EXCITED-STATE DYNAMICS IN 6-THIOGUANOSINE FROM FEMTOSECOND TO MICROSECOND TIME SCALE

CAO GUO, CHRISTIAN REICHARDT AND CARLOS E. CRESPO-HERNÁNDEZ, *Department of Chemistry and the Center for Chemical Dynamics, Case Western Reserve University, 10900 Euclid Avenue, Cleveland, Ohio 44106*.

6-thioguanine is a widely used pro-drug[a] in which the oxygen atom in the carbonyl group of guanine is replaced by a sulfur atom. Previous studies have shown that patients treated with 6-thioguanine can metabolize and incorporate it in DNA as 6-thioguanosine (6tGuo). These patients show a high incidence of skin cancer when they are exposed to extended periods of sunlight irradiation. In this work, the photodynamics of 6tGuo is investigated by broad band time resolved transient spectroscopy.[b] Similar to previously studied 4-thiothymidine,[c,d] our results show that excitation of 6tGuo with UVA light at 340 nm results in efficient and ultrafast intersystem crossing to the triplet manifold (τ = $0.31 \pm 0.05\,ps$) and a high triplet quantum yield (ϕ = 0.8 ± 0.2). The triplet state has a lifetime of $720 \pm 10\,ns$ in N_2-saturated $vs.$ $460 \pm 10\,ns$ in air-saturated aqueous solution. In addition, a minor picosecond deactivation channel ($80 \pm 15\,ps$) is observed, which is tentatively assigned to internal conversion from the lowest-energy excited singlet state to the ground state. Quantum chemical calculations support the proposed kinetic model. Based on the high triplet quantum yield measured, it is proposed that the phototoxicity of 6tGuo is due to its ability to photosensitized singlet oxygen, which can result in oxidative damage to DNA.

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[c] C. Reichardt, C. E. Crespo-Hernández, J. Phys. Chem. Lett. 1, 2239 (2010).

[d] C. Reichardt, C. E. Crespo-Hernández, Chem. Comm. 46, 5963 (2010).