# Complexation of Fullerene Adducts of Pyridine or Imidazole by Water Soluble Zinc Porphyrins in the Langmuir and Langmuir-Blodgett Films

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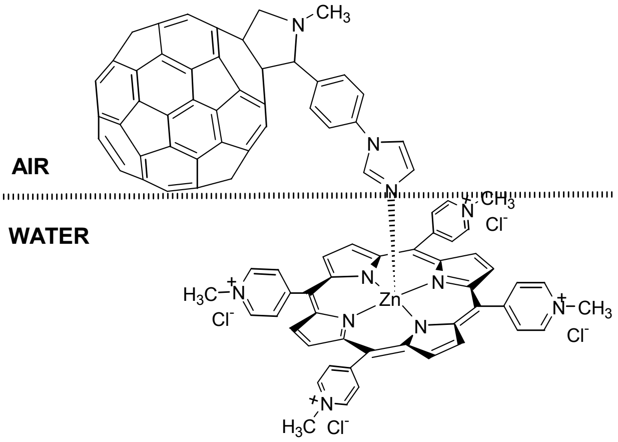
Langmuir films of the [60]fullerene-pyridine, $C_{60}$py, and [60]fullerene-imidazole, $C_{60}$im, adducts were formed on surfaces of liquid subphases, such as water or aqueous solution of tetrakis (N-methylpyridinium)porphyrin cation, Zn(TMPyP), or zinc tetrakis (4-sulfonato=phenyl)porphyrin anion, Zn(TPPS (Scheme 1). The $C_{60}$ adducts (acceptors) self-assembled in the films due to axial ligation of Zn porphyrins (donors), which resulted in the formation of relatively stable donor-acceptor dyads. The Langmuir films were characterized by isotherms of surface pressure and surface potential vs. area per molecule as well as by in situ Brewster angle microscopy imaging. Aggregated Langmuir films of the "expanded liquid" type were formed for all systems examined. Extensive compression of the films resulted in two-dimensional phase transitions involving rearrangements of the adduct molecules. The area per molecule at infinite dilution of the adducts in films was dependent on composition of the subphase solution and increased in the order: water < Zn(TPPS) < Zn(TPMyP) solution. Values of the determined and calculated area per molecule were compared and conclusion formulated on orientation of the complexes in the films.

**Scheme 1**



The Langmuir films were transferred, by using the Langmuir-Blodgett (LB) technique, onto both uncoated and ITO electrode coated quartz slides for the UV-vis spectroscopic and voltammetric characterization, respectively. The former studies revealed that Zn porphyrins were transferred in films together with the adducts and that the transfer efficiency increased in the order: $C_{60}$py-Zn(TPPS) < $C_{60}$py-Zn(TMPyP) < $C_{60}$im-Zn(TPPS) < C60im-Zn(TMPyP), in accord with the order of the increase of stability of the respective complexes in bulk solutions. The latter experiments showed electrochemical activity of both the $C_{60}$ and porphyrin components of the dyads in the LB films.