Konstruksi Fantom Berbahan Dasar Gypsum dan Hidroksiapatit = Construction Bone Phantom with Gypsum and Hydroxyapatite

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Abstrak

Penelitian ini bertujuan untuk membuat fantom dengan komposisi perbandingan antara hidroksiapatit dan gypsum yang paling sesuai dengan tulang manusia. Pengujian dilakukan dengan memperhatikan tiga parameter, yaitu nilai Hounsfield Unit (HU), densitas elektron (e), dan nomor atom efektif (Zeff). Enam sampel fantom dipersiapkan dengan perbandingan komposisi massa antara hidroksiapatit dan gypsum sebesar 100:0; 80:20; 60:40; 40:60; 20:80; 0:100. Pengujian dilakukan dengan menggunakan pemindai CT pada dua tingkat energi yang berbeda, yaitu energi rendah (tegangan tabung 80 kV) dan energi tinggi (tegangan tabung 140 kV) dengan menggunakan metode DEEDZ. Hasil perhitungan menggunakan nilai HU menghasilkan nilai densitas elektron pada keenam sampel fantom dengan akurasi sampel 1 (96.78%), sampel 2 (94.16%), sampel 3 (93.15%), sampel 4 (86.97%), sampel 5 (86.04%) dan sampel 6 (71.05%). Perhitungan juga mendapati nilai nomor atom efektif pada keenam sampel fantom dengan akurasi sebagai berikut sampel 1 (74.19%), sampel 2 (72.88%), sampel 3 (74.35%), sampel 4 (74.74%), sampel 5 (73.99%) dan sampel 6 (71.32%). Untuk parameter densitas elektron, akurasi tertinggi didapatkan dari sampel 1 (96.78%). Sedangkan hasil uji nomor atom efektif memberikan akurasi kurang dari 75% untuk seluruh sampel. Hal ini disebabkan oleh berat molekul yang menyebabkan adanya absorpsi fotolistrik. Fantom dengan bahan hidroksiapatit telah berhasil dibuat dan perlu investigasi lebih lanjut.

.....The purpose of this research is to find a mass composition ratio of hydroxyapatite and gypsum to construct bone fantomsimiliar as human bone. Three parameters were selected to evaluate the constructed fantom which are Hounsfield Unit (HU), electron density (e), and effective atomic number (Zeff). Six fantom samples were prepared with a mass composition ratio between hydroxyapatite and gypsum as follows: 100:0; 80:20; 60:40; 40:60; 20:80; 0:100. The test was carried out by using CT Scan with low and high energies (80 kV and 140 kV tube voltages) using DEEDZ method. Hounsfield Unit values that were obtained then calculated to determine electron density, with result accuracies of 96.78%, 94.16%, 93.15%, 86.97%, 86.04% and 71.07% for samples 1, 2, 3, 4, 5, and 6, respectively. Subsequent calculation of effective atomic numbers were obtained with accuracies of 74.19%, 72.88%, 74.35%, 74.74%, 73.99%, and 71.32% respectively, for samples 1, 2, 3, 4, 5, and 6. For electron density, the highest accuracy were obtained from sample 1 (96.78%), while effective atomic number tests yielded on accuracies below 75% for all samples. This might be caused by the molecular weight being prone to photoelectric absorption. Hydroxyapatite based fantom has been successfully constructed with needs of further investigations.