Radiation Hazards on Crop Soils

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ABSTRACT

Electro Magnetic Radiation is becoming a big threat to mankind. In these modern days the EMR is becoming higher and higher and become a major factor of polluting the environment. In this aspect the present work leads to present the effect of Radiation on soil. These soil samples are tested by MICROBIAL TEST to differentiate the radiated and non-radiated soil samples.

Key words: microwave, radiation, biological estimation and data analysis

1. INTRODUCTION

The effects of EMR upon biological systems depend both upon the radiation's power and frequency[1,2]. For lower frequencies of EMR up to those of visible light (i.e., radio, microwave, infrared) [3], the damage done to cells and also too many ordinary materials under such conditions is determined mainly by heating effects, and thus by the radiation power[4]. By contrast, for higher frequency radiations at ultraviolet frequencies[5,6] and above (i.e., X-rays and gamma rays) the damage to chemical materials and living cells by EMR is far larger than that done by simple heating[7,8], due to the ability of single photons in such high frequency EMR to damage individual molecules chemically[9,10].

2. METHODOLOGY

2.1 COLLECTION OF SAMPLES

The soil can be collected from various places. These soils are both radiated and non-radiated ones. Soils can be radiated by x-band and ku-band Microwave bench setup for radiating a soil in which soil by using x-band frequency with 255v beam voltage and 400mA for sample 1.

<table>
<thead>
<tr>
<th>Band specification</th>
<th>Beam voltage</th>
<th>Current</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ku-band</td>
<td>255v</td>
<td>4ma</td>
</tr>
</tbody>
</table>

Table 1 represents the ku-band Readings

Microwave bench setup for radiating a soil in which soil by using x-band frequency with 255v beam voltage and 400mA and Ku-band with 4mA and 255mv and soils samples are collected from different places for sample 2.

Samples are collected from different places for sample 2

<table>
<thead>
<tr>
<th>Band specification</th>
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<tbody>
<tr>
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</tr>
<tr>
<td>Ku-band</td>
<td>255v</td>
<td>4mA</td>
</tr>
</tbody>
</table>

Table 2 Represents x-band and ku-band

The rest of soils are non-radiated which are tested directly and are collected from different areas and one of soil which is collected from deep forest which is purely non-radiated where the area doesn’t obtain single network.
2.2 MICROWAVE INDUCTION:

Molecular rotation occurs in materials containing polar molecules having an electrical dipole moment, with the consequence that they will align themselves in an electromagnetic field. If the field is oscillating, as it is in an electromagnetic wave or in a rapidly oscillating electric field, these molecules rotate continuously aligning with it. This is called dipole rotation, or Dipolar Polarisation. As the field alternates, the molecules reverse direction. Rotating molecules push, pull, and collide with other molecules (through electrical forces), distributing the energy to adjacent molecules and atoms in the material. Once distributed, this energy appears as heat.

Temperature is the average kinetic energy (energy of motion) of the atoms or molecules in a material, so agitating the molecules in this way increases the temperature of the material. Thus, dipole rotation is a mechanism by which energy in the form of electromagnetic radiation can raise the temperature of an object. There are also many other mechanisms by which this conversion occurs.

Dipole rotation is the mechanism normally referred to as dielectric heating, and is most widely observable in the microwave oven where it operates most efficiently on liquid water, and much less so on fats and sugars. This is because fats and sugar molecules are far less polar than water molecules, and thus less affected by the forces generated by the alternating electromagnetic fields. Outside of cooking, the effect can be used generally to heat solids, liquids, or gases, provided they contain some electric dipoles.

Dielectric heating involves the heating of electrically insulating materials by dielectric loss. A changing electric field across the material causes energy to be dissipated as the molecules attempt to line up with the continuously changing electric field. This changing electric field may be caused by an electromagnetic wave propagating in free space (as in a microwave oven), or it may be caused by a rapidly alternating electric field inside a capacitor. In the latter case there is no freely propagating electromagnetic wave, and the changing electric field may be seen as analogous to the electric component of an antenna near field. In this case, although the heating is accomplished by changing the electric field inside the capacitive cavity at radio-frequency (RF) frequencies, no actual radio waves are either generated or absorbed. In this sense, the effect is the direct electrical analog of magnetic induction heating, which is also near-field effect (and also does not involve classical radio waves).

Frequencies in the range of 10–100 MHz are necessary to cause efficient dielectric heating, although higher frequencies work equally well or better, and in some materials (especially liquids) lower frequencies also have significant heating effects, often due to more unusual mechanisms. For example, in conductive liquids such as salt water, "ion-drag" causes heating, as charged ions are "dragged" more slowly back and forth in the liquid under influence of the electric field, striking liquid molecules in the process and transferring kinetic energy to them, which is eventually translated into molecular vibrations and thus into thermal energy.

Dielectric heating at low frequencies, as a near-field effect, requires a distance from electromagnetic radiator to absorber of less than about 1/6th of a wavelength (\(\lambda/2\pi\)) of the source frequency. It is thus a contact process or near-contact process, since it usually sandwiches the material to be heated (usually a non-metal) between metal plates that set up to form what is effectively a very large capacitor, with the material to be heated acting as the dielectric inside the capacitor. However, actual electrical contact is not necessary for heating a dielectric inside a capacitor, as the electric fields that form inside a capacitor subjected to a voltage do not require electrical contact of the capacitor plates with the dielectric (non-conducting) material between the plates. Because lower frequency electrical fields penetrate nonconductive materials far more deeply than do microwaves, heating pockets of water and
organisms deep inside dry materials like wood, it can be used to rapidly heat and prepare many non-electrically conducting food and agricultural items, so long as they fit between the capacitor plates.

At very high frequencies, the wavelength of the electromagnetic field changes begins to be shorter than the distance between the metal walls of the heating cavity, or than the dimensions of the walls themselves. This is the case inside a microwave oven. In such cases, conventional far-field electromagnetic waves form (the cavity no longer acts as a pure capacitor, but rather as an antenna), and are absorbed to cause heating, but the dipole-rotation mechanism of heat deposition remains the same. However, microwaves are not efficient at causing the heating effects of low frequency fields that depend on slower molecular motion, such as those caused by ion-drag.

2.3MICRO-BIAL BACTERIA TEST:

Kirby-Bauer antibiotic testing (KB testing or disk diffusion antibiotic sensitivity testing) is a test which uses antibiotic-impregnated wafers to test whether particular bacteria are susceptible to specific antibiotics. A known quantity of bacteria is grown on agar plates in the presence of thin wafers containing relevant antibiotics. If the bacteria are susceptible to a particular antibiotic, an area of clearing surrounds the wafer where bacteria are not capable of growing (called a zone of inhibition).

The bacteria in question are swabbed uniformly across a culture plate. A filter-paper disk, impregnated with the compound to be tested, is then placed on the surface of the agar. The compound diffuses from the filter paper into the agar. The concentration of the compound will be highest next to the disk, and will decrease as distance from the disk increases. If the compound is effective against bacteria at a certain concentration, no colonies will grow where the concentration in the agar is greater than or equal to the effective concentration. This is the zone of inhibition. This along with the rate of antibiotic diffusion is used to estimate the bacteria's sensitivity to that particular antibiotic. In general, larger zones correlate with smaller minimum inhibitory concentration (MIC) of antibiotic for those bacteria. Inhibition produced by the test is compared with that produced by known concentration of a reference compound. This information can be used to choose appropriate antibiotics to combat a particular infection.

![Figure 1: Microbial count](image)

<table>
<thead>
<tr>
<th>Specification</th>
<th>Bacteria at 1st Stage</th>
<th>Bacteria at 5th Stage</th>
<th>Bacteria at Final Stage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Non Radiated</td>
<td>4890</td>
<td>72</td>
<td>43</td>
</tr>
<tr>
<td>1 Radiated</td>
<td>1781</td>
<td>48</td>
<td>15</td>
</tr>
<tr>
<td>2 Non Radiated</td>
<td>5921</td>
<td>107</td>
<td>49</td>
</tr>
<tr>
<td>2 Radiated</td>
<td>1960</td>
<td>52</td>
<td>20</td>
</tr>
<tr>
<td>X Band Radiation</td>
<td>4172</td>
<td>66</td>
<td>19</td>
</tr>
<tr>
<td>KU Band Radiation</td>
<td>5006</td>
<td>84</td>
<td>32</td>
</tr>
<tr>
<td>Non Radiated Soil</td>
<td>6190</td>
<td>112</td>
<td>48</td>
</tr>
</tbody>
</table>
3. RESULT

Bacteria identifying test by using agar solvent for radiated and non radiated samples which can be radiated by using microwave bench setup with x-band and ku-band frequencies setup can be tabulated as below

4. ACKNOWLEDGEMENT

I wish to express my deep sense of gratitude to Mr.Ch.Phanikumar, M.Tech, Assistant Professor, for his whole hearted cooperation, UN failed inspiration and valuable guidance. Really, I was indebted to him for excellent and enlightened guidance

5. DISCUSSION

In these modern days the EMR is becoming higher and higher and become a major factor of polluting the environment [11, 12]. In this aspect the present work leads to present the effect of Radiation on soil [13, 14, 15]. These soil samples are tested by MICROBIAL TEST [16, 17] to differentiate the radiated and non-radiated soil samples.

6. REFERENCES


