International Journal for Multidisciplinary Research (IJFMR)
E-ISSN: 2582-2160 ● Website: www.ijfmr.com ● Email: editor@ijfmr.com

An Overview of Microwave Dielectric Behaviour of Vegetable Based Soil: A Review

Pandey Priyanka[1], Shrivastava A.K.[2]

DR.C.V. Raman University, Kota, Bilaspur, Chhattisgarh, INDIA.

Abstract

In this paper review of literature of dielectric behaviour of soil in Chhattisgarh, India, has been described from 2015 to 2021. In this literature the various parameters of dielectric behaviour of soil i.e. physical properties, chemical properties and geographical properties have been illustrated briefly. This paper helps those who are researching in the field of dielectric behaviour of soil.

Keywords: Soil, dielectric, physical, chemical and geographical properties.

Introduction

Review of literatures have its own importance. Before selecting the Topic a lot of concerned literatures have been studied. Review of literatures help to find out gap of research. There is no concrete research work has been done in present scenario. Vegetables play vital role for human being. It has been chosen Vegetable based soil for comprehensive study. Some Review of literatures have given below although it has been mentioned from 2015. In the year (2015) R. Rajesh Mohan *et al.* Studied about measurement of soil moisture content at microwave frequencies and suggested that the free space transmission microwave frequencies because of the need for a large structure and large amount of soil samples can be conveniently used along with a simple microstrip patch antenna and a suitable sample holder, which is immune to microwave radiation. In the year (2015), Chaudhary H.C. *et al.* Researched dielectric properties of soil with organic and inorganic matter at J. Band microwave frequency and found that study of physical properties, chemical properties, dielectric properties of soils with varied organic and inorganic matter is useful in agriculture to predict quality and fertility of soil. In the year **(**2015) Dhiware M.D. *et al.* Studied about physic-chemical and dielectric properties of soil sample at X-band microwave frequency of Nasik region and found that the crops like soyabean, cotton, maize, rice, tur, onion, can be taken in kharif season. Soil in Sinnar tehsil is suitable for bajra, tomatoes, maize, soyabean, wheat, onion, cotton; soil in Igatpuri is suitable for rice, wheat, pulses, tomatoes etc. In the year (2015) Tiwari Manoj *et al.* Observed that metal concentration in soil of an industrial region of Chhattisgarh, Central India and found that the most of the soil samples, higher concentration of selected heavy metals are observed near the surface of ground. The surface water analysis also indicated that the concentrations of Cr and Mr are higher before and after the monsoon. Pollution can be reduced by using Scientific designed dumping sites with liners and if possible the amount of industrial solid waste generation may be reduced with the help of process modification of particular products also the higher pH (alkaline) of the disposed industrial solid waste may reduce the leachate generation, so suitable alternatives can be used for the same at the time of industrial solid waste disposal or dumping near populated vicinity. In the year (2016) Navarkhele V.V. *et al.* Studied about study of two Indian soils and found that the resistivity decreases by adding water content and reaches to a

constant value, it is higher for white soil and lower for black soil, due to lower water resistance or higher water retentive capacity black soil is good for agriculture purpose. The colour of the soil does not matter the agricultural productivity. Due to higher percentage of calcium carbonate, the white soil is used for construction and other applications where calcium carbonate is used. In the year 2016, Martine Al and Shang Julie described about complex permittivity to detect lead in soil with various salt forms and combinations and observed to changes in lead salt concentration in soil. In general, the relative permittivity at dielectric dispersion frequency decreased, whereas, the loss factor at 200 MHz increased with an increase in lead concentration. This indication that Complex permittivity can be used to monitor lead concentration in soil. In the year (2017), Tan Giao *et al.* Studied about design of a new TDR probe to measure water content and electrical conductivity in highly saline soils and observed that lots of TDR probes have been designed for different requirements since time domain reflectometry theory was introduced into soil measurement field, also plenty of relationship has been proposed to calibrate apparent permittivity and volumetric water content, and the accuracy was improved greatly**.** In the year (2017) Nishat Syeda Ruhi *et al.* Described a brief review about dielectric properties of soil at various bands of microwave frequencies and observed that the dielectric constant in the soils and frequency of measurement. Dielectric constant of soils increases slowly with increase in the moisture, after where it increases rapidly with moisture content. In the year (2018), Moradizaer mina ***et al.*** Studied about estimation of improved resolution soil moisture in vegetated areas using passive AMSR-E data and found that soil moisture variability is effectively captured at 5 Km spatial scales without a significant degradation of the accuracy. In the year (2018) Patel Lakhapati *et al.* Discussed about role of moisture content and dielectric constant in soil and found that there are a lot of effects viz water effect, texture effect, Nitesh Kumar, et al., J. Pure Appl. & Ind. Phys. Vol.9 (5), 40-55 (2019) 49 bulk density effects, organic matter content, soil water temperature, salinity effects, etc, but role of moisture content plays pivoted role in microwave remote sensing. It has been also seen that microwave remote sensing has the potential for wide spread use in soil moisture. In the year (2018) Dhiware Manisha *et al.* Described about the dielectric study of soil at X-band microwave frequency and physiochemical properties and found that in Niphad tahsil (NE Maharashtra) farmers from, this region usually grow grapes in their form in which pH is between 5.5 to 7.0 its major rivers are the Godavari and its tributary, the Kadwa Sugarcane is are of the most important agricultural products and the basis for a Sugar refining and alcohol distilling industry, conducted at two cooperation sugar factories. Other major crops include onions, grapes, soyabean, tomatoes and flowers, all exported internationally as well as wheat, gram and other vegetables and grains (bajra, Jowar, tur). Niphad is the largest grapes processing location in India. The dielectric constant of Niphad soil varies with the texture of the soil. These variations have been found to be strongly dependent on the texture of soils. It is observed that soil sample of this region is sandy loam, so main crop of Niphad tehsil is grapes. In the year (2018) Dhiware M.D. *et al.* Showed about relationship between dielectric constant and water content of soil from western ghat of Maharashtra, India and observed that there is slow increase in dielectric constant at lower percent of water content, whereas it increases sharply at higher water content and becomes constant at certain value of water content in soil. Further it has been observed that dielectric constant increases with increase in moisture content slowly up to transition moisture them in increases rapidly with increases in moisture content. The result shows the change in the electrical properties of soil before and after the addition of water, also dielectric loss is directly proportional to the microwave conductivity and transition temperature. It has been found that Emissivity decreases with increase in moisture content, in the field of remote sensing and agriculture results obtained are useful. In the year

(2018) Sahu Vijay et al. Explained the role of dielectric behaviour of soil in agriculture with reference to pond area and stated that soil is a heterogeneous mixture of silicate particular, humus a variety of insoluble salts and oxides of metals called the solid phase, a liquid phase and a gaseous phone. Organic matter level and structural improvement of soil can be Build up, to varying degree, and maintained by continuous judicious application of manures, even under tropical conditions prevailing in India. He further suggested that the dielectric constant of soil are strongly dependent a soil moisture and soil texture, such study of soil is also useful in microwave remote sensing and agriculture in order to increase its productivity. In the year (2018), Jain Amar Kumar et al., estimated the response of organic manure, zinc and iron a soil properties, field and nutrient up take by pearlmillit crop grown in inceptisol and found that the increase in NPK uptake by pearl millt with integrated application of nutrients may be due to improvement of the soil environment. More over organic manures after decomposition released nutrient which became available to the plants and thus increased NPK concentration. In the year (2019), Patel Lakhapati *et al.* Discussed about significance of dielectric behaviour of flood affected soil in agriculture with special reference to Bihar and Chhattisgarh, and stated that study of Physical properties, chemical properties, dielectric properties of soils with varied organic and inorganic matter is useful in agriculture to predict quality and fertility of soil. Meena Mahesh C and Meena Ramavatar.in year (2019) study and modify Ulaby model on back scattering as a function of salinity frequency and soil moisture. He describes and illustrated that due to component of the mixture and their corresponding dielectric properties, back scattering of this type of soil can be molded and monitored. The dielectric property of soil depends on soil moisture of content along with its salinity; texture & frequency. Konings Alexandra G. et al. in the year (**2019)** Observed about macro to micro behaviour of microwave remote sensing of plant water content for physiology & ecology and found that MRS observation how they are sensitive to plant water content. They used Q-H model GRMDM & holme parameterization scheme and found that the higher the soil salinity was the greater the decreasing amplitude of the brightness temp. Because further they observed correlation coefficient of V polarization and H polarization were 0.971 and 0.935 respectively. Soeid Gharechelar *et al*.in the year (2020) Study about mineral soil texture. Land cover dependency on Microwave dielectric models in an and environment and found that cover of land influenced the condition of moisture even identical soil texture type. They showed good argument in between the land cover and the dielectric constant even for the same soil texture type further he suggested that it can be useful further he suggested that it can be useful for clarifying the effect on the D.C. Kabir Humayun *et al*.in the year (2020) Estimated measurement and modelling of soil dielectric properties as a function of soil class and moisture content and they showed that, increasing soil moisture from oven dry conditions to 100% field capacity, both the real and imaginary components of the dielectric properties increased; however, the responses were not linear. Further they observed that the dielectric parameter of oven dry soils were very low compared with the soils with greater moisture content. So, soil moisture was the major contributor to the dielectric behaviour of soil. Prachi Patta *et al.* in this paper (2020) Studied the Dielectric properties of soils of Mega region (Punjab) at X-band frequency 9.0 GHz and found that Dielectric constant is a function of moisture content further they showed several of dielectric properties of soil of Mega in Punjab. Patel Virendra Kumar N *et al*.in the year (2021) illustrated about calculation of dielectric parameter of clay loam and silty soil with different salinity levels over low frequency range and calculated the dielectric parameter of two different types of soil with water of different salinities over the frequency range from 20 Hz to 2 MHz using a precision LCR meter. Again they asserted that dielectric constant and dielectric loss increase with decrease in frequency over the radiofrequency range. Itolikar Ashish B. *et al*. in the year (2021) enunciated

that dielectric response due to combine effect of soil and vegetation layer (Grass) at C-Band microwave frequency and stated that the comparative study of complex dielectric properties of bare/uncovered soil and soil covered with vegetation is a unique effort. This study provides useful information for interpretation of microwave remote sensing data of soil moisture under vegetation cover. Patel L. *et al*. in the year (2021) illustrated about microwave remote sensing dielectric behaviour of soil and utilization in agriculture and described a lot of results as fundamental properties of soil, soil texture, physic-chemical properties of soil, analysis of dielectric constant, dielectric constant of soil in relation to India, remote sensing characteristics of soil for farming utilization, soil parameters and dielectric parameters, microwave remote sensing behaviour of soil and fertilizers in relation to agriculture, soil testing and fertilizers for crops and applications of microwave remote sensing in agriculture. Shrivastava *et al*.in the year (2021) enunciated about microwave dielectric parameter of soil texture and surfaced transparently. Lots of fundamental knowledge of microwave dielectric properties of soil. Further they listed textural analysis, physical properties, chemical properties, dielectric aspects of different types of soil especially south east central region i.e. Chhattisgarh. LuleZi-Xuan *et al*. in the year (2022) Explained microwave dielectric properties of (0.75 $ZnAl_2O_4$-0.25TiO_2)- $MgTiO_3$ ceramics prepared using digital light processing technology and found that DLP is a promising method for preparing high performance microwave dielectric ceramics with complex structures. Further they showed that an increase in the sintering temperature, the dielectric constant and quality factor of ZTM ceramics initially increased owing to the increase in the density and diffusion of ions.

REFERENCES .

1. Ahire Vidya D., Ahire D.V., Chaudhary P.R. (2015), "Effect of Chemical Fertilizers on Dielectric Properties of Soils at Microwave Frequency'', International Journal of Scientific Research Publications. Vol 5(5), PP 1-7.
2. Chandan Naresh Kant & Shrivastava Sidhatri Kumar (2015), "Measurement of Dielectric Constant of Soil Near Berhampur District of Orissa state at X-Band frequency'', J. Inst. Engg. India Ser. B, Springer, DOI: 10.1007/s40031-014-0179-8.
3. Chaudhary H.C. (2015), "Dielectric Study of Soils with Varied Organic Matter at Microwave Frequency'', IJCPS, Vol, 4, No. 3.
4. Chaudhary H.C. (2015), "Dielectric Properties of Soils with Organic and Inorganic Matter At J-Band Microwave Frequency'', International Journal of Remote Sensing & Geosciences, Vol. 4, Issue3, PP 14-19.
5. Chaudhary H.C. (2015), "Dielectric Study of Soils with Varied Organic Matter at Microwave Frequency'', International Journal of Chemical and Physical Sciences, vol.4, No.3, PP 45-53.
6. Chaudhary P.R. *et al.* (2015), "Effect of Chemical Fertilizers on Dielectric Properties of Soils at Microwave Frequency'', International Journal of Scientific And Research Publications Vol.5, Issue 5, PP 1-7.
7. Das Kaushik and Paul (2015), "Present Status of Soil Moisture Estimation by Microwave Remote Sensing Cogent Geo Informatics'', Review Articles,1 :1084669, PP 1-21.
8. Dhiware M.D., Nahire S.B. and Deshmukh (2015), "Physicochemical and Dielectric Properties of Soil Samples at X-band Microwave Frequency of Nasik Region'', Bio Nano Frontier, vol.8(3), http://www.researchgate.net/publications/339817269].

9. Dhiware M.D., S. B. Nahire, S. B. Deshmukh (2018), "Relationship Between Dielectric Constant and Water Content of Soil From Western Ghat Of Maharashtra, India'', Int. Res. J. Of Science & Engineering A2: 76- 82.
10. Dhiware Manisha *et al*., (2018), "Dielectric Study of Soil at X-band Microwave Frequency and Physic-chemical Properties", International Journal of Engineering and Techniques, Vol 4, issue 1, PP 381-392.
11. Gadani D.H, F.M.Modi, Rana V.A., (2020), " Estimation Of Sea Water Salinity From Dielectric Measurements: Effect Of Temperature'' , Indian Journal Of Pure & Applied Physics, Vol. 58, June, PP-455-464.
12. Gharecelou Saeid, Tateishi Ryntaro and Johnson A. Brin (2020), "Mineral Soil Texture Land Cover Depending on Microwave Dielectric Models''. In An Arid Environment Land, MDPI, PP. 1-13 Doi: 10.3390/ Land 9020039].
13. Itolikar Ashish B, Joshi Anand, Deshpande Santosh and Kurtadikar (2021), IEEE India Geoscience and remote sensing symposium, Publisher: IEEE, DOI: 10.1109/InGARSS48198.20209358944.
14. Jain Amar Kumar (2018), "Response of Organic Manure, Zinc, And Iron on Soil Properties, Yield and Nutrient Uptake by Pearlmillet Crop Grown in Inceptisol'', IJPAB, 6(1): 426-435**.**
15. Jaiswal Shweta, Patel Lakhapati, Paul A.C., & Shrivastava A.K. (2019), "Correlations of Environmental Soil and Dielectric Constant with Microwave Remote Sensing'', OIIRJ, Vol. 9, April Special Issue (01).
16. Kabir Humayun, Khan Mohammad Jamal, Brodie Graham, Gupta Dorin, Pang Alexis, And Jacob Mohan V., (2020), Measurement and Modelling of Soil Dielectric Properties as a Function of Soil Class and Moisture Content, Journal of Microwave Power and Electromagnetic Energy, Vol. 54, Issue 1, PP- 3-18.
17. Kapre A.K. *Et Al*, (2015), "Dielectric Properties of Black Soil with Chemical Fertilizers At X- Band", India Journal of Radio & Space Physics, Val 44. PP. 102-105.
18. Klotysche A et al., "Measuring Soil Water Content with Ground Penetrating Radar: A decade of Progress, Vadose Zone Journal Advancing Critical Zone Science'', PP-2-9 DOI: 10.2136/viz 2018.03.0052 (2018).
19. Kumar Rajeev and Sharma Anupam deep (2015), "Variation in Dielectric Behaviour of Soil of Indo-Gangetic Region of Haryana (India) with fertilizers at 5 GHz''. 6th International Conference an "Recent Trends in Applied Physical, Chemical Sciences, Mathematical / Statistical and Environmental Dynamics", ISBN: 978-81-930585-8-9, PP 43-47.
20. Kumar Shashi Ranjan et al., (2018), "Review and analysis of microwave remote sensing behaviour of soil in India'', IJRAT, 6(11): 2972-2975.
21. Kumar Virendra, Patel N., Chaudhary Prahalad D., Rana Vipin A. And Deepak Gadani H., (2021), Research Article, Current Science, Vol. 120, No. 2.
22. Liu Jing, Liu Qinhuo Li Hua, Du Yongminge, Cao Bio [2018], "An improved microwave semiempirical model for the dielectric behaviour of moist soils''. This article has been accepted for induction in a future issue of this journal content is final as presented, with the exception of pagination, IEEE TRANSACTIONS ON GEOSCIENCE AND REMOTE SENSING.
23. Meena Mohan C. Mena Ramontor "Modified Ulaby model on Backscattering as a function of salinity, frequency and soil moisture", Indian general of agriculture research volume 533, issuer 6 - 646-654, DOI: 10.8805? IJAREA- 5282.

24. Mohan Rajesh et al. (2015), "Measurement of Soil Moisture Content at Microwave Frequencies", Science Direct, Procedia Computer Science 46 PP 1238-1245.
25. Mohan Rajesh et al. (2015), "Study and Analysis of Dielectric Behaviour of Fertilised Soil at Microwave Frequency'', EJAET, 2(2): PP 73-79.
26. Moradizadeh Mina et al. (2018), "Estimation of Improved Resolution Soil Moisture in Vegetated Areas Using Passive AMSR-E Data'', Indian Academy of Sciences, Cross Mark, J. Earth, Syst. Sci. 127: 24.
27. Nahire S.B. *et.al*. (2015) Physicochemical and Dielectric properties of Soil Samples at X-Band Microwave Frequency of Nasik region, Bio nano Frontier, Vol. 8(3)
28. Navarkhele V.V., (2016), "Study of Two Indian Soils'', Journal of Chemical and Pharmaceutical Research, 8(1): 153:160.
29. Navarkhele V.V., Kapre A.K., & Shaikh A.A. (2015), "Dielectric Properties of Black Soil with Chemical Fertilizers at X-band'', Indian Journal of Radio & Space Physics, vol. 44, PP 102-105.
30. Navarkhele V.V. (2016), Study of two Indian Soils, JOCPR, 8(1) :153-160.
31. Nishat S.R., (2017) "A Brief Review: Dielectric Properties of Soil at Various Bands of Microwave Frequencies'', Journal of Medicinal Chemistry on Drug Discovery, issue 03, Vol.02, PP 1-12.
32. Pillai Sonali, Pandey Ashutosh, Shrivastava A.K. (2017), "Role of Water Content In Dielectric Constant of Soil With Reference To Northern Chhattisgarh'', Journal Of Pure Applied And Industrial Physics, Volume 75, No. 5, May, PP-197-200.
33. Pandey Ashutosh, Shrivastava A.K. (2017), "Study of Fundamental Concept of Microwave Remote Sensing''. In Relation to Characterization, Applied Science Periodical, Volume XIX, No. 1, February, PP-24-31.
34. Pandey Ashutosh, Shrivastava A.K. (2018), "Review and Analysis of Microwave Remote Sensing Behaviour of Soil in India'', IJRAT, Volume 6, No. 11, November, PP-2972-2975.
35. Patel Lakhapati (2021). "Microwave Remote Sensing Dielectric Behaviour of Soil and Utilization in Agriculture'', Scrip own Publication, ISBN: 978-93-90833-85-6.
36. Patel Lakhapati et al., (2018) "Role of Moisture Content and Dielectric Constant In soil'', International Journal of Research in Advent Technology, Vol. 6, No. 11, PP-3288-3293.
37. Patel Lakhapati et al., "Significance of Dielectric Behaviour of Flood Affected Soil in Agriculture, with Special Reference to Bihar and Chhattisgarh'', International Disciplinary Research Journal, Vol-09, issue 01 PP 67-72 (2019). Nitesh Kumar, et al., J. Pure Appl. & Ind. Phys. Vol.9 (5), 40-55 (2019) 53
38. Patel Virendra Kumar N. (2018), "Variation of Electrical Parameters of Soil with Moisture and Salinity Over Frequency Range From 20Hz to 2 MHz, International Journal of Scientific Research And Reviews, 7(1), 457-471.
39. Paul Binu, R.Rajesh Mohan, Mridula S.,Mohanan P. (2015), "Measurement of Soil Moisture Content At Microwave Frequencies'', Science Direct, Science 46,Elsevier PP 1238-1245.
40. Pithori Suryaraj (2018), "Remote Sensing Techniques in Agriculture'', Pacific Books International, ISBN: 978-93-86655-84-4.
41. Plta prachi, pankaj pram, Kaur prabhdeep and Mann singh kuldip (2020), " Dielectric properties of soil of Moga region (Punjab) at X-band frequency 9.08 GHz'', Chemical physics reviews: https://doi.org/10.1063/5.000810:]

42. R. Rajesh Mohan et al., (2015) "Measurement of soil Moisture Content at Microwave frequencies" Science Direct, Proceedings Computer Science 46 PP 1238-1245.
43. R. Rajesh Mohan et al., (2015) "Study and Analysis of Dielectric Behaviour of Fertilized Soil at Microwave Frequency, European Journal of Advances in Engineering and Technology, 2(2) :73-79.
44. Rajesh Mohan *et Al.* (2015)," Measurement of Soil Moisture Content at Microwave Frequency'' Elsevier, PCS 46 1238- 124.
45. Rathore Yogeshwar (2017), "Dielectric Properties Of Soil At Frequency Range 8-12 GHz In East Chhattisgarh'', Dissertation, DR. C.V. Raman University, Kota, Bilaspur, Chhattisgarh, India.
46. Rawat Deepak (2015), "Microwave Attenuation Studies Impacted by Rain for Communication Links Operating at Tropical REGION: A Survey''. IJATCSE, Vol. 4, No. 1, PP 05-14.
47. Sahu Vijay (2018), "Role of Dielectric Behaviour of Soil in Agriculture with Reference to Pond Area'', Journal of Pure Applied and Industrial Physics, Vol. 8(6), PP 62-65.
48. Sharma, Anupam Deep and Kumar Rajeev (2015), ''Variation in (India) With Fertilizer At 5 GHz'',6th International Conference on "Recent Trends in Applied Physical, Chemical Sciences, Mathematical/Statistical And Environmental Dynamics''. ISBN: 978; 81930585-8-9 PP 43-47.
49. Shrivastava A.K. (2021), Microwave Dielectric Parameter of Soil Texture, Scrip own Publication, ISBN: 978-93-90833-31-3.
50. Shrivastava Rajesh et al (2018). "Study of Microwave Dielectric Characteristics of Soil in North East Chhattisgarh'', Journal of Pure applied And Industrial Physics, vol. 8(12) PP 214-218.
51. Shrivastava Rajesh et al. "Study of Microwave Dielectric Characteristics of Soil in North East Chhattisgarh'', Journal of Pure applied And Industrial Physics, vol. 8(12) PP 214-218 (2018).
52. Syeda Ruhi Nishat et al. (2017), A brief Review: "Dielectric Properties of Soil at various bands of Microwave Frequencies'', JMCDD, Issue 03, Vol. 02. PP 01-12.
53. Tale Ku. Samita and Ingole DR. Sangita (2018), "A review on Role of Physicochemical Properties in Soil Quality'', Chemical Science Review and letters 4(13), PP 57-56.
54. Tan Xiao et al., (2017), "Design of A New TDR Probe to Measure Water Content and Electrical Conductivity In Highly Saline Soils, J. Soils Sediments, Cross Mark, DOI 10.1007/S 11368-017-1838-6.
55. Tiwari Manoj Kumar, Bajpai DR. Samir & Dewangan DR. U.K. (2015), "An Analytical Study Heavy Metal Concentration in Soil of an Industrial Region of Chhattisgarh'', Central India, International Journal of Scientific and Research Publication, vol 5(7), PP-1-8.
56. Venkatesh M.S. and Raghavan G.S.V., Shrivastava A.K., Mishra S., Shrivastava Umakant, (2017), Microwave Remote Sensing Characteristics of Soil for Agriculture, Journal of Pure Applied and Industrial Physics, Volume 7, NO.3, March, PP107-114.