Effect of Fungicide Treatment on Dielectric Properties of a Vegetable Seed

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ABSTRACT

Effect of fungicides' (thiram, captan, carbendazim, bagalol) treatment on dielectric constant and dielectric loss of a vegetable seed, namely the brinjal at given moisture content and bulk density was examined using Hewlett-Packard (HP-4194A) impedance/gain phase analyzer over the frequency range of 0.01 to 10 MHz and temperature range of 30-45^{0}C. Julabo (temperature controller, F-25, Germany) was used for keeping the temperature of seeds constant. Study showed that fungicide treatment cast considerable change in dielectric parameters namely the dielectric constant and dielectric loss.

Key words:- *Dielectric constant, dielectric loss, moisture content, vegetable seed, fungicides.*

1. INTRODUCTION

The seed treatment refers to the application of fungicide, insecticide, or combination of both to seed, so as to disinfect and disinfest them from seed born or soil-born pathogenic organism and storage insect and pests. Vegetable seeds are treated with appropriate fungicides for control of fungal diseases arising from soil born organism, and pathogens that causes seed rots, damping-of, seed and seedling blights and root-rots. The fungicide treatments also save the seeds from fungal pathogens that are surface born on the seeds and causes covered smut and rust. Fungicide treatment is also useful to control internally seed-born fungal pathogens such as loose smut fungi of vegetable seeds. It is important to choose the appropriate fungicide that provides the best control of the organism present on the seed or potentially present in soil, and in the environment in which seeds are stored.

Seed treatments are not done only at the time of sowing but generally done at the time of harvesting to preserve the seed quality during transportation and storage and unit packaging. As enumerated in our earlier paper [1] the dielectric properties are well correlated with moisture content and bulk density of the material and can be used as indicator of these physical parameters of seeds by appropriate modeling. The dielectric based sensors use these models for the sensing of the moisture content and other physical parameter of seed lots and single kernel of seeds.

To investigate and assess the degree of impact of fungicides treatment on dielectric parameters, namely the dielectric constant, dielectric loss factor and electrical conductivity, at different frequencies and temperature, four fungicides - Thiram (75% WS), Carbendazim (50 % WP), Captan (50% WP) and Bagalol [MEMC, 6 % (Hg), SD] were selected. The treatments were done by a common and versatile method-the slurry treatment method, described in details elsewhere [1]. These fungicides are used in treatments of various vegetable seeds for protection of seeds from various seed surface-born and soil-born diseases and other leaf and fruit blight and smuts. Other details of the fungicides have been published in our earlier paper [1]. Dielectric properties of many seeds have been explored a lot, but the effect of

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fungicides on dielectric prope rties has not yet been explored much, though different kinds of studies relating to fungicides and seeds have been done in past [1-9].

2. MATERIALS AND METHODS

The experimentally determined values of dielectric constant (ε'), dielectric loss factor (ε''), loss tangent ($\tan\delta$) and electrical conductivity (σ), for reference (untreated) and fungicide trea ted samples for selected vegetable seeds at a given moi sture content and bulk density, between the temperatu re range of 30-45 ^{0}C, and over the frequency range o f 5 kHz to 10 MHz at different discrete frequencies : 5 kHz, 10kHz, 30kHz, 100 kHz, 300 kHz, 1 MHz, 3 MHz, and 10 MHz have been evaluated.

In order to examine the impact of fungicide treatment on the above mentioned dielectric parameters, bar plots were drawn for dielectric constant, dielectric loss factor and electrical conductivity at 30 ^{0}C of temperature with treated and non-treated (reference) seed sample of brinjal.

Effects of fungicide treatment on vegetable seed brinjal were examined at its initial moisture content 8.7% and at normal bulk density 0.608. Here the moisture content is given in percent and wet basis (w.b.), whereas the bulk densi ty is in gm cm^{-3}. Density of sample in sample holder was kept constant to avoid the density valuation effect o n dielectric parameters by consistent and systematic f illing of seed kernels in sample holder to get natural c ourse of settings.

Analysis of experimental resuls showed considerable effect of fungicides on dielectric parameters of vegetable seed.

3. RESULTS AND DISCUSSION

The treatment of fungicide brings considerable change in the values of dielec tric parameters of brinjal seed.

The bar plots presented in fig s 1 to 4 showed that the dielectric constant of brinjal increases with the treatments of all the fungicid es. Maximum variations are noticed with thiram follow ed by carbendazim and captan. Least impacts on dielectric parameters are noticed with bagalol amongst a ll fungicides. In general the changes are diminished wit h increase in frequency. The changes in dielectric constant over the given frequency range of 5 kHz to 10 MHz, moisture content ,bulk density and 30 ^{0}C are found to lie in the range of 4.084 to 0.146 with thiram, 3.554 to 0.170 with carbendazim, 3.495 to 0. 135 with captan, and 1.647 to 0.130 with bagalol [1].

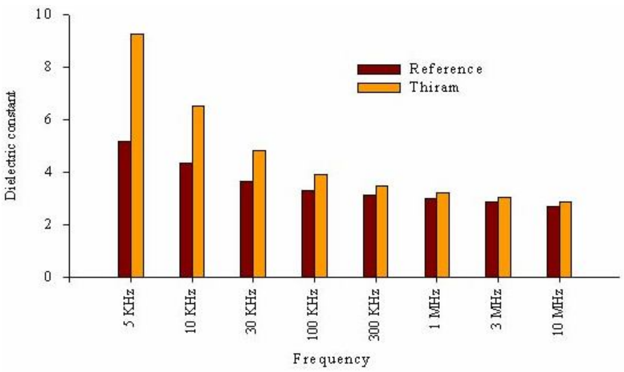

Fig.1. Effect of Thiram Treatment on Dielectric Constant of Brinjal at Indicated Frequencies and 300C.

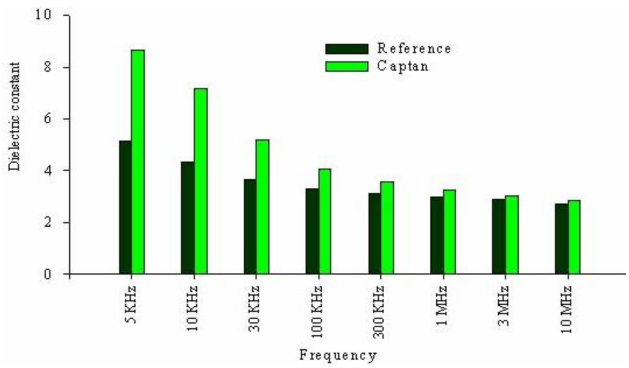

Fig.2. Effect of Captan Treatment on Dielectric Constant of Brinjal at Indicated Frequencies and 30^{0}C.

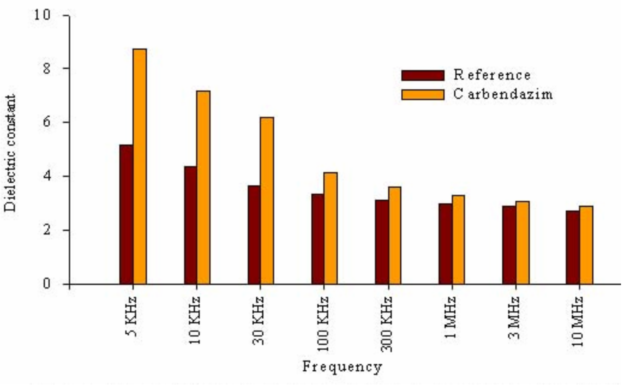

Fig.3. Effect of Carbendazim Treatment on Dielectric Constant of Brinjal at Indicated Frequencies and 300C.

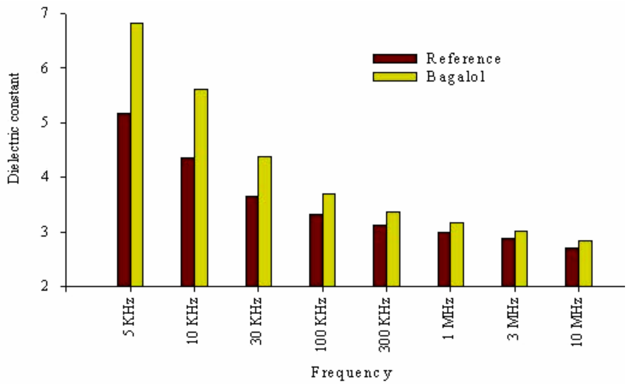

Fig.4. Effect of Bagalol Treatment on Dielectric Constant of Brinjal at Indicated Frequencies and 300C.

Dielectric loss factor and electrical conductivity (The bar plots presented in figs 5 to 8 and 9 to 12) are also affected by the fungicides. Similar pattern of variation with all the fungicides are observed in both the parameters, as were observed in the case of dielectric constant [1]. However, the magnitudes of the variation are different for different dielectric parameters of the given seed. The changes in dielectric loss factor over the given frequency range and 30^{0}C are found to lie in the range of 3.880 to 0.015 with thiram, 3.457 to 0.045 with carbendazim, 3.604 to 0.101 with captan, and 0.0455 to 0.056 with bagalol, whereas the change in electrical conductivity are found to lie in the range of 0.011 to 0.177, 0.01 to 0.247, 0.01 to 0.560, and 0.001 to 0.309, with corresponding fungicides respectively.

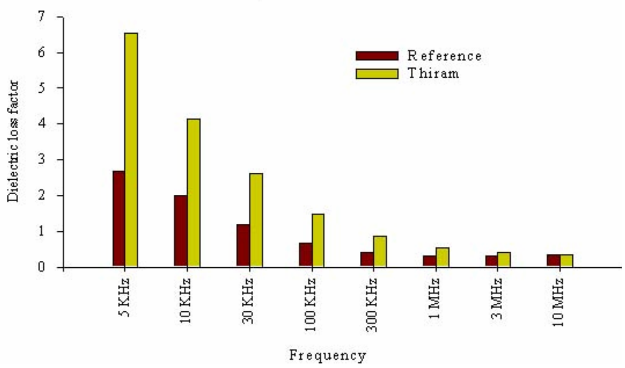

Fig.5. Effect of Thiram Treatment on Dielectric loss Factor of Brinjal at Indicated Frequencies and 30^{0}C.

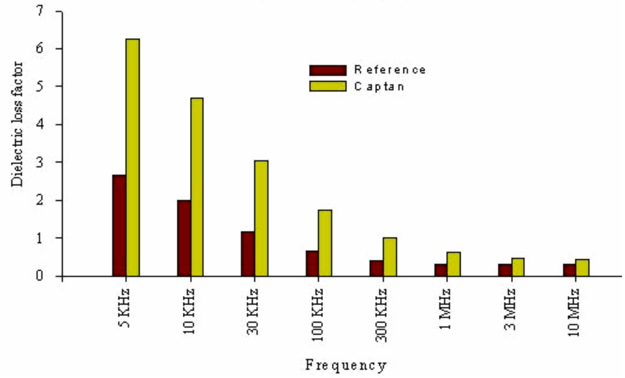

Fig.6. Effect of Captan Treatment on Dielectric loss Factor of Brinjal at Indicated Frequencies and 300C.

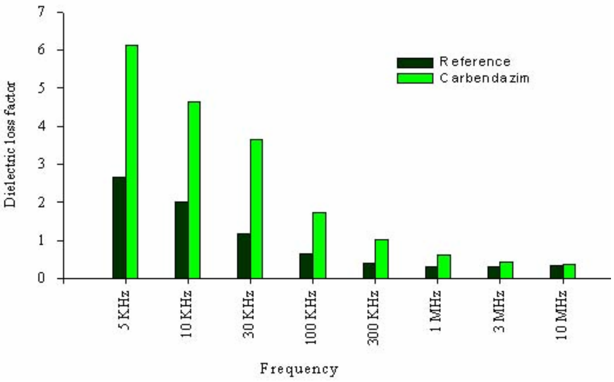

Fig.7. Effect of Carbendazim Treatment on Dielectric Loss Factor of Brinjal at Indicated Frequencies and 300C.

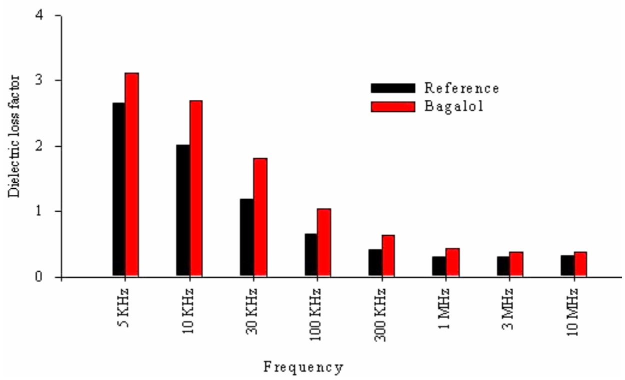

Fig.8. Effect of Bagalol Treatment on Dielectric Loss Factor of Brinjal at Indicated Frequencies and 300C.

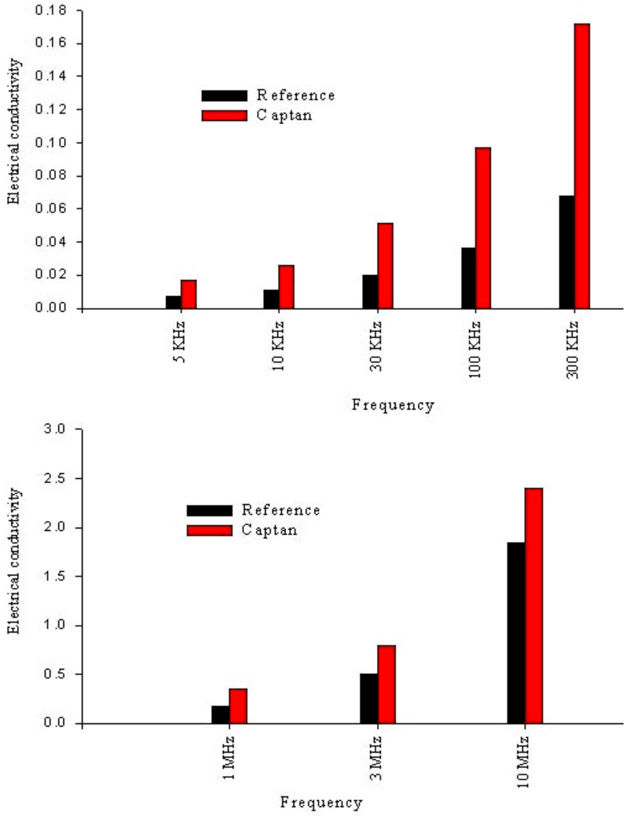

Fig.9. Effect of Captan Treatment on Electrical Conductivity of Brinjal at Indicated Frequencies and 300C.

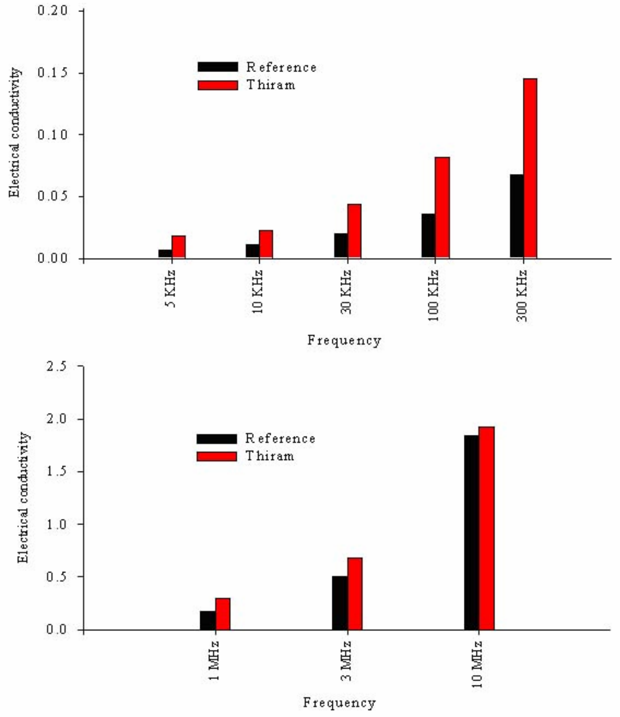

Fig.11. Effect of Thiram Treatment on Electrical Conductivity of Brinjal at Indicated Frequencies and 300C.

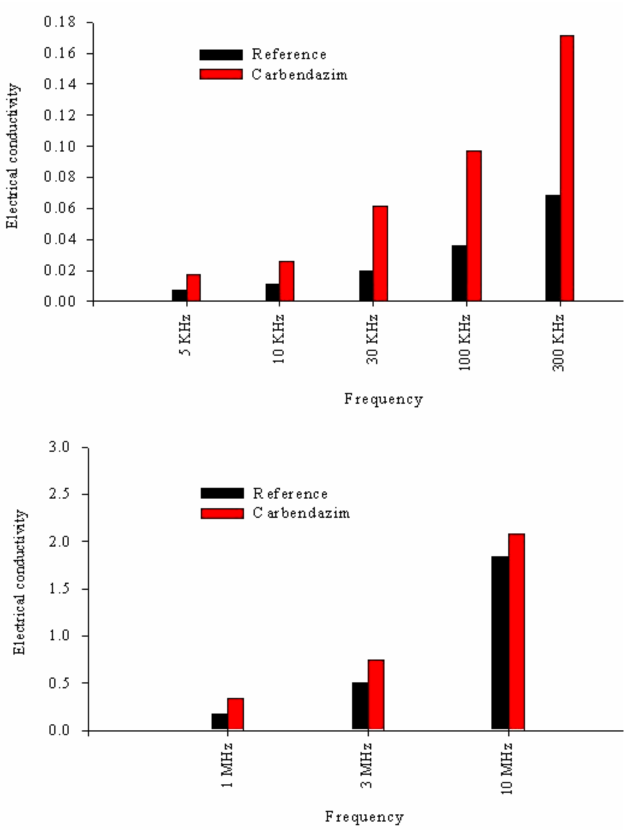

Fig.10. Effect of Carbendazim treatment on electrical conductivity of brinjal at indicated frequencies and 300C.

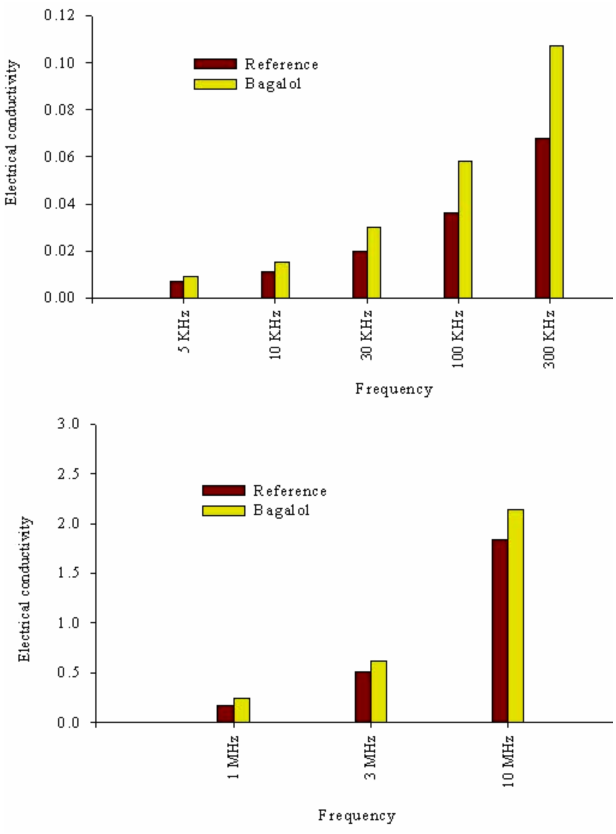

Fig.12. Effect of Bagalol Treatment on Electrical Conductivity of Brinjal at Indicated Frequencies and 300C

4. CONCLUSION

The analysis of effect of fungicide treatment on dielectric parameters of vegetable seed revealed that different types of fungicides cast different amount of change in different dielectric parameters of vegetable seed. The changes induced by the fungicides are quite high and cannot be ignored when precise and accurate measurements are needed for the sensing of extensive physical properties of seed and for other applications useful in agricultural technologies.

A change in dielectric parameters of same seed when treated with different types of fungicides is obvious from difference in chemical composition and electrical and dielectric properties of fungicides. The physical and chemical properties of seed are also having their own contribution in altering the dielectric parameters when fungicide treatments are done.

REFERENCES

[1]. V. S. Chandel, A. Rahman, J. P. Shukla and R. Manohar. Effect of Fungicide Treatment on Dielectric Properties of Few Coarse- Cereals Over the Frequency Range 0.01 to 10 MHz, Walailak J Sci & Tech 2012; 9(3): 217 227.

[2]. C.M.Tu, Effect of fungicidal seed treatments on alfalfa growth and modulation by rhizobium meliloti. *Chemosphere*, 1981; 10: 127-34.

[3]. C.M.Tu. Effects of some pesticides on rhizobium japonicum and on the seed germination and pathogens of soybean. *Chemosphere*, 1982; 11(10), 1027-33.

[4]. L.R. Rathod, M. D. Jadhav, D.S. Kanse, D.P. Patil, S.D. Gulhane and P.S Deshmukh. Effects of fungicides on seed borne pathogen of groundnut. *International Journal of Advanced Biotech. and Research*. 2010; 1(1), 17-20.

[5]. S.N. Manjunatha, R. Hunje, B.S Vyakaranahal and I.K Kalappanavar. Effect of seed coating with polymer, fungicide and containers on seed quality of chilli during storage. *Karnataka J. Agric. Sci.*, 2008; 21(2), 270-73.

[6]. B.O.Basavaraj, N.K.B Patil, B.S Vyakarnahal, N.Basavaraj, B.B. Channappagoudar and R. Hunje. Effect of fungicide and polymer film coating on storability of onion seeds. *Karnataka J. Agric. Sci.*, 2008; 21(2): 212-218.

[7]. G. Saeidi and A.A.M. Mirik. Fungicide seed treatment and seed colour effects on seed vigour and emergence in flax. *International Journal of Agriculture & Biology*, 2006; 8(6), 732–735.

[8]. S.P. Singh, P. Kumar, R. Manohar and J.P. Shukla. Dielectric properties of some oil seeds at different concentration of moisture content and micro-fertilizer. International Journal of Agricultural Research, 2006; 1(3), 293-304.

[9]. M.S. Khan and V.S. Chandel. Study of conductivity and penetration depth of argemone seeds at different concentrations of moisture. *J. Pure Aplll. & Ind. Phy*, 2011; 1(2), 153-161.

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