7th Brazil-Spain Workshop on Organic Chemistry

BSWOC 2023

Ribeirão Preto - SP, Brazil
July 10-12, 2023

Bicolor Fluorescent Sensors for Barium Tagging in the Neutrinoless Double Beta Decay Reaction of Xe-136

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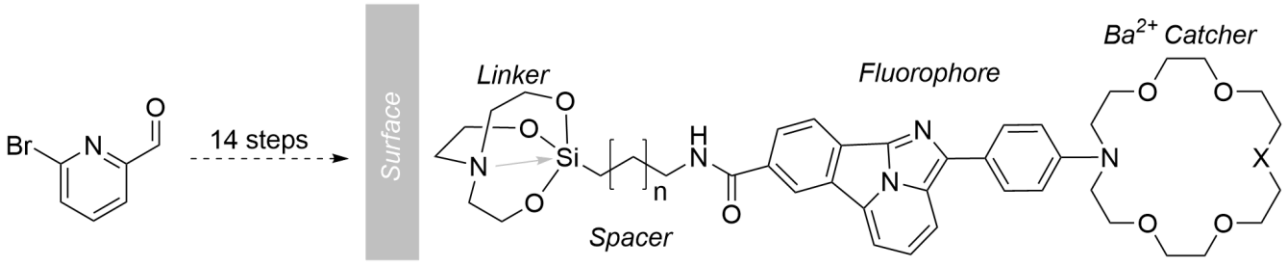
Keywords: *Cycloadditions, C-C Coupling, Fluorescence, Neutrinos.*

ABSTRACT

Neutrinoless double beta decay (*bb0n*) processes constitute a very promising method to find out whether neutrinos are they own antiparticles. Demonstrating this hypothesis would constitute a major discovery in physical sciences and cosmology. One useful *bb0n* nuclear reaction involves the Xe-136 isotope and leads to the emission of two electrons, whose drift and energy can be recorded, together with a barium cation. Therefore, the second essential component to monitor this reaction is the BTD (Barium Tagging Detector). The BTD must incorporate a fluorescent sensor [1] whose photophysical properties are adequate to distinguish the free and Ba^{2+}-bound states, thus giving rise to a bicolor fluorescent indicator (FBI) potentially useful for barium tagging [2,3]. The different emission spectra of the free and coordinated states stem from the decoupling between the aromatic components of the fluorophore after barium capture.



Scheme 1. Basic components of bicolor fluorescent sensors for barium tagging in bb0n experiments.

The basic components of our FBI molecules (Scheme 1) are an aza-crown ether to catch Ba^{2+}, a coupled fluorophore incorporating aromatic rings whose photophysical properties are different at the free and bound states, a spacer and, finally, a linker to anchor the sensor to a suitable functionalized surface. In our presentation, details about the chemical synthesis and properties of these FBI sensors will be discussed, as well as the suitability of these FBI sensors for barium tagging experiments in bb0n reactions.

ACKNOWLEDGEMENTS

The following agencies and institutions supported the present work: the European Research Council (ERC-2020-SyG 951281), the Spanish MICINN (PID2019-104772GB-100, RED2018-102387-T) and the Basque Government (IT-1553-22).

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