Computational modeling of photothermal therapy using gold nanoparticle for lung cancer treatment

Ibtihag Yahya

Sudan University of Science and Technology, Sudan

In last years, nanotechnology has gained wide interest from researchers, especially in the medical field and its applications in the cancer treatment where it is difficult to determine and understand of human cancer cells resistance mechanism to many treatments. photothermal therapy is efficient and promises future strategy in cancer treatment where photon energy is converted into heat that killed cancer cells. Gold nanoparticles (AuNP) are the most important candidates among the rest of inorganic nanoparticles for hyperthermia for cancer treatment due to their unique properties such as (surface functionalization, surface plasmonic, optical characteristics). This study focused on modeling of physics process to look at the effectiveness of high temperatures in the treatment of cancer whereas the clinical trials of thermal therapy have big challenges as the temperature can become higher than 50°C that harms the surrounding normal tissues. In addition to, studying the behavior of AuNPs injected into a lung tumor under different degrees of heating by exposing it to laser pulses and then observe the thermal activation and the heating effects of these AuNPs on biological tissues using the COMSOL Multiphysics® by applying both of PDE and Heat Transfer in Solid Modules. The results showed that both of the PDE and heat transfer Modules have simulated the thermal activation of AuNP and predicted the thermal profile within the tumor successfully. As well as, the COMSOL program can provide a more effective way to identify optimal treatments given the possibility of changing many of parameters like temperature, thermal diffusivity, laser energy and optical density, etc.