Chemiluminescent detection of peroxide using novel stabilized 1,2-dioxetane boronic acids and boronate esters

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We describe the development of a novel class of thermally stable 1,2-dioxetanes bearing boronic acid or boronate ester moieties for the detection of hydrogen peroxide. These dioxetanes are converted to the corresponding phenols through reaction with hydrogen peroxide. The hydroxy-substituted dioxetanes decompose under alkaline conditions generating chemiluminescence. Solutions of the boronic acid substituted dioxetanes and various monomeric and polymeric cationic surfactants provided enhanced levels of light emission. Enhanced formulations were prepared and used to detect peroxide concentrations over several orders of magnitude. Application of this peroxide detection system to peroxide-generating systems was also examined. As a proof of principle, detection of glucose concentrations over several orders of magnitude was achieved. Reaction of glucose with glucose oxidase generated peroxide which then further reacted with the boronic acid-substituted dioxetane under alkaline conditions to generate a chemiluminescent signal proportional to the quantity of glucose initially present. Kinetic and spectroscopic studies of this new reaction will be presented.