

Recent findings on confounding factors affecting the ESR signals of fingernails

Chryzel Angelica B. Gonzales^{1*}, Jolan E. Taño^{1,2}, and, Hiroshi Yasuda¹

¹Department of Radiation Biophysics, Research Institute for Radiation Biology and Medicine (RIRBM), Hiroshima University, Hiroshima, Japan

²Graduate School of Biomedical and Health Sciences, Hiroshima University, Hiroshima, Japan

*E-mail: chryzelgonzales@hiroshima-u.ac.jp

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Electron spin resonance (ESR) is one of the successful retrospective dosimetry techniques to measure the effects of ionizing radiation in biological materials such as tooth, bone, and nails). Recently, several studies suggest the possibility of using fingernails as a retrospective tool in combination with ESR technique. However, limited information is available yet with regard to some influential factors that might perturb its ESR signal. Here we report our recent findings on the possible determinants that could alter the main radiation-induced signal in the fingernail dosimetry analysis. We investigated the potential effects of multiple irradiations and the influence of heat in the drying process of the samples. Results show that the slopes of the dose-response curves and radiation sensitivity of the fingernail samples decreased after multiple irradiations of the same doses. This finding is important for potential dose reconstruction of fingernail doses by examining the dose-response curves through repeated irradiations. Furthermore, heat exposure considerably affected the visual shape and peak-to-peak intensity of the ESR spectra of fingernails. Heating to temperatures above 80°C resulted in a noticeable increase to the intensity of the ESR spectra – generating a new ESR signal that overlapped with the native background signal in unirradiated fingernail samples. This observed heat-induced signal needs to be ultimately taken into account as heating is one of the effects of radiation absorption which means that a combination of heat and radiation exposures might occur in radiological accidents. Nevertheless, our recent findings suggest that some confounding potential factors may affect the accuracy of dose reconstructions if ESR dosimetry of fingernails is to be applied in real radiological accident situations.

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