Ultra-trace quantity detection of Toxic Ions towards better health management and sanitation

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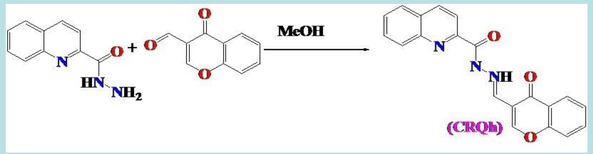
Abstract:

Molecules/Ions are in the centre of the birth, development, survivability and death of living body. The cellular activities are directed and carried over by the molecules and ions. The concentration of ions in biology is to be maintained at optimum level – neither low nor high for executing highest efficiency of living machines. Recently, the chemosensors are used in the selective and specific detection of ions/molecules. Last few years we have been engaged in the developing of fluorogenic receptors and their use in the ultra-trace detection of ions and molecules. In this research we will focus on detection of $Al^{3+}$and F^- in drinking water.

Introduction

Aluminium is non-essential element available on the earth's crust is useful in the water purification instruments and is entering into human body through foods and beverages. World Health Organization (WHO) has assigned Al^{3+} as a prime food pollutant with limiting concentration 200 μg/litre (7.41 mM) a dietary human intake is 7.0 mg/kg body weight. Selective and sensitive chemosensor for detection of ions in solution has been designed. Schiff base ligands act as fluorescent sensors for metal ions including Al^{3+} due to their relatively easy one step synthesis

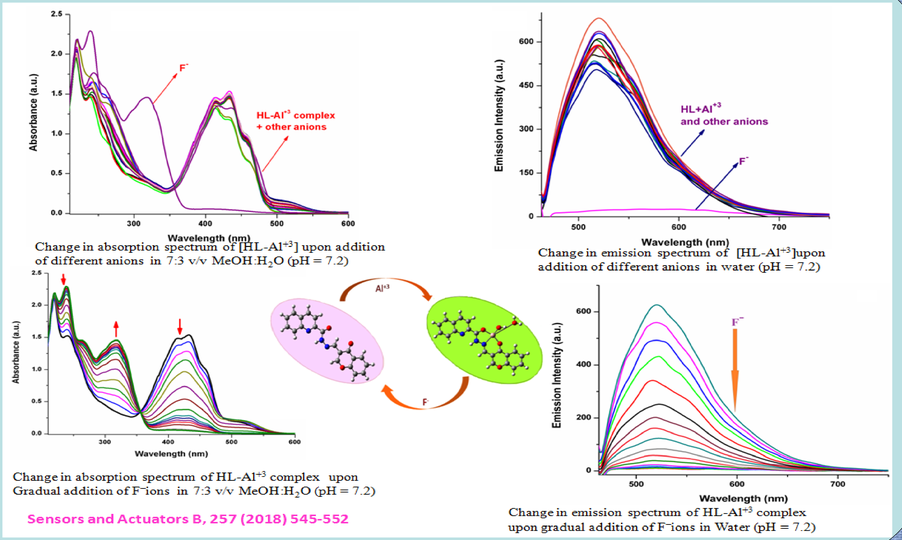
Synthesis of Chemosensors



Synthesis of probe , CRQh

Chromone appended hydrazide chemosensor

We have designed dual sensor which is capable to detect sequentially of probes in A chromone-quinolinyl hydrazide Schiff base probe(**CRQh**), quinoline-2-carboxylic acid (4-oxo-4H-chromen-3-ylmethylene)-hydrazide has been synthesized which acts as specific fluorogenic sensor to Al^{3+} in the visible light (438 nm) excitation in presence of biologically available cations and emission appears at (λ_{em}) 520 nm. The limit of detection (LOD) for Al^{3+} is 7.6 nM in aqueous medium which is less than 10^{-3} times of WHO recommended data (7.41 mM). The Job's plot and mass spectral data support 1:1 composition of the complex [Al(**CRQh**)(OH)H_2O][$(NO_3)_2$. The emission of Al^{3+}-complex turns off upon addition of F^- and is detected at the level of (LOD) 7.4 nM. Thus, F^-, a harmful water pollutant, could be identified at much lower level of WHO recommended toxic limit (3.68 μM). The absorption and emission spectral features of **CRQh** and its Al^{3+}-complex have been explained by DFT computation of optimized geometries and calculation of molecular functions. act as fluorescent sensors for metal ions including Al^{3+} ion.



Acknowledgment: We acknowledge Dr. Rakesh Purkait , Department of Chemistry, Jadavpur University for initial work and sharing.