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Abiotic Fluorescence Sensor for Aluminium ions

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Abstract

In the present mini review, couple of recent literature for the design and synthesis of artificial chemosensor for Al^{3+} is being incorporated. These are very efficient sensor in terms of strong binding affinity along with high detection limit.

Introduction

Aluminium is the third most abundant (8.3% by weight) metallic element in the earth. Various compounds containing Aluminium are immensely used in the different type of industry like, paper, in dye production, in the textile industry [1-3]. Aluminium salts are also used as a component for the preparation of many cosmetics and in alimentary industry [4,5]. Many drug molecules are also prepared using aluminium compounds for human and veterinary medication [6]. Among them, buffered aspirin containing aluminium glycinate is commonly used as an analgesic [7]. Accumulation of excessive amounts of this metal damages the kidney, central nervous system causing Parkinson's disease [8,9]. It reduces total bone and matrix causing osteoporosis, osteomalacia [10,11]. It also retarded plant growth and damage water body ecosystem by killing fish due to enhance acidity of the waters [12-14]. The maximum recommended limit by the FAO/WHO Joint Expert Committee on Food Additives for daily intake of aluminium is 3-10 mg per day per body mass. So aluminium ions have a very adverse effect on living organism when it crosses the permissible limit. Beside it is highly responsible for polluting soil, water and even ground water. The aluminum containing compounds present on earth surface are very much susceptible to any type of acidic contamination which may come from industrial effluent or rain water.

Therefore, development of convenient and selective methods for determination of Aluminium is highly desirable [10]. Several methods have been reported in the literature for the estimation and detection of Al^{3+} but the spectrofluorimetry procedure has received considerable attention in recent years due to its easily detectable signals upon recognition of metal ions with high sensitivity and selectivity [15-19]. Though there are numerous reports have been published but only couple of interesting examples are mentioned herewith. Sen et al. [20] has reported an imine based water soluble chemosensor and its application in living cell imaging (Figure 1). This probe performed sensing of Al^{3+} in physiological pH. Another probe based on pyrene-amno acid conjugate has been reported by Sun et al. [21]. This sensor is effective to detect both Al^{3+} and H^{+}. Beside there is some strong solvent effect during sensing process.

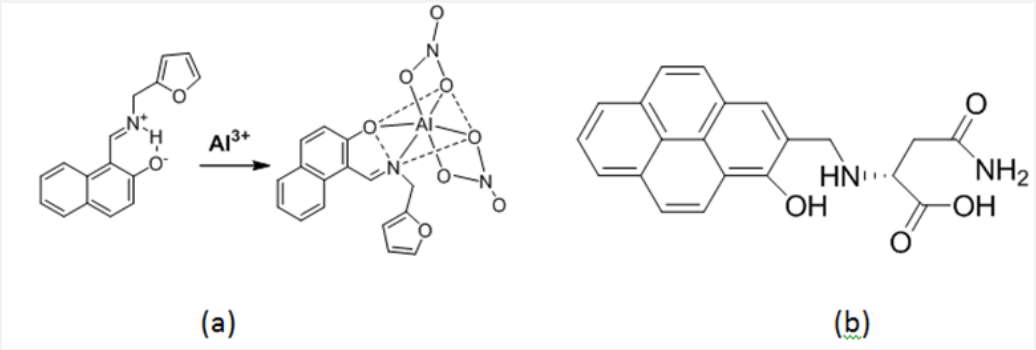

Figure 1: (a) Imine based chemosensor and its complex with Al^{3+} ion and (b) pyrene - amino acid conjugate chemosensor

The chelation enhanced fluorescence effect has been observed during the sensing of Al^{3+} by a tailor made pyridoxal hydrazone based receptor (Figure 2). This chemosensor shows very high association constant as well as high detection limit towards Al^{3+} [22]. Along with different chemosensor with wide variety of fluorophore rodamin B is an excellent tool for the designing of a different class of sensor with very high binding capabilities and detection limit [23]. Beside Maity et al. reported a pyrrolidine constrained bipyridyl-dansyl fluoroionophore for the sensing of Al^{3+} ion with very high binding affinity [24].

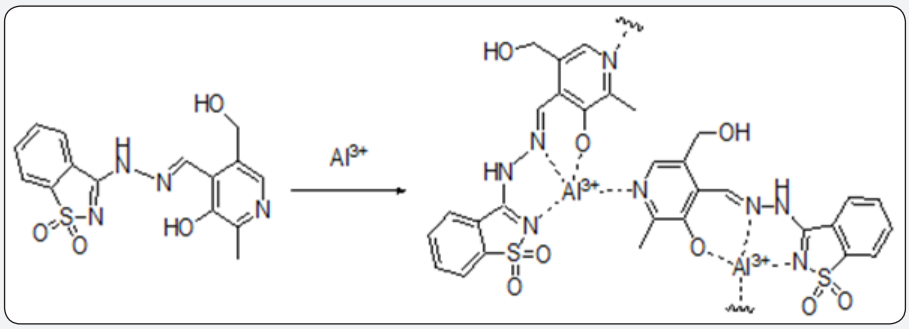

Figure 2 : Pyridoxal hydrazone based sensor and its interaction with Al^{3+}.

Conclusion

Aluminium ion has prominent role in different biochemical pathways and environmental issues. So design and synthesis of efficient chemosensor for Al^{3+} is a very important area of research and draw much attention from the scientific community. Though it is always very challenging for the researcher to design and synthesize a sensor which can work in either physiological or aqueous environment. Here couple of different sensor is being included though there is numerous reports for this purpose are omitted due to space.

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