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Selective Ionophore-Based Optical Sensor for Metal Ion measurement in Aqueous Environments

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Metals are ubiquitous. Aqueous environments can be contaminated by metal ion naturally and by human's activities. An over dose of metal ions has serious lethal effects on human health; the symptoms include bone disease, anaemia, brain damages and diabetes. The determination of heavy metals in the aquatic environment is of tremendous interest. The most common heavy metals which fulfil these criteria are iron, antimony, copper, nickel, lead, zinc, cobalt, and calcium (1).

Optical sensors have received greatest interest in the last decade for potential metal ion measurement in the aqueous environment due to its simplicity and remote applications. The application of a so-called ionophore which comprises a lipophilic ion carrier and a complexing agent capable of reversibly binding ions and transporting them across organic membranes, e.g. PVC, by carrier translocation, is an important improvement in optical sensing area (2).

This project involves the design of ion-selective optodes based on novel materials capable of selectively interacting with specific metal ions in aqueous solutions. Absorption spectrometry is the basic technique. The potential of optical sensing materials for determination of metal ions in a wastewater stream is presented. Promising results have been obtained by using chromophoric dyes: Acid Alizarin Violet N (AVN) with Fe^{2+} ,Fe^{3+}, 2-(5-Bromo-2-pyridylazo)-5-diethylaminophenol(Br-PADAP) with Cu^{2+} , Co^{2+} .2,6-Dichloro-3,3-dimethyl-4-hydroxy-3-sulfofuchson-5,5-dicarboxylic acid (CAS) with Fe^{2+}. The complexation of a novel compound 2-145 (Figure 1) with Fe^{2+} obtained new bands at pH 7 and 8 (Figure 2).

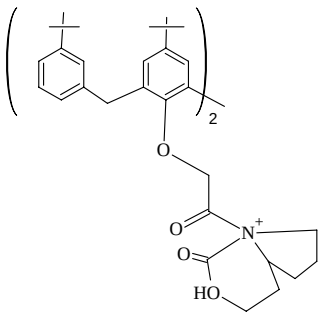

Figure 1. Novel sensing material 2-145.

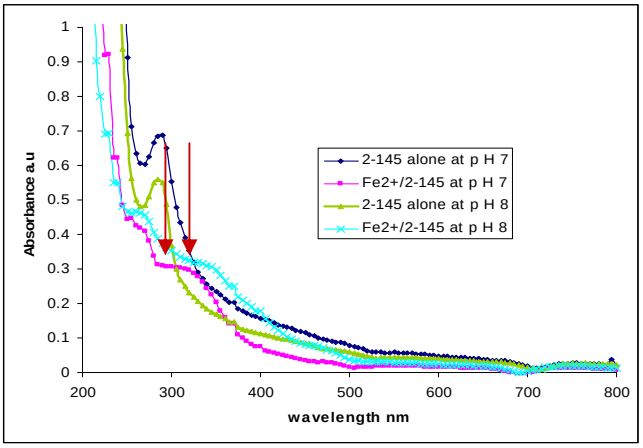

Figure 2. UV-Vis absorbance spectrum showing complexation of 2-145/ Fe^{2+} at pH 7&8.

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(1) J. Burgess, *Metal Ions in Solution*, Ellis Horwood Limited, 1978.
(2) I. Oehme, O. S. Wolfbeis, *Mikrochim. Acta*, 126 (1997) 177-192.