

# determination of mercury(II) ions with a regenerative chemodosimeter

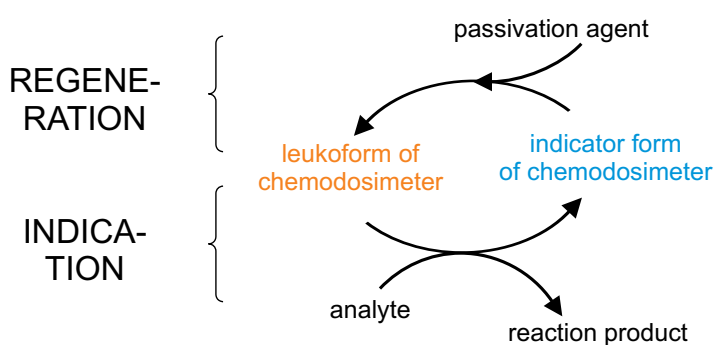
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## Introduction

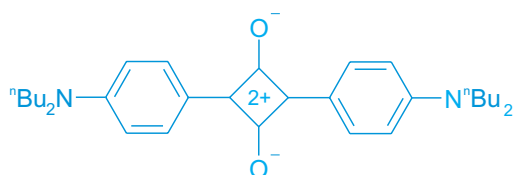
- Mercury(II) is one of the environmentally most important metal ions whose toxicity, even at very low concentrations, is a problem of primary concern.[1]
- The need for analytical methods for the sensitive and selective determination of mercury(II) is still of topical interest, especially when conventional techniques are not appropriate as for instance for many on-site or in-situ analyses or for rapid screening applications.
- For such purposes, devices like fibre optic-based (pocket) instruments or test strips play a leading role, in particular employing indicator molecules to signal the analyte's presence.[2]
- When attempting a highly specific indication reaction, an attractive approach is the use of chemodosimeters, i.e., indicator molecules that undergo a specific chemical reaction with the target species, yielding a fluorescent or coloured product.[3]
- The disadvantage of dosimeters, that the reactions are mostly irreversible and they often constitute disposable assays, will be overcome here by the design of a regenerative chemodosimeter.[4]

## Idea

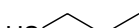


## Experimental

Squaraine  
indicator dye:

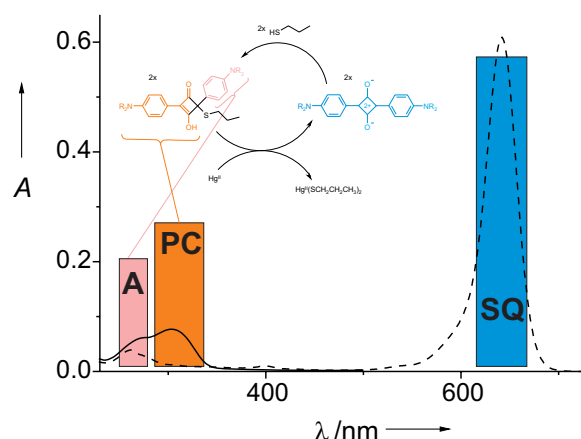


Propanethiol  
passivation agent:

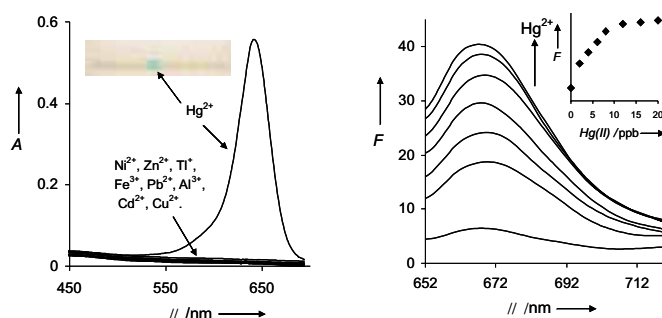


- Formulation: indicator dye is physisorbed onto powdered silica which is fixed on a polyethylene-terephthalate film
- Instrumentation: conventional spectrophotometer and fluorometer
- Conditions: pH 9.6, 0.01 M CHES buffer

## Results



- The analytical cycle: Hg<sup>2+</sup>-induced formation of blue squaraine (SQ) and regeneration of leukoform by reaction with propanethiol.
- Absorption spectra of leukoform (—, with two subchromophores) and SQ (---) before and after the reaction with Hg<sup>2+</sup>.



- Absorption spectra of leukodye (6 μM) upon addition of 0.5 eq. of metal ion. Photo (fr. left to right): Ni<sup>2+</sup>, Zn<sup>2+</sup>, Tl<sup>+</sup>, Fe<sup>3+</sup>, Pb<sup>2+</sup>, Al<sup>3+</sup>, Cd<sup>2+</sup>, Cu<sup>2+</sup>, none.
- Fluorescence titration spectra of leukodye (0.1 μM) with Hg<sup>2+</sup> (exc = 642 nm). Inset: titration curve from emission intensities at 670 nm.

## Future Work

- Commercialization is currently in progress.
- The concept will be developed for other analytes.

## Literature

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- I. Murkovic, O. S. Wolfbeis, *Sens. Actuators B* 1997, 39, 246.
- V. Dujols, F. Ford, A. W. Czarnik, *J. Am. Chem. Soc.* 1997, 119, 7386.
- J. V. Ros-Lis, M. D. Marcos, R. Martínez-Máñez, K. Rurack, J. Soto, *Angew. Chem. Int. Ed.* 2005, 44, 4405.

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