Rhodamine 6G-anthracene conjugate for dual photo-triggered sensing of singlet oxygen

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Singlet oxygen ($^1O_2$) is the excited state of molecular oxygen, which attract great attention to photochemical environmental remediation, and photodynamic therapy. To precisely understand and control the chemical and biological reactions of $^1O_2$, it is essential to detect the generation of $^1O_2$ temporally and spatially. Fluorescence sensing is one of the most promising methods to detect $^1O_2$.[1] Although there are serval molecular sensors of $^1O_2$, a coumarin-anthracene based molecular dyad developed in our laboratory demonstrates the ability to trap, store, and release $^1O_2$ under a specific wavelength and intensity of light. This kind of light-control of $^1O_2$ is beneficial in chemistry, and cell biology. In this work, I reveal the ability of the rhodamine 6G-anthracene conjugate (**RA**) to capture $^1O_2$ and show photo-triggered fluorescence. **RA** is synthesized into a purple powder and characterized by spectroscopic methods.

The $^1O_2$ sensing ability of **RA** is studied using fluorescence and absorption spectroscopic techniques. As a representative result, upon continuous photoirradiation of a photosensitizer **rTPA** at 700 nm (20 mW cm^{-2}) in the presence of **RA** in an aqueous solution, the fluorescence intensity of **RA** remarkably increases due to $^1O_2$ sensing. **RA** shows 9-fold enhancement in the fluorescence intensity after the 60 min sensitization, which indicates an effective $^1O_2$ sensing by **RA**. After illumination with feeble UV light, the fluorescence intensity further increases rapidly. This photo-triggered increase in the fluorescence intensity suggests that **RA** is capable of capturing and releasing $^1O_2$ (Scheme 1), similarly to a reported coumarin-anthracene conjugate. This feature enables **RA** to control $^1O_2$ release and detection spatiotemporally. Therefore, **RA** can be a promising molecular tool to understand and use $^1O_2$ in the various reactions.

Scheme 1. $^1O_2$ trapping and sensing by **RA**.

1). Y. You, et al. *Org. Biomol. Chem.*, 2018, **16,** 4044-4060.