

Multibranched phenylene-ethynylene fluorophores as tunable fluorescent transducers for biological sensors

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Phenylene-ethynylene has recently emerged as one of the most attractive fluorescent building blocks for constructing fluorescent transducers due to its high fluorescence quantum efficiency and ease of synthesis. In this contribution, phenylene-ethynylene units are incorporated into multi-branched structures to furnish wide ranges of molecular surface tunability. A water soluble series of multi-branched fluorophores is synthesized by using Sonogashira cross-coupling reaction as a key step. The variations of the branch numbers and their end groups are key to tune interactions between the fluorophores and analytes which in turn modulate the sensing properties. The fluorophores exhibited pronounced fluorescence responses to nanoconfined environments such as cavities and folding structures. Upon the exposure to a surfactant, cyclodextrin, protein or DNA, the fluorescence signals of the fluorophores are significantly enhanced and shifted to shorter wavelength while the absorption spectra are barely changed. The fluorescence enhancement and wavelength shift are associated with conformational restriction, deaggregation and solvent exclusion affected by the nanoconfined environments. The binding constants of the interactions are determined from the Benesi-Hildebrand double reciprocal plots. The inclusion complex with γ -cyclodextrin was observed by circular dichroism (CD) and ^1H NMR spectroscopy while electrostatic and dipolar interaction at the molecular surfaces were suggested, by the photophysical behaviors and molecular modeling, for the interaction with protein and DNA. The phenomena were applied for enhancement of metal ion detection, DNA sequence detection and aptasensor design.

Biography

Mongkol Sukwattanasinitt has completed his Ph.D from Iowa State University (1991-1996) and postdoctoral study from University of Massachusetts Lowell (1996-1997). He received a young scientist award from Thailand Science and Technology Foundation under Royal Patronage (2002). He has published more than 40 papers in international journals and served as a frequent reviewer for Biosensors & Bioelectronics and other reputed chemistry journals.

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