

RESEARCH ARTICLE

Study of effect of magnetized water treated with varying temperature on growth of *Penicillium chrysogenum*

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ABSTRACT

It has been proved that the magnetic field has positive impact on biological activities to accelerate rates of most of the reactions such as photosynthesis, respiration, blood circulation etc. When water is magnetized, the ions of the water are oriented as per the magnetic field and they acquire magnetic properties. This water can be used in various processes to study the effect of magnetic field on the biological activities. In the present studies, a bar magnet with known power of 70 Gauss was used to magnetize the distilled water, which was used with the parameter of varying temperature for preparation of Potato Dextrose Broth (PDB) for inoculation of *Penicillium chrysogenum*. The effect of magnetized water treated at different temperature on growth of *Penicillium chrysogenum* and production of mycotoxins by the fungal organism was studied.

Key words: Magnetized Water, Varying Temperature, Biological Activities

INTRODUCTION

Liquid water is required for life to start, continue and sustain. Recently, various theories have been proposed but without a consensus except for the key involvement of liquid water. Water possesses particular properties which cannot be found in other materials and that are required for life. These properties are brought about by the hydrogen-bonded environment particularly evident in liquid water. The hydrogen bond in liquid water is highly affected by electrical and magnetic fields. It is found that some physical and chemical properties change when water pass through magnetic field (Hirota *et. al.*, 1999). Therefore the so called "magnetized water" has different chemical and physical properties and action than ordinary water (Madsen, 2004).

The physical and chemical properties of magnetized water have a series of changes which lead to special functions (Dandan and Shi, 2013). Magnetic water improved the plant growth characteristics and nutrients uptake in tomato and soybean (Carbonell, 2011; Radhakrishnan and Kumari, 2012), root function (Aladjadjiyan, 2010), influenced the

chemical composition of plants, activate plant enzymes (Alikamanoglu and Sen, 2011; Shabrangi, 2011), in wheat (Hozayn and Abdul Qados, 2010), Maize (Zepeda, 2011).

Till 1980, a little was known about how the magnetic field can stimulate plant growth or even prevent (Mahmoud and Amira, 2010). Recent, there has been a rapid increase in the use of technologies employing magnetic water. The magnetized water is made by ordinary water which can get through the magnetic field of certain intensity with a certain flow rate, along with a direction perpendicular to the magnetic field lines.

Hay (1873) received first patent for introduction of a device for magnetization of water. Since, then various experiments were devised to study the effect of magnetized water on the biological activities in the organisms. Water molecule composed of positive hydrogen ions and negative hydroxyl group along with the dissolved minerals are diamagnetic. (Busch *et al.*, 1985). Kovacs *et al.* (1997) proved that magnetic field has positive impact on water, which can be utilized to enhance biological activities in the organisms. It has also been proved that varying temperature also has effect on the magnetic power of the water (Yadav, 2016). Iverson (2004) and Hoadley (2006) also proved that varying temperature has positive impact on the magnetic power.

Hence, in the present investigation authors have tried to study the impact of magnetic water on the growth of *Penicillium chrysogenum* and even effect of varying temperature on the magnetic power of the water.

MATERIALS AND METHODS

Part I: Preparation of Potato Dextrose Broth (PDB)

Potato – 200 gms
Dextrose – 20 gms
Distilled Water – 1000 ml

200 gms of peeled and sliced potatoes were boiled in 500 ml distilled water to make a slurry and filtered to separate the slurry from the potato pieces. 20 gms of dextrose was dissolved in 500 ml of distilled water separately. Both the solutions were mixed together and volume was adjusted to 1000 ml with distilled water. The pH was adjusted to 5.6. The solution was

autoclaved at 120°C temperature and pressure of 15 lb/inch² for 20 minutes. The solution after cooling to the room temperature was used as the PDB for inoculation of the fungus.

Obtaining the fungal organism

20 ml of the autoclaved PDB was poured into pre-autoclaved Erlenmeyer's flasks (150 ml) and a loopful pure culture of *Penicillium chrysogenum* was inoculated in the flasks in aseptic conditions. The flasks were incubated at 28 (\pm 2) °C for 5 days to get luxuriant growth of the fungal organism. This was treated further for the experiment.

Part II: Quantitative Estimation of Biomass:

Four types of PDBs were used in the experiment. They were as follows:

1. PDB prepared in regular distilled water and autoclaved (120°C)
2. PDB prepared in magnetized distilled water without autoclaving or chilling (Room Temp.)
3. PDB prepared in magnetized distilled water and autoclaved (120°C)
4. PDB prepared in magnetized distilled water and chilled (0°C)

A loopful of pure culture was inoculated in the four flasks containing above mentioned PDBs and incubated at 28 (\pm 2) °C for 5 days. After 5 days, all the cultures were filtered separately by using pre-weighed Whatman No. 1 filter papers and weight of biomass in each flask was calculated. The experiment was repeated 3 times and average weight of fungal biomass was noted down.

Part III: Colorimetric Estimation of Mycotoxins:

When fungal biomass was separated from each flask, the filtrate was collected separately and concentrated on the water bath (60°C) to obtain the Mycotoxins in concentrated form. These Mycotoxins were subjected to quantitative estimation as follows:

1 ml of each concentrated filtrate was taken in a test tube in which 1 ml solvent containing (Chloroform and Acetone - 9:1) was added. It was allowed to stand for 10 minutes. 1 ml of 1 N HCl followed by 1 ml of 1 N NaOH was added in each test tube to provide ionization gradient. The test tubes were incubated for 10 minutes at room temperature to separate the two layers of immiscible liquids as

aqueous and organic solvents. 1 ml of Ninhydrin solution was added to all the test tubes, whereby blue colour was obtained for aqueous solvent. This aqueous solution from each test tube was separated from the organic solvent by using separating funnel and subjected to colorimetric estimation of Mycotoxins. The Optical Density (O. D.) was calculated for each test tube by using red filter at 600 nm..

RESULTS AND DISCUSSION

As per Table No. 1, the amount of fungal biomass obtained in autoclaved distilled water, magnetized distilled water without autoclaving or chilling, magnetized and autoclaved distilled water and magnetized, chilled distilled water was 3.91, 4.98, 5.18 and 7.07 gms respectively.

This clearly indicates that there is a positive impact of magnetized water on growth of the fungal organism, which enhanced with lowering of the temperature. When temperature was increased, the impact of magnetic water was reduced.

As per Table No. 2, the highest amount of toxins were detected to be present in magnetized and chilled water (0.73) followed by magnetized and autoclaved distilled water (0.61), magnetized distilled water without autoclaving or chilling (0.34) while least amount of Mycotoxins were obtained in autoclaved distilled water (0.10) in terms of Δ O. D.

This shows that magnetized water has positive effect not only on growth of the fungal organism but even on the production of the mycotoxins by the organism.

Table No. 1: Quantitative Estimation of Biomass

Sr. No.	Particulars	Weight of Biomass (gms)
1	Autoclaved Distilled Water	3.91
2	Magnetized Distilled Water without Autoclaving or Chilling	4.98
3	Magnetized and Autoclaved Distilled Water	5.18
4	Magnetized and Chilled Distilled Water	7.07

Table No. 2: Colorimetric Estimation of Mycotoxins

Sr. No.	Particulars	O. D.	Δ O. D.
1	Blank	0.95	---
2	Autoclaved Distilled Water	1.05	0.10
3	Magnetized Distilled Water without Autoclaving or Chilling	1.29	0.34
4	Magnetized and Autoclaved Distilled Water	1.56	0.61
5	Magnetized and Chilled Distilled Water	1.68	0.73



1. *Penicillium chrysogenum* 2. Growth of Cultures in Treated PDBs 3. Extraction of Mycotoxins
Fig. 1: Growth of cultures in treated PDBs Extraction of Mycotoxins *Penicillium chrysogenum*

CONCLUSION

Above mentioned observations and results clearly indicate the positive effect of magnetized water on growth of *Penicillium chrysogenum*. It is also been seen that magnetized water helps the organism to release more amount of Mycotoxins. If we use magnetized water for preparation of PDB and autoclave it then it has more impact for production of biomass as well as secretion of Mycotoxins. It is revealed further that preparation of PDB in magnetized water followed by chilling treatment enhances the impact to produce more amount of biomass of *Penicillium chrysogenum* along with release of more amount of Mycotoxins. These observations are in tune with the fact that magnetic properties of water can be enhanced by chilling treatment at 0°C

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