Radical formation in lithium and magnesium oxalate

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Abstract: Lithium oxalate (Li-oxalate: Li2C2O4) and magnesium oxalate (Mg-oxalate: MgC2O4.2H(2)O) were investigated by electron spin resonance (ESR) spectroscopy as new ESR dosimeter materials. The ESR spectra of Li- and Mg-oxalates irradiated by gamma -rays have a singlet with a spectroscopic splitting factor (g-factor) of g = 2.0043 +/- 0.0004 and are ascribed to a self-trapped hole, the oxalate radical C2O4-. A broad signal formed by high dose irradiation is considered to be due to the zero field fine structure splitting, DS2 (Dg beta congruent to 0.65 mT) for the triplet state (S = 1) of a dimer of C2O4- or a pair of electron and hole centers. The response to the gamma -ray dose and thermal stability as well as the effect of illumination have been studied with respect to using these materials as ESR dosimeter elements. The radical formation efficiencies (G-value) for Li- and Mg-oxalates were 0.4+/- 0.1 and 0.21 +/- 0.06 and the activation energies (E) from the Arrhenius plot were 1.16 +/- 0.24 eV and 1.28 +/- 0.26 eV, respectively. These lead to the respective lifetimes of 2.6 +/- 0.9 and 3.2 +/- 1.1 years at 25 degreesC, which are sufficient for practical dosimetry.

Author Keywords: electron spin resonance; dosimetry; free radicals; lithium; magnesium; oxalate; dimer; triplet

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