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Research Article

Evaluation of Bacteriological-Therapeutic Effectiveness of Scalar Magnetic Fields in Electromagnetic High-Frequency Oscillations of Toroidal Applicators.

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Abstract

Scalar magnetic fields, a concept derived from the scalar potential in electromagnetism, have garnered significant interest due to their unique properties and potential applications. These fields are particularly relevant in the context of high-frequency oscillations of toroidal coils, where they can be utilized for various technological and therapeutic purposes. The research includes the mathematical description of the trajectories of force lines, determination of absolute values, and safe power levels of such fields for a physiotherapeutic applicator, which is one of the main tasks that served to obtain numerical research results.

ISSUES IN MEASURING SCALAR MAGNETIC FIELDS

Scalar magnetic fields are generated in specific configurations of electromagnetic fields, especially in high-frequency oscillations of toroidal coils. These fields are characterized by their ability to create a uniform magnetic environment without the unidirectional properties typically associated with vector magnetic fields. Measuring scalar magnetic fields involves the use of advanced techniques, such as magnetometers and specialized sensors, which can detect subtle variations in the magnetic scalar potential.

BENEFICIAL PROPERTIES OF SCALAR MAGNETIC FIELDS

Uniform Heating: Scalar magnetic fields can be used for uniform heating. Unlike traditional magnetic fields, which can create hot spots, scalar fields distribute energy more evenly, making them ideal for processes that require consistent thermal management.

Application in Physiotherapy: In physiotherapy, scalar magnetic fields can be used to enhance treatment effectiveness. Their uniform nature ensures an even distribution of therapeutic energy across the treatment area, potentially improving outcomes in pain management and tissue regeneration.

Delicate Technological Impacts: Scalar magnetic fields are suitable for delicate technological processes, such as precise manipulation of materials and substances. Their ability to create a controlled and uniform magnetic environment makes them valuable in applications like semiconductor manufacturing and materials science.

ACTIVATION OF BIOCHEMICAL PROCESSES

Scalar magnetic fields have shown promise in activating biochemical processes and enhancing the functionality of bacterial environments. The uniform and non-invasive nature of these fields can stimulate cellular activity and promote the growth and efficiency of beneficial bacteria. Research has shown that scalar magnetic fields can influence the behavior of bacterial cultures, potentially accelerating bioremediation processes and improving the effectiveness of probiotic treatments.

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Stimulation of Cellular Activity

Scalar magnetic fields can enhance cellular activity, including fibroblasts, which are crucial for wound healing and tissue repair. This stimulation can lead to faster recovery and improved therapeutic outcomes.

Enhancement of Probiotic Efficiency

In bacterial environments, scalar magnetic fields can improve the penetration and activity of probiotics, such as Lactobacillus paracasei. This enhancement can lead to more effective treatment of gastrointestinal disorders and other diseases.

Reduction of Inflammation

Scalar magnetic fields can modulate inflammatory responses by affecting signaling molecules such as cytokines. This modulation can reduce inflammation and promote healing in various medical conditions.

MATHEMATICAL DESCRIPTION OF FORCE LINE TRAJECTORIES. RESEARCH METHODOLOGY

One of the research tasks is the mathematical description of the trajectories of force lines of scalar magnetic fields. For this purpose, Maxwell's equations are used, particularly the equation for the scalar potential.

Research on Scalar Magnetic Fields Research on scalar magnetic fields began with the work of Nikola Tesla, who studied them in the context of his experiments with high-frequency electromagnetic fields. Tesla discovered that such fields could create unique effects, including uniform heating and influence on biological systems. Other scientists, such as Thomas Bearden and Konstantin Meyl, have also investigated scalar magnetic fields and their potential applications in various fields.

To evaluate the scalar alternating magnetic field acting along the axis of the torus, if this torus is a toroidal radiation coil, an empirical equation was developed, which was based on Ampere's formula for the force of interaction between straight parallel wire segments.

RESEARCH RESULTS

As an example, we will take the approximate geometric parameters of a toroidal emitter of a physiotherapeutic device, perform substitutions, and obtain numerical results. For a toroidal coil with a torus diameter of 8 cm, a winding diameter of 8 mm, and a wire diameter of 1 mm, the calculation of the magnetic field strength will be as follows:

- Radius of the torus (R) = 8 cm / 2 = 4 cm = 0.04 m
- Radius of the winding (r) = 8 mm / 2 = 4 mm = 0.004 m
- Diameter of the wire (d_wire) = 1 mm = 0.001 m
- Current (I) = 1.0 A

Calculation in Mathcad

mu_0 := 4 * π * 10^-7 // Magnetic constant (H/m)
R := 0.04 // Radius of the toroid (m)
r := 0.004 // Radius of the winding (m)
d_wire := 0.001 // Diameter of the wire (m) I := 1.0 // Current (A)
N := floor(2 * π * R / d_wire)
B_scalar := (mu_0 * I * N) / (2 * π * r)
B_scalar // Magnetic field strength at the central axis of the toroid (T)

RESULT OF CALCULATING THE TRANSVERSE SCALAR MAGNETIC FIELD IN MATLAB

The magnetic field strength (B_scalar) on the central axis of the torus: B_scalar = 0.01255 T

We calculate the specific power of the axial radiation of the toroidal coil, assuming a current of 1 ampere:

RESULT OF CALCULATING THE SPECIFIC POWER OF THE SCALAR MAGNETIC FIELD OVER THE AREA

The specific power of axial radiation per square centimeter: 1.2467 W/cm^2.

We synthesize the function of the axial magnetic field intensity of the vortex-scalar components from the toroidal coil using Maxwell's equations for the scalar potential. From geometric considerations, we obtain the resulting function for calculating the axial magnetic field intensity:

H(z)=μ0•N•I•R22•(R2+z2)3/2H(z)=2•(R2+z2)3/2μ0•N•I•R2

where:

- μ0 - magnetic constant (4π×10−7 H/m4π×10−7H/m),
- N - number of turns,
- I - current through the coil,
- RR - radius of the torus,
- z - distance from the center along the axis.

We recalculate the specific powers of the magnetic field for an average current of 0.1 A in the wire. We obtain the following arithmetic estimates:

Axial magnetic field intensity (z = 0.05 m, 0.10 m, 0.15 m):

- H≈9.61×10−5 A/mH≈9.61×10−5A/m
- H≈2.02×10−5 A/mH≈2.02×10−5A/m
- H≈6.74×10−6 A/mH≈6.74×10−6A/m

Specific power respectively

- P≈3.68×10 W/cm2P≈3.68×10W/cm2
- P≈1.62 W/cm2P≈1.62W/cm2
- P≈3.68×10−1 W/cm2P≈3.68×10−1W/cm2

The obtained numerical results of the magnetic field intensity and specific power over the area correlate well with the

permissible power levels for irradiating the human body, as indicated in the standards and operating rules of the relevant equipment. Based on the developed analytics, it is possible to preliminarily assess the impact of the scalar magnetic field on the clients' bodies under certain specified output parameters of such a toroidal irradiator-applicator.

CONCLUSIONS

Scalar magnetic fields generated by high-frequency oscillations of toroidal coils demonstrate significant potential for applications in uniform heating, physiotherapy, and delicate technological processes. Their ability to activate biochemical processes and improve the functionality of bacterial environments underscores their importance in medical and industrial fields. The mathematical description of the trajectories of force lines of scalar magnetic fields is a key research task and an important result that allows for a deeper understanding and more effective use of these fields. The evaluation of the power of a physiotherapeutic applicator with toroidal geometry showed compliance with safe and effective activation levels in a biological environment. Further research and development in this area may lead to significant advancements in both therapeutic and technological applications.

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