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SIMULATION STUDY OF AN EBG-M APPLICATOR TOWARDS NON-INVASIVE BREAST HYPERTHERMIA CANCER PROCEDURE

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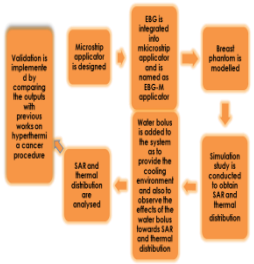
Graphical abstract



Abstract

Interest in the development of hyperthermia for cancer procedure is growth explosively all over the years as it is able to damage and kill the cancer cell non-invasively. An EBG-M antenna is designed with FDTD simulation packages, which is then applied towards treated cancerous area, where for the purpose of this simulation studies, breast is developed as the targeted cancer area to be treated. The radiation absorption is presented as the results obtained to be compared with previous works and also to be analyzed. It has been recognized that the designed antenna or also called as the applicator is able to offer depth radiation absorption and also improved the focusing, which is represented by the specific absorption rate (SAR) distribution towards breast hyperthermia cancer procedure.

Keywords: Hyperthermia, non-invasive, EBG-M applicator, SAR

1.0 INTRODUCTION

Over recent years, there has been an explosive growth of interest in the development of an applicator for non-invasive hyperthermia cancer procedure. Hyperthermia is currently classified as an alternative therapy for cancer. Hyperthermia utilizes slightly high heat, which is around 41^0C-45^0C [1]–[5], where it is capable to denaturate the cancerous tissue into the necrotic tissue, which then may damage and also kill the treated tissue with minimal side effects. Hyperthermia can be invasive and non-invasive. It is significantly dependent on the heat applicator used for the treatment either it is applied towards the human body internally or externally, respectively. Although the internal applied applicator is invasive, it is significant for deep-seated cancer. On the other hand, the non-invasive applicator is benefited towards in situ, localized, regional and whole body type of cancer. Various invasive and non-invasive applicators have been designed, developed and investigated. Example for invasive applicators, which are either interstitial or intracavitary are as in [6]–[8] and [9], respectively. Then, the external applicators such as presented in [3], [5], [10]–[14].

Both of the applicators offer substantial effectiveness towards hyperthermia for cancer therapy, however, since massive concerns increase for safer, less invasive and at the same time effective therapy, non-invasive type applicator for non-invasive hyperthermia procedure has been more attracted and fascinated to be studied, investigated and improved so that it may provide significant results in deducing and damaging the treated cancer cell. Various applicators for non-invasive effects were introduced in [13], [14]. The strengths and limitations were discussed and microstrip applicator has been chosen to be explored further as it may offer the utmost outcomes. The microstrip is categorized as a low profile applicator, where it can be effortlessly modified in term of its