Multi-responsive Porphyrins for Sensing Applications

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Abstract:
Porphyrins are widely studied functional dyes that play essential role in living organisms (e.g. photosynthetic antenna and reaction center, heme protein as an oxygen carrier, etc.). Previously, we have shown that porphyrins can be used for various sensing applications[1-9] such as enantiopurity detection, selective detection of anions, determination of trace water impurities in organic solvents, etc. However, most of these properties are achievable only in organic solvents (chloroform, DMSO, etc.). Therefore, we have synthesized water soluble porphyrin derivatives (Fig. 1a), which exhibit reversible response to various external stimuli such as temperature (phase separation, Fig. 1b), *pH* (colorimetric response, Fig. 1c) and solvent composition (co-nonsolvency, Fig. 1d). We attempt to describe this rich behavior using various concepts of physical chemistry, such as chemical equilibria, chemical kinetics and Flory-Huggins solution theory. Potential applications of these effects, such as PDT (Fig. 1e) or MRI imaging of chirality (Fig. 1f) will be also discussed in the presentation.

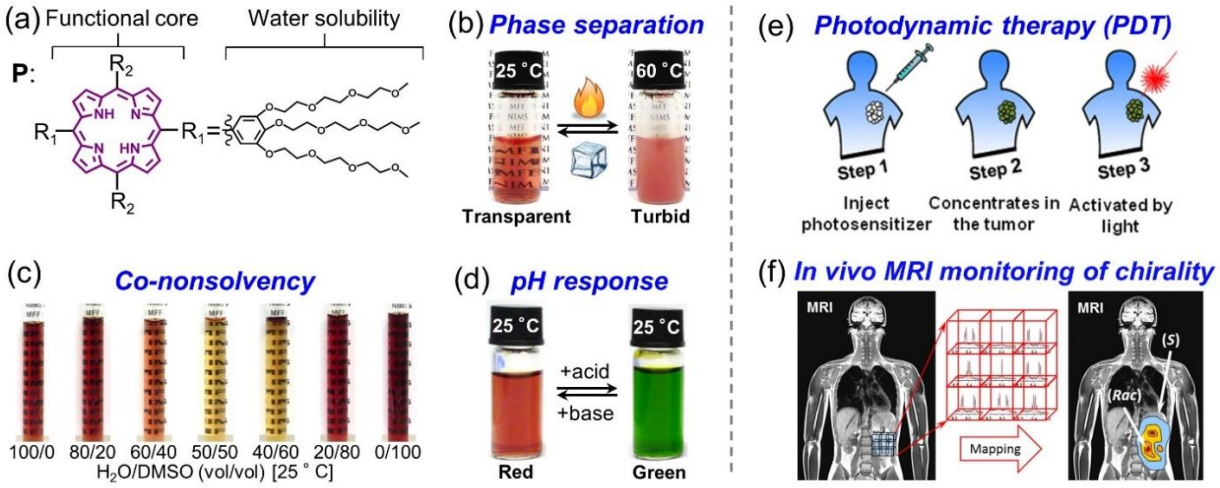

Fig. 1. (a) Structure of water-soluble porphyrins (**P**). (b) Phase separation. (c) Reversible *pH* response. (d) Solvent composition response (co-nonsolvency). (e, f) Examples of two potential applications. (e) PDT photosensitizer for cancer treatment. (f) Magnetic resonance imaging (MRI) 'contrast' agent for *in vivo*/*in situ* monitoring of local chirality.

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