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Analysis of Coil Type in Pulsed Electromagnetic Field Therapy System

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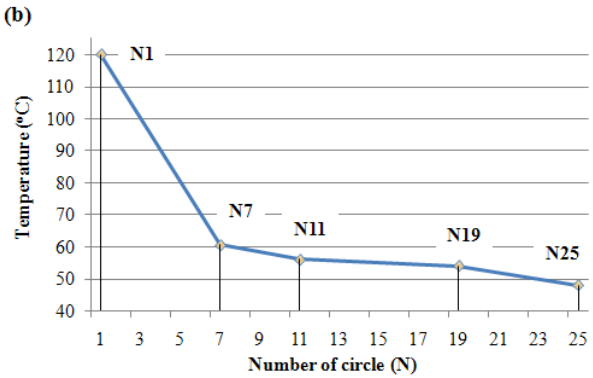
Pulsed electromagnetic fields (PEMF) have been used in the treatment of non-union and related problems in bone healing and pain relief, due to osteoarthritis and traumatic joint damage, since the 1970s with relatively consistent success rate of 70-80% in several countries. Since most of these claims were based on anecdotal observations, and different PEMF devices had varied characteristics, an effort was made to determine whether a pulsed electromagnetic field with specific parameters might provide superior and more consistent results. It is based on the application of a very specific type and form of signal that is carried on a pulsed electromagnetic field to the affected joint, or area to be treated. The device consists of a magnetic field generator, or control box, connected to a ring-shaped coil, or other applicator, by means of an electronic interface, that emits a proprietary signal via a pulsed electromagnetic field. Different coil sizes have been designed to treat peripheral joints (knees, shoulders and wrists), the spine (cervical, thoracic and lumbar vertebral bodies), tinnitus and dental disorders, and for veterinary applications.

In this study, the thermal stability and field simulation of magnetic field for a various coil types in Pulsed Electromagnetic Field Therapy System were investigated. The temperature dependence of coil type on number of turn and coil size were measured, as shown in figure 1. As reducing the cross section size of coil, the temperature of the coil was decreased below 50 ^{o}C. The magnetic field simulation for the coil types of solenoid, spinal, and bi-cycle shape were calculated. The biological testing for Pulsed Electromagnetic Field Therapy System measured as the field strength of magnetic field increases were measured.



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DU01

Magnetorheological Characteristics of Polymer Coated Magnetite Particle Composites with Carbon Nanotube Nanohybrid

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Magnetorheological (MR) fluids are considered to be smart materials which have controllable properties by external magnetic field strength. Recently, MR fluids are vigorously investigated in many research areas due to their potential engineering applications such as automobile industry, military equipment, construction industry, and so on. Some of MR application devices are already commercialized in various fields.

We mainly focus on preparing the polymer coated nano-sized magnetite (Fe_3O_4) particles with multiwalled carbon nanotube (MWNT) nanohybrid. The polymer coated magnetic particles with MWNT nanohybrid is made by a two-step procedure. At first, the magnetic particles were synthesized by a co-precipitation method in aqueous (distilled water) Fe^{3+} ($FeCl_3 \cdot 6H_2O$, 98%) /Fe^{2+} ($FeSo_4 \cdot H_2O$, 99%) solution with ammonium hydroxide and oleic acid [1]. After that, the obtained samples were coated with polyacrylamide (PAAm) in SPAN85 added cyclohexane mixture [2]. Secondly, polyacrylamide coated magnetite particles (Mag-PAAm) were physically adsorbed onto multiwalled carbon nanotubes surface under ultrasonication [3]. Based on the visible transmission electron microscopy (TEM) images, we confirmed that prepared polyacrylamide coated magnetite particles (Mag-PAAM) were well adsorbed onto MWNT's surface. In addition, MR characteristics of PAAm coated magnetite particles with MWNT (Mag-PAAm-MW) nanohybrids were investigated under different external magnetic field strengths via a rotational rheometer, exhibiting typical MR behavior of yield stress and shear stress.

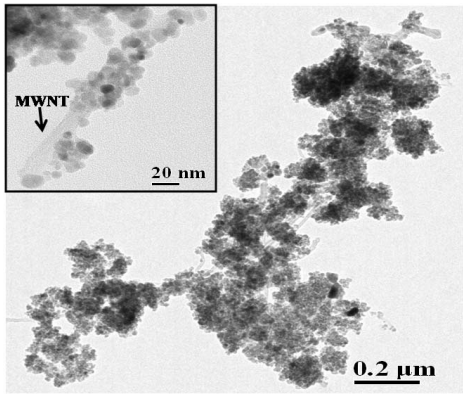

Fig. 1. TEM image of polyacrylamide (PAAm) coated magnetite (Fe_3O_4) with MWNT nanohybrid.

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