Fluorescence Detection of Radicals in Biological and Environmental Systems

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Free radicals can be detected optically by probes in which a stable nitroxyl radical is covalently-coupled at a short distance to a chromophore [1]. Due to the proximity of the radical, fluorescence emission from the chromophore can be largely quenched [1-3]. However, on reaction of (carbon-centered) radicals with the nitroxide moiety to form diamagnetic *O*-alkyhydroxylamine products (radical adducts), the intramolecular quenching pathway is eliminated and fluorescence emission increases, allowing radicals to be detected optically. The highly fluorescent radical adducts can be further separated by high-performance liquid chromatography and quantified fluorimetrically [4]. In most cases, mass spectrometry can be used to help identify or confirm the structures of the radical adducts [5]. This method, combined with the use of dimethyl sulfoxide (DMSO), can be further employed to quantify the production of OH very sensitively [6, 7]. Recent applications of this approach to the highly sensitive detection and quantification of radical intermediates in biological and environmental systems will be described.

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