Simulation of Triple Helmholtz Coils for Wireless Power Transfer in Photocatalytic Wastewater Photoreforming

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Abstract:
The recently proposed assimilation of wireless power transfer in photocatalytic wastewater reforming is worth exploring. Unfortunately, ongoing research effort are both scarce and inadequate particularly in the aspect of numerical analysis. In this study, 2-dimensional numerical solution to the flux density distribution inside the triple Helmholtz coil pairs is sought using the finite element method. Homogenous multi-turn circular coil geometry is used to model the Helmholtz pairs wound around the cylindrical reactor wall of different heights. Based on simple statistical approach, an optimized coil diameter for each cylinder height is then presented and is found to be linearly related. Moderate parasitic capacitance effect at 150 kHz is observed and increases exponentially with increasing excitation frequency. The observed "pairing " of inductance value between L1:L6, L2:L5, and L3:L4 is the effect of mutual inductance between coils and varies with the distance of separation. AC resistance increases exponentially once excitation frequency reaches 700 KHz. An optimized coil geometry will ensure uniform and optimal flux distribution inside the photocatalytic reactor so that maximum power transfer to the receiving entity inside the reactor can be realized.1.50 to 3 h, CFU/mL was increased again. This result indicates that increasing microbial inhibition time had a positive influence on CFU/mL reading. It means that 1.50 h was adequate for microbial growth inhibition process. This study demonstrates that pineapple leaves could be exploited as valuable sources of natural products that could be used as microbial growth inhibitor and thus become one of the cheap and green alternatives for more expensive chemical pesticides.

Keywords: Finite Element Method; Helmholtz; Photocatalytic; Photoreforming; AC Resistance; Mutual Inductance; Modelling, Flux Density

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