Studi kelayakan material berbasis lilin dan karbon sebagai material ekuivalen jaringan: Uji densitas elektron dan nomor atom efektif = Feasibility study of carbon and wax based material as tissue equivalent material: Electron density and effective atomic number test

Brigitha Dwinesti, author

Abstrak

Penelitian ini bertujuan untuk mengevaluasi kombinasi lilin dan karbon sebagai material ekuivalen jaringan yang dapat merepresentasikan jaringan tubuh manusia. Parameter atomik yang umum digunakan untuk merepresentasikan adalah densitas elektron dan nomor atom efektif. Penelitian ini menggunakan metode dual-energy CT (DECT) dengan menggunakan formulasi alpha blending (Möhler, 2017) dan DEEDZ (Saito, 2017). Sampel yang dievaluasi yaitu fantom sampel jaringan lemak (80% parafin, 10% cecek, dan 10% karbon), otot (80% gondorukem, 10% cecek, dan 10% karbon), white matter brain (68% gondorukem, 16% cecek, dan 16% karbon), dan grey matter brain (60% gondorukem, 20% cecek, dan 20% karbon). Berdasarkan hasil uji, fantom sampel lemak, otot, grey matter brain, dan white matter brain memiliki kesalahan relatif densitas elektron sebesar masing-masing 4.6%, 2.6%, 4.4%, dan 4.8%, serta kesalahan relatif nomor atom efektif masing-masing sebesar 11.9%, 19.7%, 19.5%, dan 19.4%. Selain itu, pada penelitian ini dilakukan pula verifikasi fantom sampel hati, air, dan PMMA dengan kombinasi penelitian sebelumnya. Fantom sampel hati, air, dan PMMA memiliki kesalahan relatif densitas elektron sebesar masing-masing 7.0%, 1.5%, dan 0.5%, serta kesalahan relatif nomor atom efektif masing-masing sebesar 16.7%, 22.6%, dan 2.1%.

.....This study aims to evaluate the combination of wax and carbon as tissue-equivalent material which can represent human body tissue. The atomic parameters used to represent it are electron density and effective atomic number. This study used dual-energy CT (DECT) method using alpha blending formulation (Möhler, 2017) and DEEDZ formulation (Saito, 2017). The samples evaluated in this study were phantom sample of fat (80% paraffin, 10% cecek, and 10% carbon), muscle (80% gondorukem, 10% cecek, and 10% carbon), white matter brain (68% gondorukem, 16% cecek, and 16% carbon), and gray matter brain (60% gondorukem, 20% cecek, and 20% carbon). Based on the test results, phantom samples of fat, muscle, grey matter brain, and white matter brain have a relative deviation of electron density of 4.6%, 2.6%, 4.4%, and 4.8%, and relative errors of effective atomic number of 11.9%, 19.7%, 19.5%, and 19.4%, respectively. This study also verified phantom samples of liver, water, and PMMA with a combination of previous studies. Phantom samples of liver, water, and PMMA have a relative deviation of electron density of 7.0%, 1.5%, and 0.5%, and relative errors of effective atomic numbers of 16.7%, 22.6%, and 2.1%, respectively.