

Spectral Decomposition and Quantification in Fingernail/Toenail EPR Dosimetry

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One method to determine how much radiation a person has received involves removing fingernail clippings after exposure and measuring the amount of radicals created by the radiation in the nails. Since there is a significant mechanically induced signal (MIS) that is created in the nail at the time of cutting, the observed EPR spectrum is mixture of the radiation induced signal (RIS) and MIS. Experiments have shown that MIS is a mixture of signals that change with time and also have different power saturation characteristics some different spectral features. With the development of appropriate models for the shapes and properties of the various components, it should be possible to decompose the spectra into their components, enabling the quantitative estimation of the RIS.

We have been developing a spectral decomposition method that decomposes spectra into four major base functions, three MIS and RIS. There is an additional function for the standard that is simultaneously recorded with the spectra of the fingernails, to provide a quantitative monitor of the spectral conditions and the performance of the spectrometer with each measurement. We use the time-course EPR measurements to identify the shape of these base functions and fit them to irradiated and non-irradiated samples. Our results show that this is an effective way to quantify the RIS and therefore the radiation dose.

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Introduction: