Application of a potential Fluorescence Resonance Energy Transfer (FRET) method sensing combining CdTe quantum dots and Au nanoparticles for the determination of relevant analytes

conferenceseries.com

Julia Jiménez-López[1], S.Sofia M. Rodrigues[2], David S. M. Ribeiro[2], João L. M. Santos[2], Pilar Ortega-Barrales[1], Antonio Ruiz-Medina[1]

[1] Department of Physical and Analytical Chemistry, Faculty of Experimental Sciences, University of Jaén, Campus de las Lagunillas, E-23071 Jaén, Spain

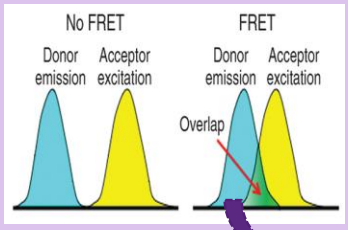
[2] REQUIMTE, Laboratory of Applied Chemistry, Department of Chemical Sciences, Faculty of Pharmacy of Porto University, Rua Jorge Viterbo Ferreira, 228, 4050-313 Porto, Portugal

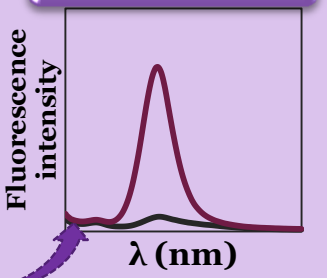
Introduction and Aim

This work was focused on the study and analytical exploitation of the fluorescence resonance energy transfer (FRET) process between mercaptopropionic acid (MPA)-capped CdTe quantum dots (QDs) and cysteamine (CS)-capped Au nanoparticles. In the developed system, selected target analytes were capable of interacting with either the CdTe QDs, acting as energy donors, or the Au nanoparticles (AuNPs), behaving as energy acceptors, yielding a concentration-related modulation of the FRET efficiency between both nanoparticles.

Distinct mechanisms, involving modification of the QDs quantum yield (QY), AuNPs agglomeration, nanoparticles detachment, etc, could be proposed to explain the referred FRET modulation. The proposed approach confirmed a great prospective for implementing rapid, simple and reliable sensing methodologies for the monitoring of relevant pharmaceutical, food and environmental species. Moreover, it shows a great analytical versatility since it is possible to easily adapt the surface chemistry of both QDs and AuNPs to the chemical nature of target analytes.

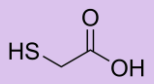
Mechanism



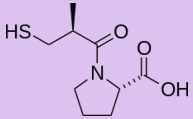


Oppositely charged MPA-CdTe QDs and CS-Au NPs can form FRET donor–acceptor assemblies due to electrostatic interactions, resulting in effective quenching of QDs emission, while all studied thiols can induce the aggregation of CS-AuNPs accompanied with the absorption spectral changes.

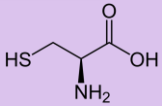
Studied analytes



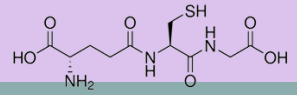
Thioglycolic acid



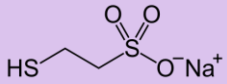
Captopril



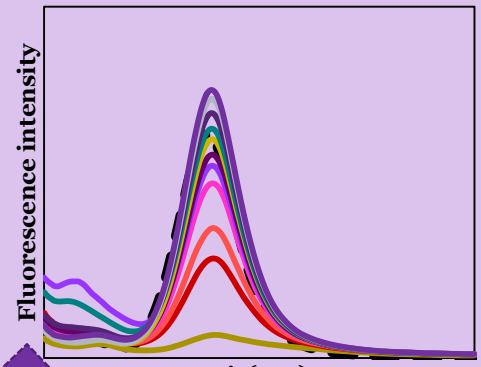
L-Cysteine



L-Glutathione



Sodium 2-mercaptoethanesulfonate



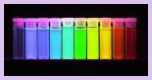
Example: QDs+ Au NPs + Captopril

QDs

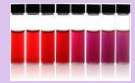
QDs + Au NPs

QDs + Au NPs + 10 uL captopril

Different colors → + different amounts captopril



Distance < 10 nm



Acknowledgements: This study was funded by the "Ministerio de Economía y Competitividad" (grant number CTQ2016-7511-R).