International Congress on Engineering Science and Sustainable Urban Development
Denmark – Copenhagen
September, 2018

Dosage Effect of the Magnetic Nano Particles on Temperature Distribution in Hyperthermia Cancer Treatment

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The interest in exploring more effective methods for cancer treatment has increased widely in recent years. In clinical studies it is difficult to determine the temperature distribution in both normal tissue and in tumor during hyperthermia treatment since temperature can be measured in limited number of positions in tissue or tumor. Simulation studies can play crucial role in physician's perception of the temperature distribution in tissue. Hyperthermia treatment is facing some unsolved problems such as the appropriate dosage of magnetic nano particles required to achieve the optimum temperature which results in apoptosis in tumor cells. In this study, A 2D computational model is created in COMSOL Multiphysics in order to analyze temperature distribution in both normal tissue and tumor during hyperthermia treatment using various dosages of magnetic nano particles. Temperature distribution is achieved by considering various layers from wave source through to the tumor and also by taking into account the amount of heat generated through the Brownian rotation and the Neel relaxation. Simulations of a spherical tumor located in ellipse tissue were designed. A systematical variation in dosage has been performed. Temperature distribution and maximum temperature in steady state and effect of the dosage of nano particles.

Keywords: Hyperthermia, cancer treatment, COMSOL, Magnetic Nano Particles, Tumor, Bioheat

1. Introduction

1.1. Cancer

Despite all researches and efforts to treat cancer, it is one of the major causes of mortality worldwide. Several conventional methods as chemotherapy and radiation have been used to treat cancer. Even with technical progresses, these methods are still limited and the need for new and more effective methods still remain[1].