Projecte de Treball Fi de Grau (TFG)

Grau de Química
Universitat de Barcelona

Títol	**Disseny de nanopartícules de sulfur de bismut i d'òxid de ferro mitjançant rutes químiques per diagnosi per la imatge**
Title	**Design by chemical routes of bismuth sulfide and iron oxide nanoparticles for imaging diagnosis**

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Tutor empresa	
Empresa	

Curs	**2019-2020**	**Semestre**	**1**

Summary

Magnetic resonance imaging (MRI) and X-Ray Computed Tomography (CT) are among the most powerful diagnosis imaging techniques to detect cancer at early stages. Both techniques use compounds or nanomaterials to enhance the contrast of the image in human tissues. The obtention of hybrid nanoparticles operative in both MRI and CT and with a good control of the structure is still a great challenge. Here, we propose to develop a synthesis method to obtain hybrid structures formed by bismuth sulfide and iron oxide nanoparticles by chemical routes using inert atmosphere. Thereafter, a preliminar characterization will be perform to elucidate the insights of the structural, optical and magnetic features of these systems. Finally, the most suitable samples will be redispersed in aqueous media by a ligand exchange strategy.

Keywords	**Colloidal chemistry, bismuth sulfide@ iron oxide nanoparticles, Magnetic Resonance Imaging, X-Ray Computed Tomography**

Breu descripció del projecte

Early diagnosis of cancer usually increases the chances for a successful treatment. Currently, the most powerful diagnosis imaging are MRI and CT. Both techniques generally use contrast agents to enhance the imaging contrast of human body tissues. Despite the great variety of commercial MRI and CT contrast agents, there is a lack of contrast agents that work successfully in both techniques.

Iron oxide nanoparticles have been extensively used as contrast agents in MRI because their unique properties such as ease to be prepared and stabilized in aqueous media, excellent biocompatibity and a fast magnetic response to an external magnetic field.[1] In addition, one can take advantage of their versatile chemical behavior to form hybrid nanoparticles operative in both MRI and in CT.[2]

In this project, the student will work tuning the size, the shape and the composition of hybrid nanoparticles formed by bismuth sulfide and iron oxide particles through colloidal chemistry in a Schlenk line. Nanoparticles will be prepared by the thermal decomposition of metalorganic precursors in an organic media using oleic acid as surfactant. The student will also contribute to the structural and magnetic characterization of these systems. Next, these hybrid nanoparticles will stabilize in aqueous media by using Dimercaptosuccinic acid (DMSA) and a ligand exchange strategy.

1- G . Kandasamy, D. Maity. Recent advances in superparamagnetic iron oxide nanoparticles (SPIONs) for in vitro and in vivo cancer nanotheranostics. *International Journal of Pharmaceutics*, 30, 291, 2015.

2- Y. Hu, S. Mignani, J.-P. Majoral, M. Shen and X. Shi. Construction of iron oxide nanoparticle-based hybrid platforms for tumor imaging and therapy. Chem. Soc. Rev., 47, 1874, 2018.

Breu descripció del grup

The Group of Magnetic Nanomaterials (https://magneticnano-materialsub.wordpress.com/) has more than twenty five years of experience in the synthesis and characterization of nanomaterials for technological (and Health) applications. Our group has a full equipped lab specialized in the preparation of particles by chemical routes with a Glovebox and Schenk line to work under inert atmosphere, suitable set-ups and a temperature controller to have a full control of the particle reaction profile.

Competències addicionals
We are looking for motivated students, good team workers and with excellent English skills who want to join a multidisciplinary and dynamic group

Tasques a desenvolupar		Cronograma (setmanes)																	
Tasca	Descripció	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16	17	18
T01	Tunning the estructural features of iron oxide@bismuth sulfide nanoparticles through the rational study of the reaction parameters	x	x	x	x	x	x	x	x	x	x	x							
T02	Structural, Optical and Magnetic characterization		x	x	x	x	x	x	x	x	x	x	x	x	x	x			
T03	Stabilization of NPs in water media by the Surface functionalization with DMSA												x	x	x	x			
T04	Project final report															x	x	x	x
T05																			
T06																			
T07																			
T08																			
T09																			
T10																			