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Synthesis, characterization and evaluation of fluorescent "turn on" sensors for Zn^{2+} for potential application as biosensors

Said Neme Sanchez
Pontifical Catholic University of Peru, Peru

Zinc is a known trace element and cofactor of more than 300 human metalloenzymes involved in many physiological processes. Moreover, its potential therapeutic activity for the treatment of various diseases is extensively investigated. However, many physiological and therapeutic mechanisms of action of zinc are not yet well understood, as the d^{10} configuration of Zn (II) hinders detection by usual spectroscopic techniques. In this sense, the development of fluorescent sensors for the detection of zinc constitutes a very active field of research. In addition, fluorescence as a signaling technique outstrips other techniques in terms of simplicity, sensitivity and selectivity. The present investigation proposed the synthesis and characterization of coumarin Schiff bases derived from 3-aminocoumarin, with a donor substituent at position 7. The purpose of using a Schiff base is that they have a non-radiant deactivation mechanism due to the isomerization of the C=N bond, which will be suppressed by complex formation. Also, the methoxy group at position 7 will increase the intensity of the emission and move the excitation wavelength to the visible which would avoid cellular damage in possible biological tests. The characterization of the sensors was performed by IR, 1H-NMR and ESI-MS. UV-Vis and fluorescence measurements were performed with a sensor solution in the presence and absence of Zn^{2+} at 25°C in a HEPES buffer. A significant enhancement of the emission in the presence of Zn^{2+} is observed and the intensity was increased more than 10-fold. Furthermore, Job's plot analysis revealed that the sensors form 2:1 (Ligand/metal) complexes with Zn2+. Likewise, excitation wavelengths in the visible range (450-490 nm) turn these Zn (II) sensors in attractive candidate for their use at a biological level.

said.neme@pucp.pe