Potential Chiroptical and pH Responsive Switches: the Synthesis and the Characterization of Perylene Monoanhydride Monoimide with α-amino Acid

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Perylene imides, potential photoactive and electroactive organic materials, exhibit high fluorescence quantum yields with excellent photochemical, redox properties and good thermal stability [1].

The molecular systems that respond to external stimuli in connection with the design of molecular switches and molecular machines are of great scientific interest because they enable the development of new concepts and offer interesting applications in the field of nanotechnology [2,3]. To be a useful molecular switch, such a molecule must possess bistability, meaning that two different forms of molecule can be interconverted by application of external stimuli. By introducing chiral elements into a chiroptical molecule, a chiroptical switch can be attained in which its chiroptical property changes upon application of a bias to the electrochemical cell. To be an effective chiroptical switch, reduction or oxidation of the chromophore must occur rapidly and reversibly and the chiroptical properties of the two states must be sufficiently different [4].

Transfer of protons can be regarded as one of the simplest chemical signals. Many life processes, such as enzymes, operate within very narrow pH window, where their function or activity can be described as being "on-off switching" as a function of pH. Attempts to mimic such "off-on-off" or "on-off-on" behaviour by constructing luminescence devices that are modulated by a single output, pH, are of current interest [2].

In the present study, α-amino acid containing novel perylene dye, N-(2-aminoheptanoic acid)-3,4,9,10-perylenetetracarboxylic-3,4-anhydride-9,10-imide, (LFMI) has been synthesized. The compound was characterized by NMR, MS, IR, UV-vis, DSC, TGA and CV measurements. The fluorescence lifetimes, quantum yields and singlet state energies are presented. The band gap energy, LUMO and HOMO energy values were calculated.

References:
2- Feng Ge et al., Inorganic Chemistry Communications, 10 (2007) 170-173.