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Red fluorescent BODIPY molecular rotors for lifetime-based sensing of microviscosity

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Microscopic viscosity, also known as microviscosity, is an essential biological property that can provide information about intracellular processes, such as: biomolecular diffusion, cellular changes, indication of cell death or the development of various conditions, e.g. Alzheimer's disease [1]. Fluorescent molecular rotors provide a simple and effective way to visualise microviscosity in live cells using Fluorescence Lifetime Imaging Microscopy (FLIM). BODIPY-based conjugates are very popular for imaging microviscosity due to their easy wavelength tunability, non-toxicity and monoexponential fluorescence lifetime, which greatly facilitates data interpretation. It is important to know that biological samples are usually thick, therefore fluorophores with a long wavelength are required. Consequently, a well-established green fluorescent BODIPY molecular rotor must be modified to shift its spectra to longer wavelengths while maintaining viscosity sensitivity [2].

In this work [3], we show how β-phenyl and β-vinyl groups on the BODIPY core can help to obtain a red fluorescent probe suitable for a microviscosity study. The investigation consists of density functional theory calculations, absorption and fluorescence spectra, as well as fluorescence lifetime and quantum yield analysis. Furthermore, we show that the nitro-substituted red fluorescent BODIPY probe with β-phenyls can be used for live cell imaging by FLIM [4].

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