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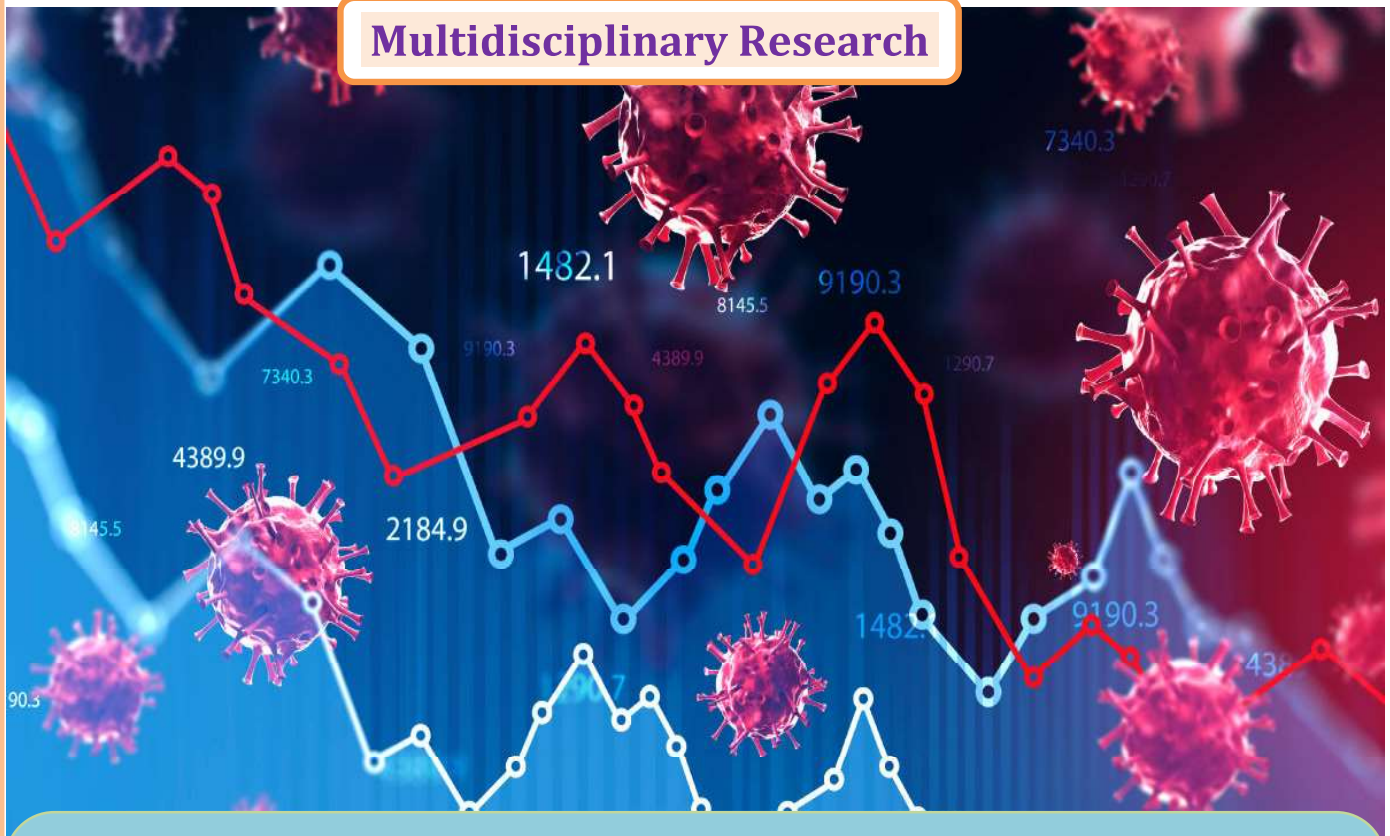
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International E-Research Journal

PEER REFREED & INDEXED JOURNAL

December 2020 Special Issue 256 (C)

Multidisciplinary Research



Guest Editor -
Prof. Dr. Rajani Shikhare,
 Principal,
 R. B. Attal College, Georai
 Dist. - Beed.

Executive Editors :
Dr. B. D. Rupnar,
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Resistivity of Food Preservative Potassium Meta –Bisulphate Using (TDR) Technique

Badhe S. G*, HelambeS. N.1, Prajapati T. A.1

*R. B. AttalArts, Science and Commerce College, Georai, Beed, Maharashtra,India.
1P.G. and Research center, Dept. of Electronics, Deogiri College, Aurangabad,Maharashtra, India.

Abstract:

Preservatives are an important part of the food industry. When the preservatives are added to the food there will be change in molecular properties of the food. These molecular changes can be observed through the impedance spectroscopy. Electrical parameters like Resistivity (RL) of food Preservative Potassium Meta –Bisulphate (KMS) is studied in the present work. A low frequency Time Domain Reflectometry (TDR) technique is developed and used to study this parameters. Various molar concentration (0.005 – 0.1) with freshly collected distilled water are prepared and studied at four different temperature (25oC, 35oC, 45oC and 55oC). It was observed that these parameters changes as the concentration and temperature changes. The Resistivity (RL) of Potassium Meta – Bisulphate (KMS) decreases as the concentration as well as temperature increases. Resistivity (RL) is inversely proportional to the molar concentration and temperature.

Keywords: Preservative, Resistivity (RL), Potassium Meta – Bisulphate (KMS), Time Domain Reflectometry (TDR).

Introduction:

Potassium Meta – Bisulphate is white crystalline powder with pungent odor. It is also known as potassium pyrosulfite. Chemical formula of Potassium Meta – Bisulphate is $K_2S_2O_5$. It is used as an antioxidant [1] also used as food additive as E224 [2]. It is commonly used in wine industry to protect colour and delicate flavor of wine. Sometimes it is used as a preservative in brewing industry, in lemon juice and bleaching agent in the production of coconut cream. Excess use of Potassium Meta-Bisulfite can irritate skin, eyes, and respiratory tract [3]. It is restricted in use that may cause allergic reactions in some sensitive persons [4].

Many scientific community has chosen impedance spectroscopy to characterize a large number of electrochemical systems [5, 6, 7]. Impedance spectroscopy technique is used for monitoring the corrosion or electro-deposition process [8]. It is also used in many kind of sensors and semiconductors [9, 10]. Use of Impedance Spectroscopy in the field of biotechnology for the characterization of cell culture is expanded in 90's [11]. In microbiology it is applicable for detecting the pathogenic bacteria [12, 13]. This technique is used for the study of polarization across cell membrane of plant and animal tissues [14, 15]. Impedance analysis technique is used for the measurements of mechanical and acoustic impedance [16, 17].

Experimental details:

A low frequency TDR of the Bandwidth 25MHz to 200MHz is developed in the laboratory. Developed TDR is of Maximum real time sampling rate, 200MHz to 1GHz and 5ns rise time. The experimental setup consists of sampling oscilloscope DS1000 [18], TDR module, a transmission line, and sample cell. Sample cell is an important part of the study. Sample cell

is connected with a co-axial transmission line of about 0.45 m length with 50 ohm characteristic impedance. Various types and shapes of probes (sample cell) were designed and tested for the accurate measurement. The measuring sample cell used is a strip line cell designed and constructed in the laboratory.

In TDR technique, a voltage step is propagated down the transmission line towards the sample under investigation and reflected voltage waves are monitored by oscilloscope at particular point on line.

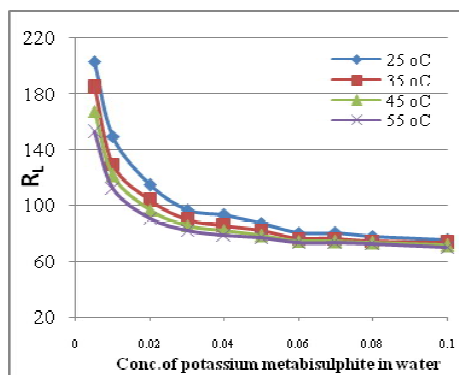
Various samples of different molar concentrations of Potassium Metabisulphite with freshly collected distilled water were prepared. These samples are kept in water bath. Temperature of the water bath was controlled and monitored by the computer.

Result and discussion:

The aqueous solutions of Potassium Metabisulphite shows 63% decrease in resistivity value with increase in molar concentration from 0.01 to 0.1. The decrease in resistivity values is exponential with change from 203 ohm to 75 ohm at 25 oC. Same trend is observed with about 53% decrease in resistivity at 55oC. For this solution there is noticeable decrease in resistivity of 25% with increase in temperature at lower concentration and about 7% decrease at higher concentrations. This indicates that, there is more effect of temperature on resistivity at lower concentration of potassium Meta-Bisulphate in water.

**Values of RLat
Molar**

Conc.	25 oC	35 oC	45 oC	55 oC
0.005	203	184	167	152
0.01	149	129	121	112
0.02	114	103	96	91
0.03	97	89	85	82
0.04	93	85	82	79
0.05	87	82	78	76
0.06	80	76	74	73
0.07	80	76	74	73
0.1	75	73	71	70



Changes in the values of RL for aqueous solution of Potassium Metabisulphite

Conclusion:

The developed TDR unit works successfully for the measurement of resistivity at lower concentration of potassium Meta-Bisulphate in water. Resistivity of Potassium Meta-Bisulphate change with the change in temperature as well as concentration of the solution. It was observed that the change is inversely proportional to the temperature and concentration. The work study help to study the strategy of preservative used in the packed food.

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