Chapter-6

Conclusions and Future Scope of Work

6.1 Conclusion

This thesis aims to design, develop and fabricate a monoaxial Helmholtz coil system for Biomedical applications. Moreover, the goal is to explore the therapeutic application of low-frequency low-intensity magnetic field exposure to develop an alternative treatment methodology for cancer treatment. To this end, a custom-made PEMF chamber has been designed and developed to perform *in vivo* and *in vitro* studies.

Therefore, to accomplish the goals mentioned above, the present thesis demonstrates the design, development, and fabrication of a monoaxial Helmholtz coil system employing simulation software, viz., ANSYS 18.0. The fabricated custom-made PEMF chamber is found applicable for low-intensity, low-frequency alternating magnetic field exposure for bioelectromagnetic studies. The application of the PEMF chamber is exhibited by conducting exposure studies on animals (Wistar rats) and different cell lines (C6, RFP-L929) to observe the effects on behavioral parameters (spontaneous alternation, anxiety, motor coordination), biochemical parameters (AST, ALT, Ck-MB and serum creatinine) and histological examination (brain, liver, heart, kidney) under *in vivo* and *in vitro* conditions respectively.

The thesis also focuses on studying the effects of ELF-PEMF exposure on lung adenocarcinoma (A549), breast cancer (MCF7), and hepatocellular carcinoma (HepG2) cells. We observed that ELF-PEMF exposure caused a significant decrease in the level of proliferation for A549 cells under the present experimental conditions. This study also demonstrates that ELF-PEMF exposure may have preferential cytotoxicity for A549 cells (but not for MCF7 and HepG2 cells). The effects of ELF-PEMF exposure on the level of cell proliferation are assessed by bright-field imaging, fluorescent microscopy, and MTT assay.

6.2 Scope for future work

The future perspectives of the current research work may involve exploring the effects of magnetic field exposure in combination with chemotherapy drugs on different cancer cells to develop an alternative therapeutic methodology for cancer treatment (Alkis et al., 2022; Chen et al., 2022; Nuccitelli et al., 2010). The fabricated device may also assist in assessing the treatment of neuroinflammation and cognitive impairment (Fu et al., 2008; Serafini et al., 2015; Téglás et al., 2018). Moreover, this device is capable of facilitating magnetic field exposure experiments on wound healing, cellular dynamics, application with magnetic nanoparticles, growth factors, etc., synapse-related studies, and cell-cell interaction, of naming a few (Ganguly et al., 2022; Goya et al., 2013; Ju et al., 2016; Nuccitelli et al., 2010). The magnetic field application as a therapeutic strategy has significant potential to be considered a breakthrough technological advancement in bioelectromagnetic.

6.3 References:

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