

Abstract

We have developed a post-processing, dual energy CT (DECT) imaging method for noninvasive *in vivo* measurement of photon cross sections of patient tissue, to support Monte Carlo-based treatment planning for low energy brachytherapy. The purpose of this study is to assess the influence of patient geometry on the accuracy and precision of the measured cross sections. A series of inorganic and organic solutions, contained in cylindrical vials, along with several industrial plastics were scanned on a Marconi UltraZ scanner. The measured attenuation coefficients (20-1000 keV) were compared to those derived from their known compositions. Cross-section accuracy and reproducibility were studied as functions of body section size (head vs. pelvis), scanning energy (80-140 KVp), sample diameter and arrangement of the samples in the phantom. An accuracy of 3-5% was achieved only when the linear relationship between Hounsfield units and the linear attenuation coefficients, averaged over the scanning beam spectrum, was measured. Then for head-like phantoms, good accuracy was achieved for both fat and bone-like materials, regardless of sample geometry. Only for 80 KVp, was there sufficient contrast to accurately measure attenuation in low-Z samples. In the pelvic phantom, increased noise and large streaking artifacts in the 80 KVp image precluded accurate cross-section measurement whenever bone-like materials were present. For body scanning, more complex preprocessing corrections for scattering and beam hardening appear to be necessary for accurate DECT imaging of cross-section data.

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