MASTER'S THESIS

Development of fluorescent chemosensors: mercury sensing and biological molecules sensing probes

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Development of Fluorescent Chemosensors:
Mercury Sensing and Biological Molecules Sensing Probes

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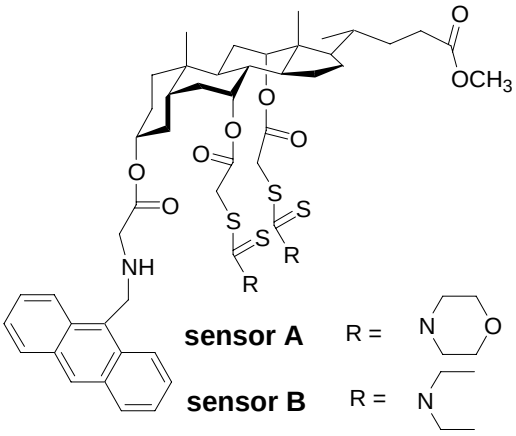
Abstract

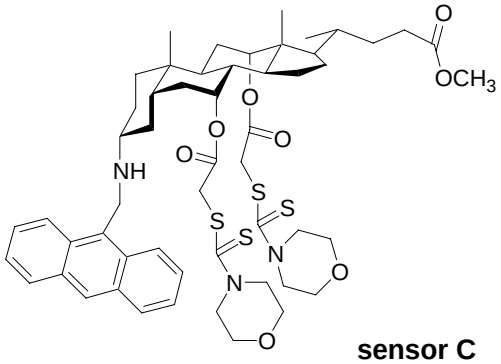
Cholic acid-based fluorescent photoinduced electron transfer (PET) sensor probes **A**, **B** and **C**, bearing a pair of dithiocarbamate pendants as the receptive site and an anthracene moiety as the signal displaying unit, were designed and synthesized via a sequence of high yield steps. The sensor probes not only show high selectivity and sensitivity to Hg^{2+} in aqueous acetonitrile solution, but also respond moderately to $MeHg^{+}$. A distinctive OFF-ON type signaling of up to 10-fold enhancement was observed for the novel sensor probe **A** toward Hg^{2+} in aqueous acetonitrile solutions.

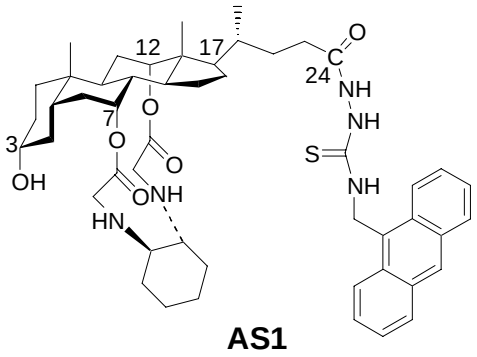
Novel ditopic fluorescent PET chemosensor **AS1** was designed and synthesized from cholic acid. On the basis of rational chemical design, an amidothiourea moiety and a cyclic diamino-chiral receptive site were introduced simultaneously to the chiral framework of cholic acid to confer the chemosensor with specific binding abilities. In acetonitrile, the sensor demonstrated differential binding toward trifunctional aminoacids like serine, lysine, threonine and tyrosine against other simple aminoacids. Moreover, high enantioselectivities (K_D/K_L) of up to 8.9 and sensitivities in the micromolar range with the sensor were observed for trifunctional aminoacids.

The interactions of chemosensor **AS1** and phosphate, pyrophosphate, AMP, ADP, ATP, CTP, GTP, TTP have been investigated. Interestingly, the aminoacid chemosensing probe **AS1** was also found to be an ideal selective ATP sensor. ATP could trigger significant quenching in fluorescence of **AS1** in a 1:1 aqueous CH_3CN solution at pH 7.4, whereas other phosphorus containing guest molecules only showed a much smaller effect. The nature of the complex between **AS1** and ATP was established through

combined UV, ^{1}H NMR and ^{31}P NMR spectroscopic methods. The uniqueness of the new sensor is that it binds with ATP 33-124 times more selectively than other nucleotides, as evidenced from the respective binding constants. **AS1** is an extremely sensitive sensing probe, as little as 30 nM ATP can cause 15% fluorescence quenching of the sensor.







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