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# Effect of Cellular Phone Tower Radiations in the Physiology of Soil Microbes – *Lactobacillus sp.*

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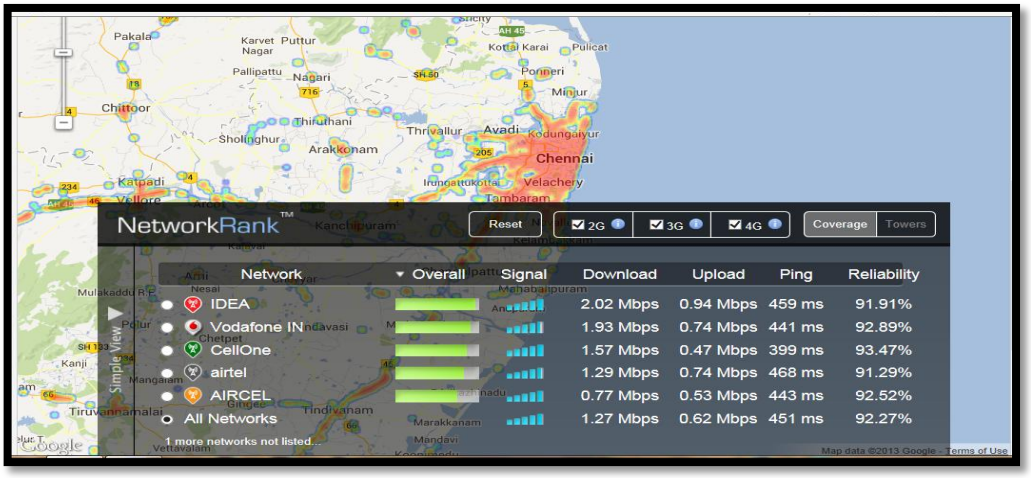
**Abstract:** With the increased usage of cellular phones, the environment is greatly exposed to radiations of radiofrequency spectrum. This study mainly focuses on the effect of radiations associated with cellular phone towers on the soil microbe- lactobacillus *sp.* The study involves isolation, characterization and qualitative determination of the species collected from the soil, between two regions. Protein estimation and protease assay were performed on the species which confirms negative impact of cellular phone tower radiations on soil microbe-lactobacillus sp.
**Keywords** : radiation, lactobacillus sp, soil quality, plant growth.

## Introduction

The electromagnetic spectrum is broadly divided into several zones amongst which, the radiofrequency radiation lies between the ELF and IR. The cellular phones utilize the spectrum existing slightly above that of ultrahigh frequency of radiofrequency spectrum. This region is characterized by several hundred hertz, which is not permissible for a healthy biotic system[1,2]. Gross coverage map of Chennai indicating the various zones of radiation exposure is discussed in (Figure- 1).

**Figure 1: Gross coverage map of Chennai indicating the various zones of radiation exposure**



Several works were effectively undertaken to study the effects of such radiations at the ecosystem level[3,4]. But there is lack of impetus in considering the microbial flora for study.

In this investigation, a serious analysis is made to study the effect of radiation on the microbial flora. The microbial flora analysed, stands out as a pioneer in understanding the negative impacts which are implicated by the radiation[5,6].

The soil samples were analysed with respect to parameters such as temperature, pH and other etiological factors such as weather conditions. The samples differed only in the extent to which they were exposed to cellular phone tower radiation. The isolation of microbes by serial dilution and characterization tests performed between the soil samples indicated that the organism was *lactobacillus sp.*

Lactobacillus is considered as a probiotic in soil environment[7]. It degrades the harmful substances that build up in the rhizosphere. Apart from disease suppression and decomposition of microbes in soil, it helps in humus formation and growth regulation of microbes[8,9]. The study of lactobacillus *sp* at the qualitative levels helps to provide an overview of the effects of radiation which might reflect in soil quality and plant growth.

The conventional protein estimation by lowry's method[10] and the protease assay serves as an efficient method to study the quality of microbes isolated from two regions. Using this technique, it is possible to quantify the amount of protein and protease enzyme activity. The results show that there is a fall in the quality of microbes isolated from the soil exposed to high radiation level when compared to low radiation level samples. This might affect the plant growth and crop patterns.

## Materials and Methods

The soil samples from which the microbes are to be studied were obtained from the agricultural lands of Kundrathur and Thandalam near Chennai , Tamilnadu, India.

The soil considered is of similar morphological density and the factors such as pH, nutrient levels of the soil collected were similar. The upper stratum of the alluvial land were chosen for the study and the agricultural lands of both the region supported paddy varieties. These parameters ensure that the only difference between the soil samples was the level to which they were exposed to cellular phone tower radiations.

The crops of the two regions were ploughed off to collect the alluvial soil occupying the rhizosphere region. This ensured that the soil collected was rich in microbial flora.

The isolation, characterization and the qualitative tests for the soil were performed. The soil samples were subjected to serial dilution method. The plating of $10^{-7}$ dilution on agar plate resulted in discrete white colonies.

The characterization tests involved gram staining, motility test, oxidase test, catalase test, urease test and citrate utilization test. Apart from these tests, the IMViC tests were also performed to determine the organism. The organism identified was lactobacillus sp.

The qualitative tests were performed on both the samples of lactobacillus sp which includes the protein estimation and protease assay. The protein estimation was done, following the protocol established by lowry

The protease assay performed revealed the protease enzyme activity of the organism between the regions. The results were expressed in terms of units per ml.

Graphical plotting and estimation of protein and protease activity were performed on graph 4.4.2 windows version.

## Results And Discussions

The cellular phone associated tower radiation is one of the primary factors, influencing the way in which microbes interact with the ecosystem[11]. So the work focuses only on various procedures which help to understand the ways in which the physiology of soil microbes is understood using lactobacillus sp as a model.

The initial methodologies involve, monitoring the weather condition of the two regions, Kundrathur and Thandalam along with a detailed analysis of all the possible cellular phone radiation associated towers.This work helps to optimize the conditions to which the region is exposed along with the quantification of radiation levels.

The rainy season enabled the collection of agricultural soil rhizoshphere which proves to be a source of rich microbial flora .The rhizosphere is always considered as the region of soil in which efficient interaction between soil microbial flora and agricultural crops are observed[12]. This therefore helps in understanding the ways in which the tower radiations affect the crop pattern and soil quality.

The gross coverage map of Kundrathur and Thandalam are provided along with the region from which the soil collection was performed and the gross coverage is discussed in (Figure- 2 & 3).

**Figure 2: Representation of Kundrathur agricultural region where soil sample was collected**

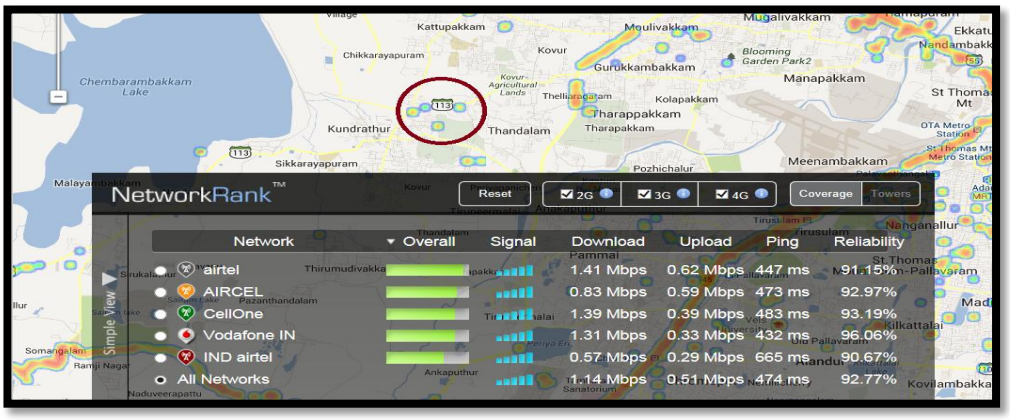
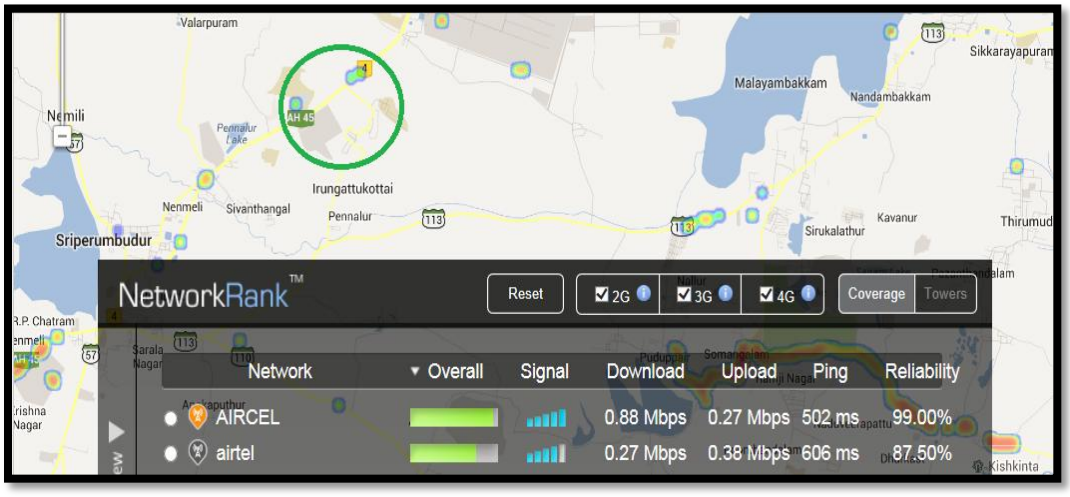



**Figure 3: Representation of Thandalam agricultural region where soil sample was collected**




Before the isolation of microbes from the two soil samples, pH of the soil, texture and other morphological analysis were performed to derive at the hypothesis that, both samples differed in the exposure of the cellular phone associated radiations. The acidic pH levels of 4-5 were observed and the soil on drying was coarser and moist. Care was taken to consider only the alluvial soil for study.

The isolation of microbes from the samples were performed by serial dilution and the plating at $10^{-7}$ dilutions were considered for further culturing and results are depicted in the (Figure- 4 & 5).

The culture were subjected to series of characterization tests and the results are tabulated in the table. The results were interpreted with the bergey's manual to confirm that the microbial flora was lactobacillus sp[13]

From the results of the quantitative tests, we can hypothesize the effect of cellular tower radiations on economically important Lactobacillus sp., in (Figure- 6)

**Figure 4: Serial dilution results ($10^{-7}$) of Kundrathur soil sample**


**Figure 5: Serial dilution results ($10^{-7}$) of Thandalam soil sample**

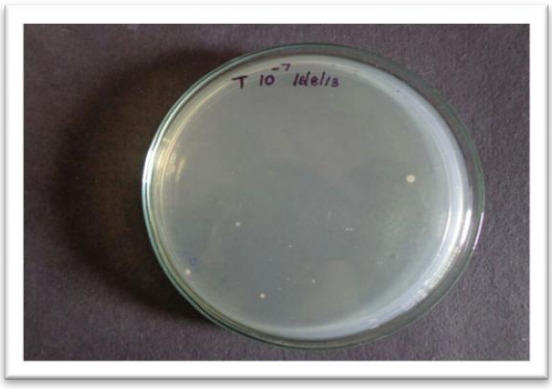
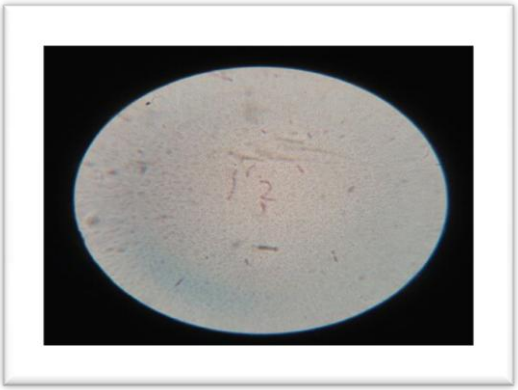



**Figure 6: Gram staining -- Lactobacillus sp**



The protein estimation is performed to determine the protein content of the organism obtained from the samples. A difference in the protein level generates sufficient data to conclude on the effects which the radiations have on the organism physiologically.The protease assay is performed to estimate the profitability which an organism can generate. As the lactobacillus sp is involved in several homo fermentation and hetero fermentation processes, it generates lactic acid as an important component[14]. The graphical plots for the protein estimation and protein assay are represented in (Figure- 7 & 8) and was interpreted that the Line of best fit is obtained to determine the protein content and protease assay of both the sample. The Characterization test for the sample with the sample were obtained (Table- 1).The table plotted gives a final overview of the quantitative tests performed.

**Table.1 : Characterization test for the sample with the sample were obtained at poonga biotech, Chennai, India**

| **Tests Performed** | **Results Obtained** |
|---|---|
| Colony feature | White |
| Gram Staining | + |
| Motility | -- |
| Oxidase Test | + |
| Catalase Test | + |
| Urease Test | -- |
| Citrate Utilization Test | -- |

**Figure 7: The graphical plot to estimate the protein content in the two samples by Lowry's Method**

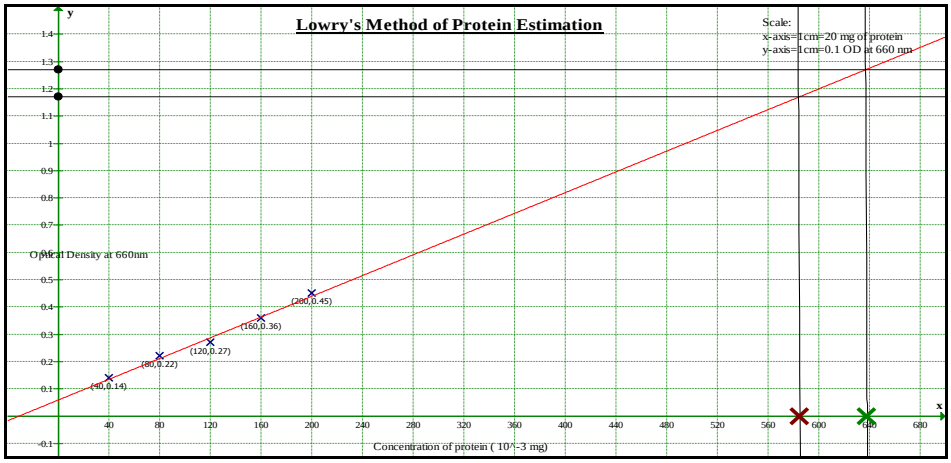



**Figure 8: The graphical plot to determine the amount of tyrosine liberated by the two samples using Protease assay method.**

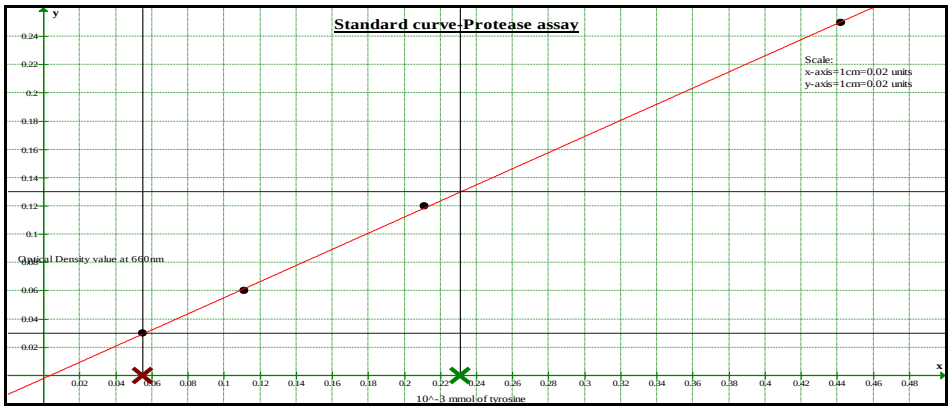



**Figure 9: Representation of the protein levels of organisms exposed to cellular phone radiations**

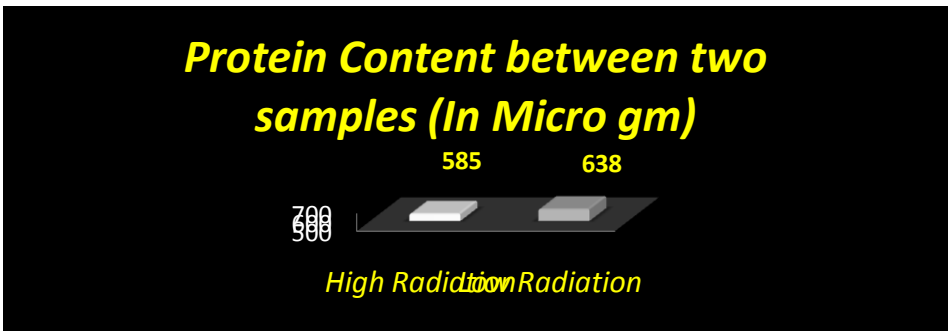
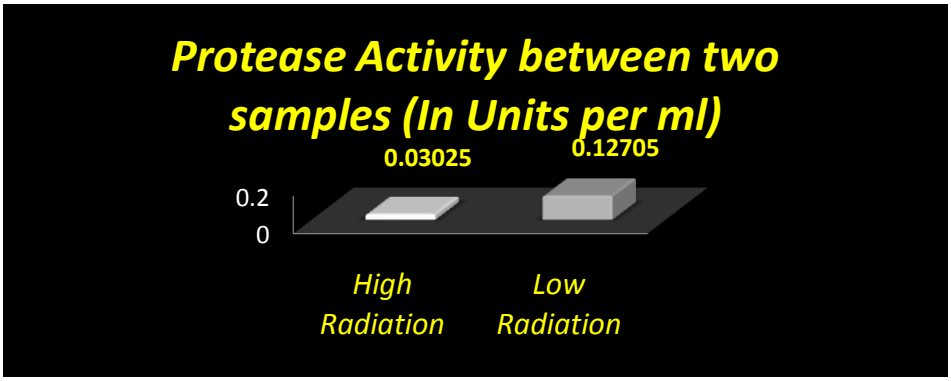



**Figure 10: Representation of the protease activity observed between the two samples**



Representation of the protease activity was discussed and represented in (Figure- 9 & 10). Our result show cast the distinct variation in the samples of high and low radiations .The quantitative drop in the high radiation level could lead to progressive loss of organism's essential functions and produces lactic acid leading to waste accumulation[15,16]. This indicates the loss of quality and quantitative loss of rhizosphere The significance of the work is that lactobacillus sp being a probiotic in the rhizosphere. As a result, the interaction of these species with plants has a negative influence of its protein level falls[17]. This shows a clear indication of cellular phone radiation interacting negatively with lithosphere flora.

Result of cellular phone radiation, the quality of organism has drastically reduced which indirectly affects the industrial sector. The possible solution is to handle the soil microbes same as that of mammalian cells viewed with respect to genomics treatment of microbes[18] .The regions of genomics such as the genes and corresponding markers all studied and response mechanisms are triggered the organisms basal vitality is improve on the quality.

## Conclusion

In conclusion, we successively demonstrated the areas of high cellular radiations that exerts direct effect on the productivity of crops. Thus, we hypothesize that further work, to acquire adequate knowledge on the types of microorganisms and study extensively the interaction of soil microbes and cellular phone tower radiation so as to find out a better novel approach towards the enhanced crop productivity and rectify the losses in microflora.

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