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Investigating the Impact of Metalloporphyrins on DNA Damage During Electron Beam Irradiation

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Recent advancements in radiobiology focus on the effects of ionizing radiation on biological systems, with a critical emphasis on understanding how radiation impacts DNA, as structural breaks in DNA are a primary cause of cellular death. Enhancing the efficacy of cancer treatments by combining radiation therapy with other modalities, such as chemotherapy and phototherapy, can mitigate the side effects of radiation therapy. This study investigates the effects of metalloporphyrins, specifically ZnTOEPyP4, used in photodynamic therapy on DNA damage during electron beam irradiation. The study explores DNA damage in both tumor and nearby healthy cells, which can lead to various human diseases. By combining radiation therapy with other cancer treatments, the approach to tumor treatment has significantly evolved.
In this research, structural changes in the DNA molecule were examined under electron beam irradiation at different doses (2 Gy, 4 Gy). The influence of ZnTOEPyP4 porphyrin on radiation-induced DNA damage was studied with varying relative concentrations of complexes (r = 0.01, 0.02, 0.04, where r = C_por./C_DNA). The study aimed to identify the potential potentiating effects of porphyrins on DNA damage, depending on the concentration of porphyrin and the radiation dose.
The experiments utilized spectroscopy melting methods in a 10^-3 M NaCl buffer solution at pH 7.2. Results indicate that the presence of Zn porphyrin enhances radiation effects on DNA structure, leading to hydrogen bond breaks or double-strand breaks in the DNA molecule, depending on the electron beam irradiation dose.

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