Dosimetric properties of different-grained quartzous sand pellets

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The termoluminescent technique (TL) has been utilized to study sand samples for high-dose dosimetry, as well as their application as routine dosemeters [1-3]. Sand is a material found in the nature in great amounts; in the decade of nineties this material presented interest for its dosimetric properties. At the Calibration Laboratory of IPEN, sand samples from different Brazilian beaches were tested for the possibility of their use in gamma dosimetry, with the techniques of thermoluminescence (TL) [2] and electronic paramagnetic resonance (EPR) [3]. The main dosimetric properties of sand samples were already published: reproducibility, batch uniformity, reutilization, dose response and detection range; they presented satisfactory results for high doses between 5Gy and 80kGy. In this work industrial quartzous sand samples, treated in a special equipment that confers steady physical characteristics to the end items (with specifications determined for the casting market), proceeding from Descalvado, São Paulo, Brazil, were studied. These sand samples were obtained with different grain sizes: 30/40, 40/50, 50/60, 80/100 and 100/120. To facilitate the sample handling, sintered sand pellets were prepared using Teflon as binder. The sintering of the pellets was achieved with a thermal treatment of 300ºC for 1 hour followed by another thermal treatment of 400º for 1.5 hour. The irradiations were performed using a Gamma-Cell 220 system (^{60}Co). The sand samples present small dimensions (in tablet form), good rigidity and easy handling with possibility to be applied for high dose dosimetry in the main radiation processes of seed stimulation, mutation breeding, industrial radiography, insect population control and water purification. The objective of this work is to determine the termoluminescent properties of different-grained industrial quartzous sand samples to verify the possibility of their use in high-dose dosimetry. The results show that the TL response of the different samples is practically equal varying only in the intensity. The reproducibility of the TL response and the calibration curves obtained were adequate for high-dose dosimetry of gamma radiation.

References

[1] Vaijapurkar, S.G.; Raman, R.; Bhatnagar, P.K., Sand – a high gamma dose thermoluminescence dosimeter, Radiat. Meas., 29 (2), 223-226, 1998.

[2] Teixeira, M.I., Caldas, L.V.E., Sintered sand pellets for high-dose dosimetry, Nucl. Inst. Meth. Phys. Res. B., 218, 194-197, 2004.

[3] Teixeira, M.I., Ferraz, G.M.; Caldas, L.V.E., Sand for high-dose dosimeter using the EPR technique, Appl.Radiat.Isot., 62, 359-363, 2005.

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