

## Dosimetric characterization of high-linearity bone radiation detector exposed to gamma-rays

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### Introduction

In radiation physics, the study of new alternative dosimeters is of interest on the growing branch of dosimetric characterization of solid-state dosimeters for radiotherapy applications in the Medical Physics fields. There are innumerable emerging techniques for reading and processing multivariate data to assess the possible linear behavior of dosimeters; such methods are the multivariate calibration Partial Least Square Regression (PLSR) and Principle Component Regression (PCR) techniques. The goal of this work was to expose bone samples to high doses and to use the FTIR spectrophotometry technique to evaluate the sensitivity and linearity of the absorbed profiles using PLSR and PCR analyses.

### Methods

Small cubes with size approximately of 0.5 cm<sup>3</sup> composed the bone samples, used in this work. The samples were irradiated in triplicates, with absorbed doses of 10, 100, 250, 400 and 500 Gy using a <sup>60</sup>Co Gamma Cell-220 system (dose rate of 1.089 kGy/h); afterwards, the absorbance spectrum of each sample was acquired on a Fourier Transform Infrared (FTIR) Spectrometer (Frontier/Perkin Elmer) with an optical step of 1 nm from 400 nm to 4000 nm.

### Results

The absorbance for high sensitivity peaks was observed for each bone sample, at the 552 nm, 991 nm and 1650 nm wavelengths in decreasing magnitude. The PLSR and PCR techniques showed, on the range from 10 Gy to 500 Gy, for the calibration curves of the system, a linearity of 0.9432 and 0.9422 respectively, using just three components on both methods.

### Conclusions

The results indicate an acceptable linear response, and therefore this material may be an interesting radiation detector.