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Synthesis and characterization of supramolecules and its applications as a chemosensor for drugs

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The monitoring of pharmaceutical drugs in the environment is of great importance world wide. For example, in Karachi, Pakistan due to contaminated water, six children were died and about 200 were fell ill in 2005. A large number of pharmaceutical drugs in highly alarming amount were found in different components of drinking water (surface water, drainage and effluent) of Karachi in the microgram-per-liter range during bioassay directed chemical analysis. The photophysical evaluation of supramolecular organic molecules as optical probes for detection of water toxins has been recognized to be very selective, sensitive, and economical as compared to the previously used methodologies. Synthesis, characterization and molecular recognition properties of fluorene based supramolecular cleft is reported. The cleft molecule was prepared in a single-step with good yield (85% yield), by linking fluorene with 1-ethyl piperazine. The cleft molecule was carefully characterized using various spectroscopic techniques such as NMR and mass spectrometry. The supramolecular interaction of cleft with amoxicillin, 6APA, aspirin, captopril, cefotaxime, ceftriaxone, cefuroxime, diclofenac, penicillin, and cephadrine was evaluated by fluorescent spectroscopy. The molecular recognition studies showed that amoxicillin selectively binds with cleft in the presence of other drugs. The analytical method developed for the supramolecular interaction of molecular cleft and amoxicillin was validated at varying pH, concentration and temperature during recognition process.

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Metal sulfide complexes and their application in catalyzed CO₂ reduction and H₂ evolution

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Metal sulfide bond plays very important, complicant and interesting role in metal sulfide complexes in reacting with organic molecules or catalyzing coupling reactions as well as electrocatalyzed reductive reactions. Previous study on the mechanism of metal dithiolenes catalyzed hydrogen evolution shows that metal hydride intermediates are necessary to be formed by either directly absorbing proton or transferring H from sulfur atom to metal center. One of our study found that Mo disulfide pyridine complex can be an efficient electrocatalyst in hydrogen evolution reactions, but no Mo-H bond can be formed during the whole mechanism because Mo hydride intermediates are not stable. Moreover, in neutral Ni bis(dithiolene) and Co bis(dithiolene) electrocatalyzed H₂ evolution reaction, metal hydride complexes are difficult to be formed due to very low stability. However, for anionic Mo bis(dithiolene) photocatalyzed H₂ evolution reaction, Mo-H can be formed easily since this anionic intermediate is stable. Our study aimed to understand these phenomena.

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