Formation of well-defined aggregates of organic dyes driven by surface pressure in mixed Langmuir monolayers

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The development of organic thin films with molecularly ordered structures has been one of the main goals of supramolecular chemistry. The formation of self-assembled structures with specific physical properties is determined by the relations between chemical composition, structure, and organization of the building block materials. The self-aggregation is a fundamental factor, as it might drive significant changes in the optical properties of the chromophore units.

Molecular aggregates, with significantly altered optical properties, are formed under certain conditions. In this sense, the air-water interface is an ideal platform for supramolecular assembly. Mixed Langmuir monolayers containing different organic dyes, i. e., methylene blue and hemycianine derivatives, have been prepared [1,2].

The evaluation of formation of aggregates, as well as molecular orientation in mixed Langmuir monolayers as a function of surface pressure, is achieved by UV-vis spectroscopy and Brewster angle microscopy (BAM). Using in situ synchrotron Grazing Incidence X-ray Diffraction (GIXD), crystalline ordering is studied. A rationale design of photoactive Langmuir monolayers is discussed.

Dye aggregation at the air/water interface: GIXD data from chain ordering and UV-vis spectra from polar head stacking