Chirality induction in porphyrin films for enantioselective sensing applications

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An achiral and hydrophobic porphyrin (figure 1) was co-assembled at the air-water interface with mesoscopic silica nano-helices functionalized with -NH_2 groups. In particular, right-handed (RHH-NH_2) and left-handed (LHH-NH_2) were dispersed in the aqueous subphase of a Langmuir trough, and the co-assembled composite film was obtained without forming covalent bonds between the components.

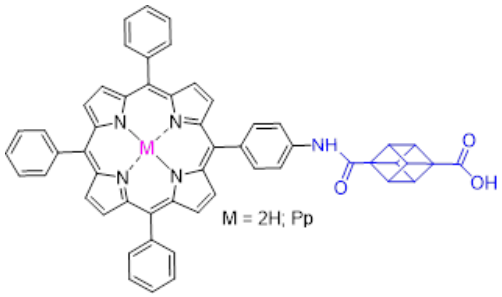

Figure 1. Chemical structure of the achiral free base porphyrin (Pp)

This method facilitated the transfer of the porphyrin/nano-helices co-assemblies onto a solid support as a thin hybrid layer, using the Langmuir-Schaefer (LS) method. The interaction between the two species was characterized using spectroscopic techniques and atomic force microscopy, confirmed the formation and interaction of the composite films, revealing that the porphyrin film's morphology differs significantly from the hybrid layer. CD measurements performed directly on the solid films demonstrated that the chirality of the porphyrin aggregates could be tuned according to the chirality of the silica nano-helices, leading to the formation of chiral co-assemblies. When the co-assemblies were transferred onto surface plasmon resonance (SPR) slides and exposed to histidine enantiomer solutions, selective chiral discrimination was observed. This discrimination was determined by the alignment or mismatch between the chirality of the analyte and the helicity of the nano-helical structure. The difference of the angle of incident position in the minimum of the SPR signal named ΔAOI, was calculated after ultrapure water flux and analyte solution flux on both films obtained using both helices. ΔAOI was used to quantify the sensitivity of the co-assembled layers to the different histidine enantiomers.