Preparation of a Crown-Ether-Modified Isoluminol Derivative and Its Chemiluminescence Properties in an Organic Medium

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The title isoluminol derivative having an aza-15-crown-5-ether function (1) has been prepared through two-step synthesis. 4-Amino-N-methylphthalimide was treated with penta(ethylene glycol) ditosylate in the presence of sodium hydride to construct an aza-crown ether on its amino group. The resulting crowned phthalimide then reacted with hydrazine to afford the desired isoluminol (1) which is the first luminol analogue possessing an aza-crown ionophore.

The crowned isoluminol (1) displayed very weak chemiluminescence (CL) in acetonitrile in the presence of hydrogen peroxide and tetrabutyl ammonium hydroxide (TBAOH). On the other hand, addition of alkali metal salts (as iodide) to this mixture triggered off intense, blue CL emission. The CL emission was short-lived and ceased within a few seconds at room temperature. In aqueous solution, however, such an intense CL emission was not observed upon addition of alkali metal iodide in the presence of TBAOH and hydrogen peroxide. The maximum of the CL spectrum was affected little by the alkali metal cation used (Li⁺, Na⁺, K⁺, 450-470 nm), whereas, the intensity of the CL emission changed depending on the cation; the relative intensity of the CL emission increased for Li⁺ < Na⁺ < K⁺.