

On the self-assembly of Porphyrins and Bile Salts: the supramolecular chiral induction by steroidal surfactants

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Porphyrins are versatile aromatic building blocks that act as chiral probes, able to sense and amplify the chiral information given by a proper environment [1]. Their ability to amplify chirality makes them ideal candidates for designing smart devices for the stereospecific recognition [2]. In this work, bile salts (BS), unconventional chiral surfactant with a peculiar facial amphiphilicity, are used as chiral trigger to induce porphyrin aggregation. The BS sodium cholate (NaC) and deoxycholate (NaDC) are used as inductors to drive the chiral aggregation of the achiral 5-(4-carboxyphenyl)-10,15,20-(triphenyl)porphyrin (H2CTPP). Remarkably, varying the H2CTPP/BS molar ratio in buffered aqueous solution, porphyrin self-assembly leads to the formation of fibrillar aggregates that tend to pack in micrometric bundles of fibres. At a 1/100 H2CTPP/BS molar ratio (i.e. BS at 1 mM), these aggregates feature a pronounced supramolecular chirality (α -factor of ca. 0.1) that can be tuned by adjusting the solvent composition (Figure 1). Conversely, at a 1/1000 molar ratio, i.e. above the BS critical micellar concentration, porphyrin remains in its monomeric form inside the hydrophobic core of BS micelles, with no detectable chirality (Figure 1). The chiral self-assembly significantly affects the optical properties in solution (both absorption and emission), revealing the sensitivity of the system to aggregation. Preliminary results show that deposition of the chiral aggregates on quartz surfaces yields solid-state materials that retain chiral properties.

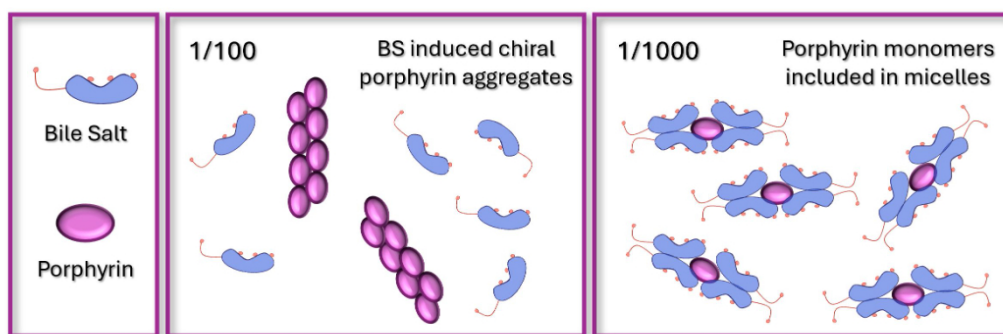


Figure 1. A graphical representation of the supramolecular interaction of porphyrins and bile salts at 1/100 (left) and 1/1000 (right) molar ratio.

References:

- [1] Z. El-Hachemi, G. Mancini, J. M. Ribò, A. Sorrenti, J. Am. Chem. Soc. 130, 15176–15184 (2008)
- [2] H. Jiang, L. Zhang, J. Chen, M. Liu, ACS Nano 11, 12453–12460, (2017)