotron	2.04	2.76	4.26
Aquaguard RO water	2.04	2.61	4.2
Tap water	2.04	2.52	4.24

Pietruszweski, 1993; Reina *et al.*, 2001; Vakharia, 2009).

A study done by Mahmoud (2011) proved that the growth parameter, biochemical components and yield components of the tested

plant is concomitantly increased when plants are treated with magnetic water. .

**Osmosis Test**

Osmosis test was done so as to find the penetration rate of water inside the dry grapes. It

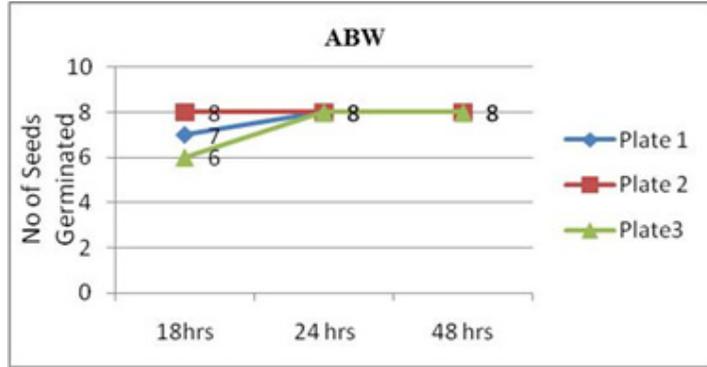


Fig. 3. Seed germination test with Aquaguard RO water with Biotron (ABW)

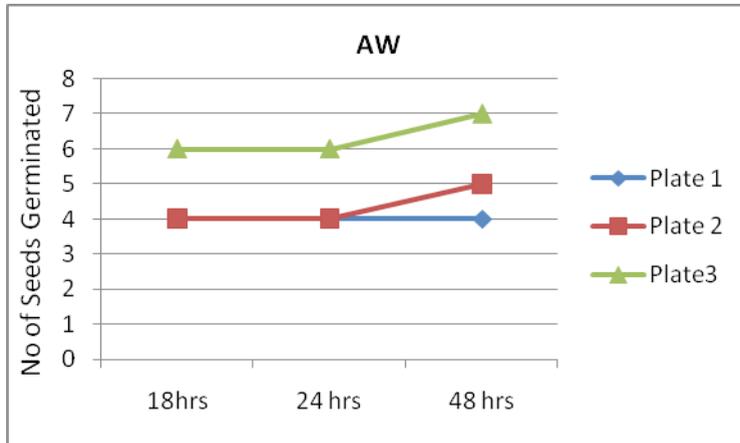


Fig. 4. Seed germination test with Aquaguard RO water without Biotron

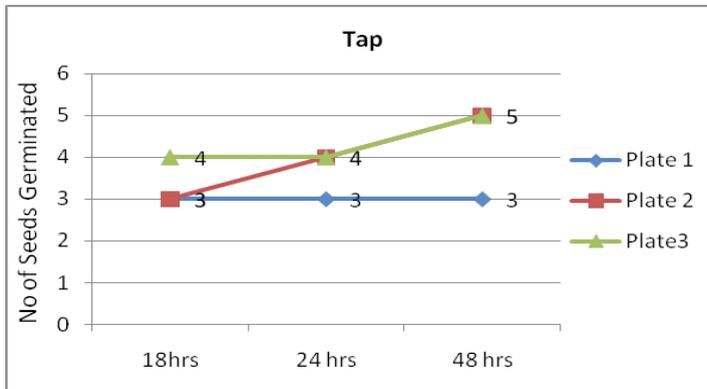


Fig. 5. Seed germination test with Tap water ( non purified )

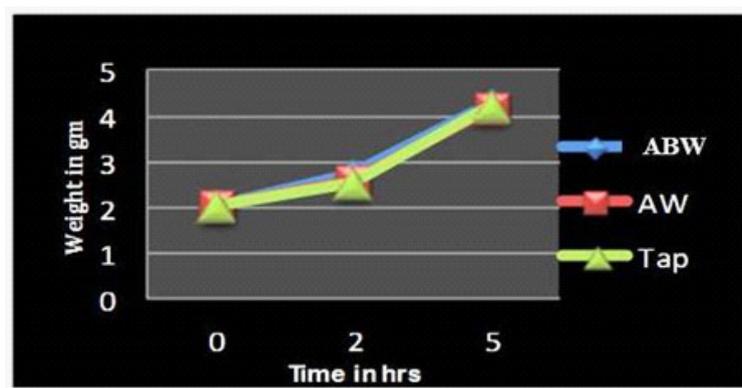


Fig. 6. Effect of treated and untreated water on Grape seed Osmosis

has been identified that the number of hydrogen bonds is proportional to strength of the magnetic field. This implies that the size of water cluster can be controlled by the application of an external magnetic field. In addition with the change in behavior of water molecules under the magnetic field, it has been founded that there was more stability in water's structure accompanied with the enhancement in water molecules to produce more hydrogen bonds (Changa and Weng, 2006). The stimulatory effect of magnetic water may be attributed to their role in increasing absorption and assimilation of nutrients consequently increasing plant growth. (Mahmoud Hozayn *et al.*, 2011).

#### pH Variation

The initial value of pH was 6.8 and after passing through the magnetic field there was an increase in the value reading 7.3. Later on the pH value remained same. This result varies with other reports. Some findings reported a constant pH value. Busche *et al.* (1985) reported that there was an initial decrease in pH of 0.5 units followed by increase from pH 7.5 - 8. Parsons *et al.* (1996) and Tai *et al.* (2008) reported that there was decrease in pH when the water is passed through the magnetic field. Later Quickenden (2002) found no pH change in double distilled water subjected to a very strong magnetic field of 24000 Gauss. A report by Ashraf *et al.* (2013) says that magnetic water doesn't have any effect on the water pH. Even if a slight change is found, it is inconsistent.

#### CONCLUSION

Hence the proof of higher penetration rate in magnetized water than in the normal water concludes that Magnetized water has positive effect on seed germination.

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