

Human Fingernails Exposed to Gamma Irradiation

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Abstract:

Emergency involving ionizing radiation is a rare occurrence, yet it can leave severe damage if a population is not equipped with necessary preparation. However, in present time only personnel of rescue teams have accessed to active dosimetry such as a personal dosimeter. This motivates the study on how biodosimetry can be an alternative retrospective dosimetry. In particular, human fingernails were sampled from different age groups and exposed to gamma ray of doses 2 to 10 Gy. The irradiated sample is subjected to be optically characterised using approach Raman spectroscopy for information on vibrational modes. The crystalline structure of alpha keratin is studied using X-ray diffraction (XRD) while the elemental composition of the sample is determined by energy dispersive x-ray (EDX) analysis. From the EDX analysis using Mayneord formula, the non-irradiated nail samples shown their effective atomic number, Z_{eff} to be in the range between 7.11 to 7.68 which is approximately near the Z_{eff} of soft human tissues at 7.4. This supports the study that nail is a good candidate as alternative of biological dosimeter material. As for the XRD analysis, it is observed that a fingernail sample is consisted of alpha keratin structure which displays both crystalline and amorphous characteristic. The crystallite size due to the exposure effect to gamma radiation shows fluctuating pattern and whether nail possesses the ability to self recover its structural order upon defect needs to investigate in future. It is unfortunate that the present work is missing the precious data from Raman spectroscopy for the nail sample, but previous works regarding the use of Raman spectroscopy to study nail sample has been summarized. It is learned from most works, the 'fingerprint' of nail sample is identical in which the peak assignment concerns on the disulfide (S-S) bond and also the alpha helix content at the amide 1 region. These are the few regions which displayed major Raman shift and intensity difference from a normal nail sample and an effected nail which have the same analogy as a non-irradiated nail and an irradiated nail sample.

Keywords: Coral Skeleton; Gamma irradiation; Thermoluminescence; Luminescence; Optical Characterisation