ANALYSIS OF THE INSTRUMENTATION FOR THE EFFECT OF ELECTROMAGNETIC FIELDS ON THE GROWTH OF PLANT PHYSIOLOGY

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ABSTRACT

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A lot of researches have been done by many years to analyze the effect of extremely low frequency (ELF) Electromagnetic fields (EMF) on human being, animals and plants. There are a lot of sources that can create ELF EMF such as power transmission and distribution lines house hold appliances and so on. This paper analyzes the comparison of the instrumentation for the production of Electromagnetic Fields (EMF) of cellular and power frequencies of 50Hz. To see how Electromagnetic Fields (EMFs) affect the plant physiology, the instrumentation is essential for the experiment. The experiment was conducted in the Plant Physiology Labrotary, Department of Bio-Technology and Electronics Laboratory, Department of Electronics and Telecommunication Engineering, University of Development Alternative (UODA) in collaboration with the Department of Computer Science and Engineering, Faculty of Engineering, UODA, Bangladesh during the period of 2008-2009.

Keywords:* *Electromagnetic field, Plant physiology, Power transmission

INTRODUCTION

In today's date we correspond with EMF in our day to day life. The uses of our home appliances, the power distribution lines across our country and even telephone networks generate electromagnetic fields which are difficult for us to avoid. EMF consists of two divisions: Electric fields and Magnetic fields. They both are by the flow of electricity in the form of waves and they both radiate into their surrounding spaces. Both the fields decrease the radiation in a longer range. Each field also has important difference. Electric fields can take place even in an area where there is no flow of electricity. It can be produced at wherever there possibility, while magnetic field take place solely by the production of current flows. There fields easily affect to shielding which also is a significant difference. The effect of electric field is significantly decreased due to the obstacles in their path. However magnetic field is not in their way by any object excluding heavy density of iron. The experiment has been broadcast to the magnetic fields effects but not about electric field. Frequency and wave length are essential to generate electromagnetic spectrum. Ionizing waves usually generated by gamma rays, x-rays, ultra violet radiation which having high frequency EMF. Because of its high energetic nature that are known to break chemical bonds which changes the production of enzymes, after chemical equilibrium and produces thermal effects which can reduce biological changes (Lin, 2002; Netzer, 2000). The range of waves from 400-1900MHz are used in mobile communication which are broken chemical bond and heated tissue by lacking energy. As a result it can not be able to consider it danger until now. The result of investigation which was started 30years ago is the effect and short rate use of X and Gamma rays are the same. Now-a-days it can not be able to find out the direct link between the cellular and transmission medium and the risk of health hazard but it is matter of sorrow that it can be possible to rule out. Some researcher says the cell membrane's permeability can be changed and can also interfere with organic molecule by the EMF's of cell phone. The electrical current on human body is producing EMF. This induced currents waste the activities of brain and heart which is lower than the natural electric current. A lot of researches have focused on human and animal, however the effect of electromagnetic force (EMF) on plants should also be considered for our ecological system.

INSTUMENTATION

The position of the unit can be changed in near and far. The characteristic impedance of the bordering medium is the ratio of electric field and magnetic field is known as impedance. By the source of magnetic or electric field; a field is created but it is not sure whether it is magnetic or electric field. The characteristic impedance of the medium are inter rated by E and H for far medium

$$Z\ w = E/H = 120\text{ð} = 377 \qquad \ldots\ldots (1)$$

$$120\pi(2\pi r/\lambda)\ \Omega < Z_w < 120\pi(2\pi\lambda/r)\ \Omega \qquad \ldots\ldots (2)$$

From the source for frequency of 50Hz the far field is 955km away. The distance at 900MHz field is just 5cm from the point. In the near field, the wave impedance may become any value ranging between:

(i) proceedings XVII IMEKO world congress, June 22-27-03, Dubrovnik, Croatia TC-1

(ii) Proceedings XVII IMEKO world congress, June 22-27-03, Dubrovnik, Croatia TC13

To produce EMF fields for power frequency and mobile phone frequency many kind of equipment are used.

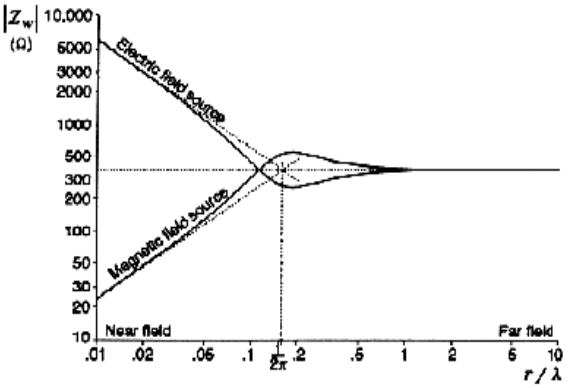

Figure1. Wave impedance versus distance

Helmholtz coil

The strength of recognized and unvarying generation fields is very significant for perfect and quotable susceptible measurements. Helmholtz coil arrangement is produced the power frequency uniform magnetic field and may produce unchangeable magnetic field H to perform experiments over a known strength volume. It lies into parallel orbital coils separated one radius apart and driven is phase. The cancellation deal of the off axis field components is good and which is brought forth by the coil that is why large volume of uniformity is results.

$$H = \left(\frac{8}{\sqrt{125}}\right).\left(\frac{nI}{r}\right) \approx 1.43 \cdot \frac{nI}{r}$$

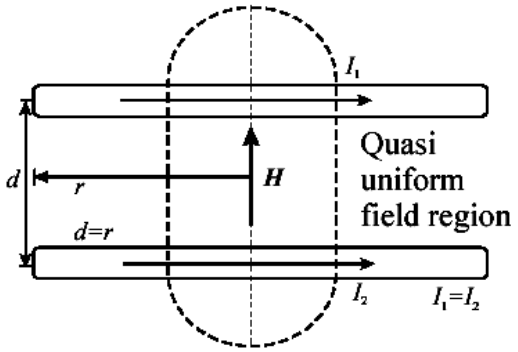

Figure 2. The Helmholtz coil is an arrangement of two parallel coils driven in phase (Koenigstein and Hansen, 1987)

Gigahertz Transversal Electromagnetic Mode (GTEM) Cell

The conduction formation based TEM cell is GTEM-cell. Without any geometrical deformation of the TEM wave a few number of circular wave propagates from the basis and spread cross extinction into a 50Ω rectangular coaxial conduction line. The conversion of characteristic impedance of the wave leads from 50Ω to 377Ω being done through the narrowed part. The accurate circular wave is like as a plane wave because of opening angle of the wave guide is small. Immunity and emission test is done by the TEM mode excited either a constant wave supply or a beat creator simulates an event plane wave.

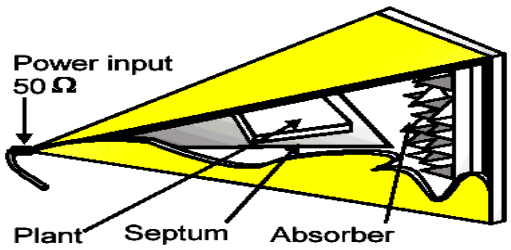

Figure 3. GTEM-cell

TEST ORGANISM

As major primary creator in the living world plants have a vital role today's EM ecological interaction with them would be demonical to examine. As a trial creature for ecological monitoring, the most commonly used sea plant is Duckweed Lemna minor which is minute widely extend out. Investigation on other superior plants like crops and other creature of self-similarities can be helpful for finding effect. Artificial Petri plats are easy to carry and manipulate of Lemna minor plant which were grown up in hygienic medium. Plants were showed in GTEN cell to frequencies of 400, 900 and 1900MHz and with field strength of 10V for 14hours to study result of EMF generated by mobile phone (Lewis, 1995). Magnetic strength with 50Hz of EMF for 24hours in Helmholtz coil were showed by plant for

the result of ELF EMF. Comparative plant number was considered after monitored during two weeks by including the amount of leaps on days 0,3,5,8,10,12,14 (Tkalec, *et a,* 1998).

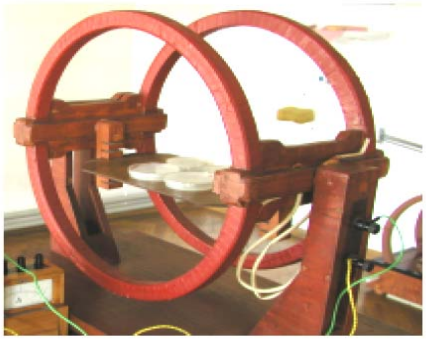

Figure 4. Lemna minor inside Helmholtz coil

RESULTS

The household equipments and mobile Phones which are contain same strengths are chosen for field strengths experiments. For example, at the distance of 2,5cm from the magnetic field, the microwave oven can produce 0,2mT but the other equipments can not produce more than 0,1 mT. Besides 40V/m field is produced by a mobile transmitter with 2 W, 2 cm away from the antenna during conversation. 400, 900 and 1900 MHz frequencies with strength of 10 V/m & 14 hours exposure did not have significant effect on the plant growth. *Lemna minor* represents 100% growth after exposure to the EMF of 400, 900 and 1900 MHz with strength of 10 V/m for 14 hours. At the beginning, growth was stimulated after exposure to 1900 and 900 MHz but at the second week of experiment 1900 MHz slightly reduced it.

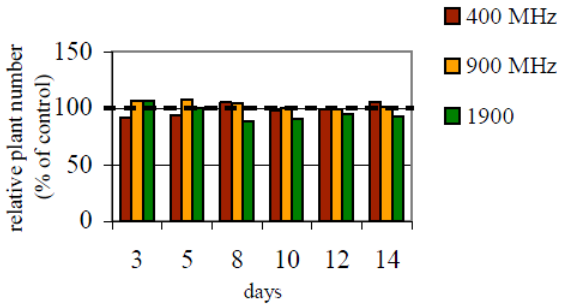

Figure 6. The growth of Lemna minor after exposure to the magnetic field of 50Hz with strength of 1 mT. Control is represented as 100% (dashed line)

The growth is reduce at the beginning when exposure to frequency of 400 Hz. Magnetic field of 50 Hz was exposed by The growth of plant for 24 hours but it was slightly stimulated in comparison with the control & it was not significant. When exposed to the magnetic field of 50 Hz with strength of 1 m then the growth of Lemna minor is shown. The representing control is 100%.

CONCLUSION

Helmholtz coils and GTEM-cell have been designed at FER, Zagreb, and could be used for biological exposures. Plant Lemna minor was exposed to the electric field of frequencies 400, 900 and 1900 MHz with strength of 10 V/m and to the magnetic field of 50 Hz, strength 1 mT. There was no significant effect on growth of Lemna minor, which is in accordance with other investigations in that field. The future research will be focused on joint effects of EMF and other environmental factors.

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