

Evaluation of transparent and black commercial soda-lime glass irradiated with gamma radiation

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Introduction

The linearity characteristic in radiation dosimetry presents a growing interest. Glasses have been applied to radiation high doses. The goal of this work was to expose transparent and dark commercial soda-lime glasses samples to high doses and to use the UV-Vis spectrophotometry technique for their evaluation.

Methods

Transparent and dark commercial soda-lime glasses with dimensions of 1 x 10 x 40 mm³ were irradiated with doses from 1 kGy to 10 kGy using a ⁶⁰Co Gamma-Cell system 220, and then were evaluated with the UV-Vis technique. The sensitivity and linearity characteristics were evaluated with the absorbed profiles of the multivariate calibration Partial Least Square Regression (PLSR) and Principle Component Regression (PCR) techniques.

Results

The PLSR and PCR techniques showed, on the range of 1-10 kGy, for the calibration curves, of transparent and black commercial soda-lime glass, linearity values of 0.9432 and 0.9422 respectively using just three components on both methods. The spectra present a baseline variation (and maximum absorbance values) proportional to the absorbed dose received by the samples. These results show that it is possible to use the technique of UV-Vis to determine if the glass samples were irradiated or not. The color changes for transparent glass irradiated with absorbed doses from 1 kGy up to 10 kGy. This color variation in relation to absorbed dose indicates that the glasses may be used as YES/NO dosimeters.

Conclusions

The UV-Vis measurements may be useful in gamma radiation dosimetry, using the spectra of irradiated glasses; the highest linearity was shown in order respectively for transparent and black commercial soda-lime glass; the glass samples changed their coloration proportional to the absorbed doses, and they may be used as Yes/No detectors and as high-dose dosimeters. The results indicate a good linear response and the radiation detectors present potential use for radiation dosimetry in high doses.