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Daphnetin: A Novel Blue-Green Photonic Switch for Disodium Phosphates That Allows Monitoring of Polymerase Chain Reactions

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Abstract: This paper describes the very simple and robust ratiometric photonic switching properties of daphnetin (**DP**) toward HPO_4^{2-} ions selectively in complex biological fluids, without any interference from other relevant anions under physiological conditions. The sensing ability of **DP** toward HPO_4^{2-} ions was first demonstrated using UV–Vis and fluorescence spectroscopy, dynamic light scattering (DLS), and one- and two-dimensional NMR spectroscopy. **DP** can detect HPO_4^{2-} ions at concentrations up to the sub-micromolar/nanomolar level very effectively, with a ratiometric response resulting from intramolecular charge transfer aided by aggregated-induced emission. The interactions between **DP** and HPO_4^{2-} ions resulted in new bands appearing in the UV–Vis (at 385 nm) and emission (at 535 nm) spectra. The noncovalently held HPO_4^{2-} ions induced pronounced specific aggregation of **DP** molecules, resulting in the new excimer band at 535 nm while retaining the monomer band centered at 445 nm. In contrast, reciprocal absorptivity changes were observed at 320 and 385 nm, with exponential decrements and increments, respectively. This probe could effectively monitor the consumption of dNTPs during various cycles of the polymerase chain reaction performed with relatively short oligonucleotides as well as genomic DNA from *Agarobaterium tumefacience* (AcH5α strain).

Keywords: Daphnetin, Aggregation-induced emission, Intramolecular charge transfer, Polymerase chain reaction, Excimer.