Use of polyamine compounds for the detection of metals such as cadmium, mercury and lead in waters

García-España E[1], García-España, L[2], Clares MP[1]

[1]Department of Chemistry. Universitat de València - Valencia, Spain

[2]Department of Plant Production. Universitat Politécnica de València - Valencia, Spain,

ABSTRACT

The study of the affinity of two types of polyamine ligands in sequestering heavy metals from water has been carried out. Cadmium, mercury and lead have been used as examples of water contaminants. The acid-base properties of the polyamines in aqueous solution have been characterized, the interaction of these receptors with the different cationic species by means of potentiometric, fluorometric, NMR techniques for their later application. The receptor Pytren-F is more selective for this metal than Tren-F.

INTRODUCTION

The isopropylamine salt of N-(Fosfono methyl) Glycina is a non-selective, systemic action herbicide of broad spectrum and suitable for the control of many weed species in postemergence treatments to foliage. It is indicated that it does not act on the seeds nor is absorbed by the roots, as well as it is not of prolonged residual action and that it is not or acts like soil sterilizing herbicide.

In this context the main objective of this work was to evaluate the effect of the aforementioned herbicide applied at different doses on earthworms and their different stages, as well as on the number and weight.

METHODOLOGY

The receptors used derive from the polyamine tris-2-aminoethylamine commonly known as TREN. This is joined by an aromatic group, fluorene, which is called TREN-F (tripodal ligand). If the TREN-F is cycled with an aromatic spacer, a scorpion-type ligand, PYTREN, is obtained, which is linked to the Fluorene aromatic unit. form the PYTREN-F.

Nuclear magnetic resonance (NMR) spectroscopy. The NMR spectra were carried out at a controlled temperature with Avance DRX Bruker 300MHz and Avance DRX Bruker 400MHz spectrometers. The 1 H-NMR spectra are recorded at 299.95 and 399.95 MHz and those of 13 C-NMR at 75.43 and 100.58 MHz, respectively. The solvents used were D2O and CHCl3. The 1 H-NMR spectra are referenced to the corresponding solvent signal, while for 13 C-NMR, dioxane (67.4 ppm) is used as external reference.

Fluorescence. Emission spectra were performed on a modular PTI fluorimeter with Xenon lamp. The geometry used was always at right angles. Transparent Hellma quartz cells were used on all 4 faces and thermostated at 25 +/- 0.1ºC. The data were corrected with the volume dilution necessary to adjust the pH (solutions of HCl and NaOH in water at different concentrations). Finally the data was normalized for a maximum emission of 1. Sabatini *et al.*, (1992); Czarnik, *et al.*, (1993), Bruno, *et al.*, (2002).

RESULTS

The pollution due to human activity agriculture, industry, land uses, has as a consequence that deep waters can not be used directly for human consumption since it is not purely biologically or chemically. The study of the affinity of two types of polyamine ligands in sequestering heavy metals from water has been carried out. Cadmium, mercury and lead have been used as examples of water contaminants. The acid-base properties of the polyamines in aqueous solution have been characterized, the interaction of these receptors with the different cationic species by means of potentiometric, fluorometric, NMR techniques for their later application.

Logarithms of the protonation and global basicity constants for PYTREN-F and TREN-F, determined at 298.1 ± 0.1 K in NaNO3 0.15 mol · dm-3 and NaNO3 0.15 mol · dm-3 Ethanol: water (30:70) respectively (Pina, et al., 2002).

By fluorimetry A) Variation of fluorescence intensity as a function of the pH of PYTREN-F-Pb (1: 1) (pH values: 2.08, 2.11, 2.51, 3.22, 3.70, 4.12, 4.66, 5.21, 5.72, 6.23, 6.79 , 7.21, 7.95, 8.57, 9.10, 9.62, 10.23, 10.95). B) Representation of the distribution diagram of species next to the maximum emission of the free ligand (•) and the ligand with Pb (II) (•). Representation of the distribution diagram of species next to the maximum emission of the free ligand (•) and the ligand with Pb (II) (•). Representation of the distribution diagram of species next to the maximum emission of the free ligand (•) and the ligand with Cd (II) (■).

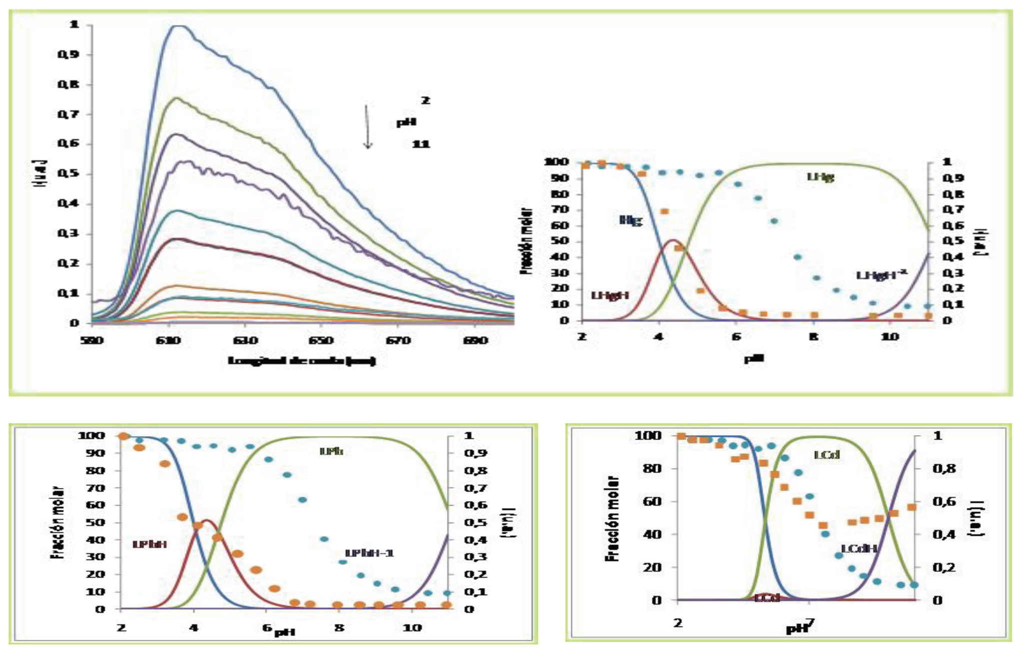
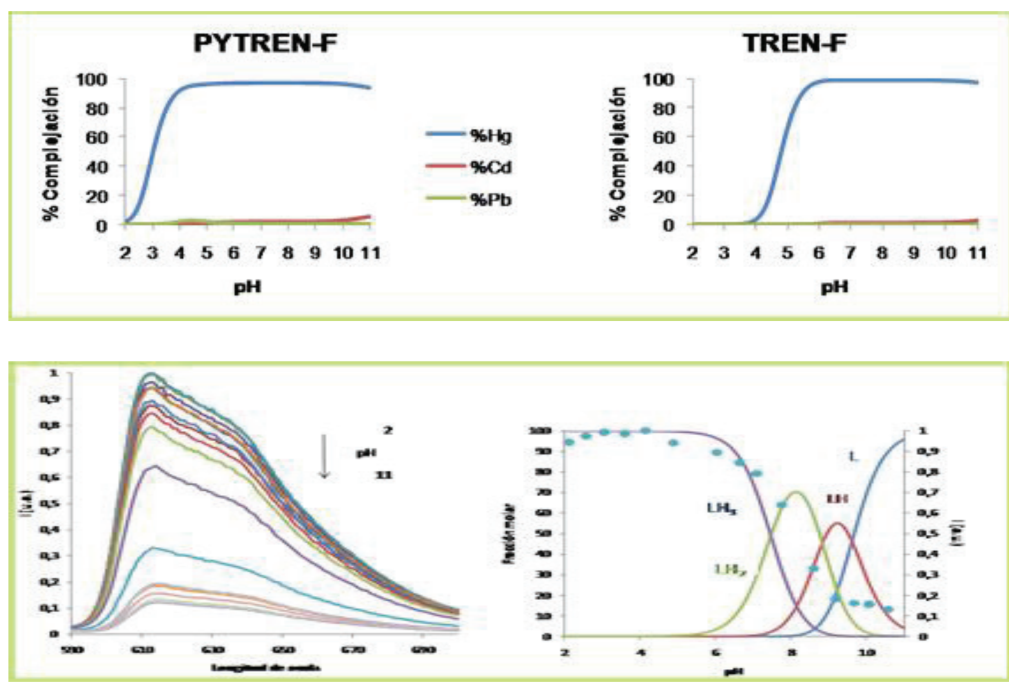


Fig. 1: A)Complexity VARIATION of the fluorescence emission spectra of PYTREN-F as a function of pH (pH values: 2.16, 2.51, 3.18, 3.67, 4.09, 4.55, 5.06, 5.56, 6.06, 6.57, 6.99, 7.6, 8.1, 8.6, 9.05 , 9.55, 10.45, 10.97). B) • Maximum fluorescence emission at 613 nm for the PYTREN-F receptor (excitation length = 285 nm



CONCLUSION

From the studies carried out with both receptors for the different metals, we can say that both the Pytren-f and the train -f interact with all the metals studied. Both receptors have greater affinity for Hg (II. Comparing the two ligands with Hg (II), Pytren-F is more selective for this metal than Tren-F.

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