

Synthesis and application of novel BODIPYs derivatives as fluorescent probes for detecting analytes from biological and environmental samples

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Highlights

New BODIPYs were synthesized and studied as fluorescent sensors in solution and solid state. Applicability was successfully demonstrated in real samples (cells, urine samples, organic reaction medium, etc).

Abstract

In this work, we will present our most recent research results on the synthesis and application of new BODIPYs derivatives as fluorescent sensors.¹⁻⁶ Synthetic strategies for chalcogen functionalization have been developed through reactions of Aromatic Nucleophilic Substitutions of halogenated derivatives and Aromatic Electrophilic Substitution reactions, originating highly functionalized derivatives.^{1,3-5} Studies using BODIPYs as sensors for selective detection of biothiols by fluorescence in HeLa cells⁴ and in urine samples¹ will be presented, showing the efficacy of the new sensors for distinguishing these analytes in biological media, in a turn-on fluorescence process. A mechanistic study was conducted, and it was possible to verify that the reaction of BODIPY with cys occurs through a nucleophilic attack of thiol group followed by a rearrangement step resulting in an amino-BODIPY, while in the reaction with GSH the rearrangement step does not apply, resulting in spectral differences of the products obtained.^{1,4} The results obtained from the BODIPY derivative as a fluorescent sensor for CN⁻, F⁻, and OH⁻ will also be presented, showing low detection limits and high fluorescence quantum yields.³ In addition, a selective sensor for palladium was also developed, demonstrating its applicability in real samples from palladium-catalyzed coupling reactions through studies in solution and in the solid state⁶, in colorimetric and fluorimetric way. The applicability of several polymeric films doped with BODIPYs for use as solid-state temperature sensors and ammonia sensors will also be demonstrated. Quantification was performed through fluorescence emission spectra and RGB color parameters extracted from photographic images. Applications for ammonia detection have also been demonstrated in aqueous solutions, using polymeric particles of PMMA and TPU doped with BODIPYs.² Thus, this work aims to demonstrate the diversity of applications of the new BODIPYs as biomarkers and sensors for detecting analytes of biological and environmental interest.⁵

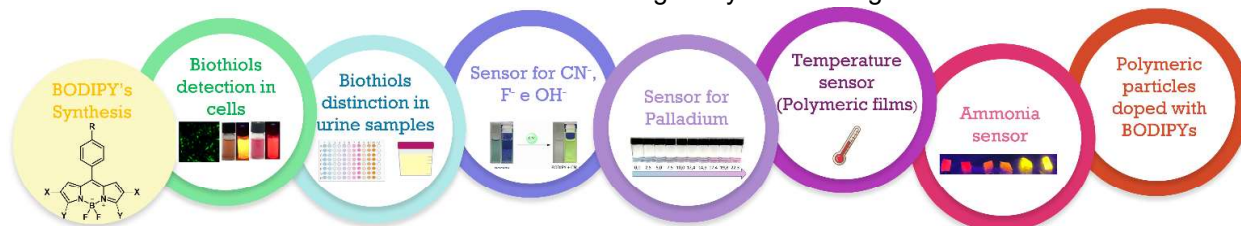


Figure 1. Graphical summary of applications of BODIPY derivatives as sensors for various analytes.¹⁻⁶

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