

Title: Unveiling the dosimetric potential of natural Malaysian zeolite powder: A comprehensive thermoluminescent study

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Abstract : Zeolite is a microporous crystalline material composed of hydrated aluminosilicates of alkali and alkaline earth metals, available in both natural and synthetic forms and commonly used in its powdered state. This study investigates the thermoluminescence (TL) properties of natural zeolite powder under gamma irradiation in the dose range of 0.5–150 Gy. TL glow curve measurements at heating rates of 2–15 °C s⁻¹ revealed an optimal rate of 8 °C s⁻¹ for maximizing TL response. The material exhibited a good linear dose response, high sensitivity at low doses, excellent reproducibility, and a fading of approximately 27 % after 28 days. The effective atomic number ($Z_{\text{eff}} = 11.53$) closely matches that of human bone (11.6–13.8), underscoring its potential for medical dosimetry. Kinetic parameter evaluation further confirmed stable glow peak behavior, with activation energies and trap lifetimes indicating moderately stable trapping centers, thereby reinforcing the reproducibility and reliability of the zeolite TL response. Overall, these findings establish natural zeolite powder as a low-cost, efficient, and sustainable candidate for radiation detection and medical applications.

Keywords: Zeolite Radiation dosimetry Thermoluminescence Dosimetric properties Gamma irradiation

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