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Enhancement of X-ray dose absorption for medical applications SARA LIM, Ohio State University, MAXIMILIANO MONTENEGRO, Universidad Catolica de Chile, SULTANA NAHAR, ANIL PRADHAN, ROLF BARTH, ROBIN NAKKULA, ERICA BELL, Ohio State University, YAN YU, Thomas Jefferson University — Interaction of high-Z (HZ) elements with X-rays occurs efficiently at specific resonant energies. Cross sections for photoionization rapidly decrease after the K-edge; higher energy X-rays are mostly Compton-scattered. These features restrict the energy range for the use of HZ moities for radiosensitization in cancer therapy. Conventional X-ray sources such as linear accelerators (LINAC) used in radiotherapy emit a broad spectrum up to MeV energies. We explore the dichotomy between X-ray radiotherapy in two ranges: (i) E < 100 keV including HZ sensitization, and (ii) E > 100 keV where sensitization is inefficient. We perform Monte Carlo numerical simulations of tumor tissue embedded with platinum compounds and gold nanoparticles and compute radiation dose enhancement factors (DEF) upon irradiation with 100 kV, 170 kV and 6 MV sources. Our results demonstrate that the DEF peak below 100 keV and fall sharply above 200 keV to very small values. Therefore most of the X-ray output from LINACs up to the MeV range is utilized very inefficiently. We also describe experimental studies for implementation of option (i) using Pt and Au reagents and selected cancer cell lines. Resultant radiation exposure to patients could be greatly reduced, yet still result in increased tumoricidal ability.

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