

OPTICALLY STIMULATED LUMINESCENCE AND THERMOLUMINESCENCE CHARACTERIZATION STUDIES OF DENTAL ENAMEL USING PORCINE TEETH

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Three types of optically stimulated luminescence (OSL) responses were observed with crushed samples of porcine dental enamel obtained from two individuals; pre-bleach response, response to ionizing radiation (⁹⁰Sr/⁹⁰Y) and response to sunlight. The pre-bleach response showed an increase in total OSL signal during consecutive reads until a maximum was reached after twelve 51 second readings. Upon bleaching overnight with 470 nm diodes, the enamel samples responded in a reproducible manner with some samples showing detectable signals at exposures of 0.1 Gy to ionizing radiation. A majority of the fading of OSL signals induced by exposure to ionizing radiation occurred within the first two hours with a maximum total loss in the signal of 29% after three days. Future studies will need to investigate how the low detectable limit can be achieved in measurements *in situ* and amidst the pre-bleach response observed, and to better understand the effects of variable individuals. Our fading observations are substantially different from the results of Godfrey-Smith,¹ who used a human tooth, but qualitatively similar to results obtained by colleagues at Oklahoma State University² who also used human teeth.

Exposure of three samples to sunlight resulted in relatively large OSL signals that were quite consistent between samples. One-hour exposures to sunlight produced OSL signals that were within 24% of one-another. Equivalent signals produced by exposure to ionizing radiation were obtained by doses that varied by a factor of more than 30. The sunlight-induced OSL signals required significantly longer bleaching times than those required after exposure to ionizing radiation.

Out of the 25 samples prepared, two highly responsive samples were identified, one from each individual, indicating the presence of impurities or normal inhomogeneities, thus highlighting the need to more fully characterize this source of variability in response.

The thermoluminescence response of the porcine dental enamel proved to be less consistent and more complex than the OSL response with the presences of at least three TL peaks.

References:

1. Godfrey-Smith, D.I.. Towards in vivo OSL dosimetry of human tooth enamel. *Radiation Measurements*, 43 (2-6) 854-858, February-June 2008.
 2. McKeever, S.W.S., personal communication to CEE 3/4/2008.
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