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BRIEF REPORT

The impact of electromagnetic fields on the growth of *Bacillus subtilis*

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The change in the number of microorganisms during cultivation on nutrient media prepared using water, which is influenced by an electromagnetic field of low power, is shown. Field-exposed water was used to prepare liquid and solid culture media for the cultivation of *Bacillus subtilis* bacteria. Field water treatment was carried out at several frequencies in the range of 30-230 MHz. In all cases, when using water exposed to field exposure, significant suppression of the vital activity of bacteria is observed. The discovered effect is explained based on the idea of a change in the hydration size of ions due to field exposure and their activity in membrane processes.

Keywords: Field effects, Electromagnetic field, Indirect biological effect of the HF field.

Introduction

The study of how various external factors influence the growth and behavior of microorganisms has been a subject of scientific exploration for decades. One such factor that has gained significant attention is electromagnetic fields (EMFs), which are generated by electrically charged particles and play a vital role in our modern technological landscape. This article delves into the effects of electromagnetic fields on the growth of Bacillus subtilis, a widely studied and versatile bacterium. The structured state of the water environment plays a crucial role in orchestrating vital processes that safeguard the body. Viewing the water environment as an information-rich phase unveils its potential to tactfully address the body's safety concerns amidst adversities and emergencies. This perspective transforms the challenge of protecting the body into a constructive avenue for natural management, enabling the body to effectively counteract detrimental factors. The unique matrix arrangement of water's structural components within each organism serves as the fundamental informational foundation upon which all life processes intricately unfold (Hecker, M., et al., 1998).

Bacillus subtilis is a gram-positive bacterium commonly found in soil and the gastrointestinal tracts of humans and animals. Its ability to adapt to a variety of environments and its well-characterized genetics have made it an ideal model organism for studying bacterial physiology and genetics. Its versatility has led scientists to explore how external factors, such as electromagnetic fields, can impact its growth and behavior (Hashem, A., et al., 2019).

Description

Electromagnetic fields encompass a broad spectrum of frequencies, ranging from Extremely Low-Frequency fields (ELF) to Radio Frequency (RF) and microwave fields. These fields are generated by various sources, including power lines, electronic devices, and wireless communication technologies. The potential effects of EMFs on living organisms have been a topic of debate and investigation for years, with conflicting research findings complicating our understanding (Aguilar, C., et al., 2007).

Impact of EMFs on *Bacillus subtilis* growth

Research into the effects of EMFs on *Bacillus subtilis* growth has yielded intriguing yet complex results. Some studies suggest that certain EMF exposure can affect bacterial growth rates, cell morphology, and even genetic expression. Here are a few key findings:

Altered growth rates: Several studies have reported changes in *Bacillus subtilis* growth rates under the influence of electromagnetic fields. While some experiments have demonstrated inhibitory effects, others have shown stimulation of growth. The variability in results can be attributed to differences in the type of EMF, exposure duration, and experimental conditions.

Cellular morphology: Exposure to specific EMFs has been linked to alterations in the cellular morphology of Bacillus subtilis. Researchers have observed changes in cell size, shape, and arrangement, indicating that EMFs might interfere with bacterial membrane integrity and cellular processes.

Genetic expression: EMF exposure has been shown to impact the genetic expression of Bacillus subtilis. Certain studies have identified changes in gene expression related to stress response, metabolism, and cell division, suggesting that EMFs could influence the bacterium's regulatory pathways (Morikawa, M., 2006).

Mechanisms of action

The mechanisms underlying the effects of EMFs on *Bacillus subtilis* growth are not yet fully understood, and multiple hypotheses have been proposed:

Membrane permeability: EMFs could influence bacterial cell membranes' permeability, affecting nutrient uptake, waste elimination, and overall cellular homeostasis.

Reactive Oxygen Species (ROS) generation: Exposure to EMFs might trigger the production of ROS within bacterial cells, leading to oxidative stress and potential damage to cellular components.

Ion transport: EMFs could modulate ion channels and transporters in bacterial membranes, affecting essential processes such as energy production and nutrient transport (Jeong, J.S., Kim, I.H., 2014).

The nutrient media utilized in the experiment underwent sterilization through autoclaving at a temperature of 115°C. One might expect that the elevated temperature would nullify the effects of the field exposure. Furthermore, the inclusion of diverse components in both the broth and agar should contribute to this nullification. Surprisingly, this anticipated outcome did not materialize. As a result, the transformations observed in the attributes of the cultivation media appear to originate from more profound underlying factors. An explanation for this phenomenon can be postulated as follows: The modulation or alteration of the growth patterns in living organisms, specifically bacteria, is attributed to shifts in the velocity of essential element transportation within them, either across the membrane or the spore wall. This observation substantiates the capability of the RF field to induce alterations in the structural arrangement of water, along with its hydrating propensity. With substantial evidence supporting the existence of water molecules exhibiting varying degrees of association in the liquid state, including individual molecules, it is plausible to propose that the equilibrium between monomolecular water and structured water is perturbed due to the influence of the RF electromagnetic field. This disruption consequently leads to a modification in the average water capacity for hydration processes, resulting in an adjustment of ion hydration radii. Consequently, the diffusion rate of ions through the channels in the membrane is impacted, which may contribute to the observed inhibition of the biological processes documented within the experiment (Yu, X., et al., 2011).

Conclusion

The interaction between electromagnetic fields and Bacillus subtilis growth is a complex and intriguing area of research. While some studies suggest that EMFs can influence bacterial growth rates, cell morphology, and genetic expression, the mechanisms behind these effects remain unclear. As technology continues to advance and our reliance on electronic devices and wireless communication grows, understanding the potential impacts of EMFs on microorganisms becomes increasingly important.

Further research is needed to elucidate the precise mechanisms by which EMFs influence Bacillus subtilis and other microorganisms. This knowledge could have implications beyond microbiology, potentially contributing to our understanding of how electromagnetic fields affect broader biological systems. As scientists continue to explore this topic, we may gain valuable insights into the intricate interplay between external factors and microbial growth, shedding light on the broader impacts of electromagnetic fields on living organisms.

References

Hecker, M., Völker, U. (1998). Non- specific, general and multiple stress resistance of growth- restricted *Bacillus subtilis* cells by the expression of the σB regulon. Molecular Microbiology, 29:1129-1136.

Hashem, A., Tabassum, B., Abd_Allah, E.F. (2019). *Bacillus subtilis*: A plant-growth promoting rhizobacterium that also impacts biotic stress. Saudi Journal of Biological Sciences, 26:1291-1297.

Aguilar, C., Vlamakis, H., Losick, R., Kolter, R. (2007). Thinking about *Bacillus subtilis* as a multicellular organism. Current Opinion in Microbiology, 10:638-643.

Morikawa, M. (2006). Beneficial biofilm formation by industrial bacteria *Bacillus subtilis* and related species. Journal of Bioscience and Bioengineering, 101:1-8.

Jeong, J.S., Kim, I.H. (2014). Effect of *Bacillus subtilis* C-3102 spores as a probiotic feed supplement on growth performance, noxious gas emission, and intestinal microflora in broilers. Poultry Science, 93:3097-3103.

Yu, X., Ai, C., Xin, L., Zhou, G. (2011). The siderophore-producing bacterium, *Bacillus subtilis* CAS15, has a biocontrol effect on *Fusarium wilt* and promotes the growth of pepper. European Journal of Soil Biology, 47:138-145.

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