

# Universal Buffer: a powerful tool to investigate the impact of pH on photophysical and (photo)chemical properties from pH 1.9 to 12.

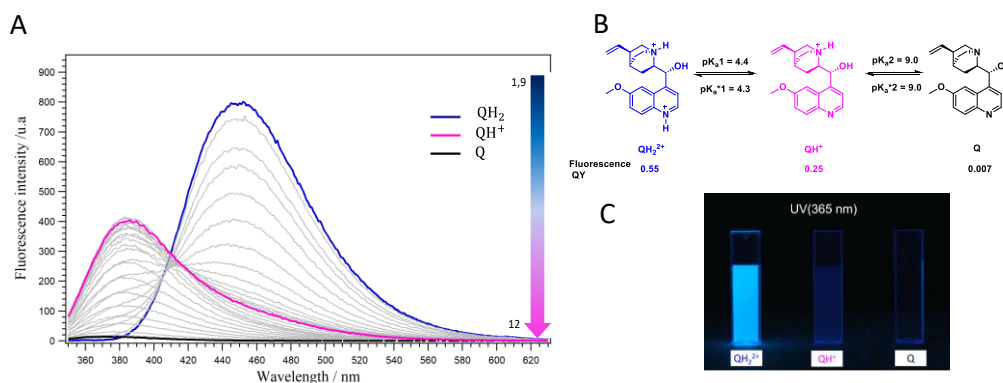
**Jonathan Piard<sup>1</sup>**

<sup>1</sup>DER chimie, ENS Paris-Saclay, 4 avenue de sciences, 91190, Gif-sur-Yvette

Email: Jonathan.piard@ensparis-saclay.fr

pH can impact a wide range of (photo)chemical (kinetics, thermodynamics or quantum yield...) or photophysical properties (absorption, emission...). We proposed to present an easy, fast and reproducible new method to tune with a very high precision pH value from 1.5 to 13 based on a so-called Universal Buffer. The latter is made of acetic acid, phosphoric acid and boric acid at 0.04 mol.L<sup>-1</sup>. To ensure the efficiency and reliability of our procedure, we used it to determine the pK<sub>a</sub> value(s) for a series of indicators from sulfonephthalein derivatives [1] to azonaphthalen derivatives [2]. For BTB (BromoThymol Blue) impressive results were obtained (R<sup>2</sup> = 0,9999) and a pK<sub>a</sub> of 7.13 ± 0.01 was found in perfect agreement with literature (7.1).

In addition, our procedure was applied to fluorescent compounds such as Quinine, Eosin Y, Rhodamine B and Riboflavine. For Quinine, absorption and emission properties (fluorescence quantum yield, absorption and emission spectrum) of the three acido-alkali forms (QH<sub>2</sub><sup>2+</sup>, QH<sup>+</sup> and Q) were obtained (Figure 1) as well as pK<sub>a</sub> and pK<sub>a</sub>\* and compared to the literature<sup>3</sup>. Potential applications in research can be also mentioned.



**Figure 1.** Series of fluorescence spectra from pH 1.9 to 12 for quinine. (B) Chemical structures, fluorescence quantum yield, pK<sub>a</sub> and pK<sub>a</sub>\* and (C) image in the universal buffer under UV (365 nm) of the three acido-alkali forms of quinine

- (1) BI, Ran; BRION, Aurélien; PERRIN, Rémi; DORÉ, Clément; CLAVIER, Gilles; Piard, J.; L.Shi. Utilisation d'un Tampon Universel pour l'étude d'indicateurs colorés Acido-Basiques (Par Spectrophotométrie UV-Visible). *Bulletin de l'Union des Physiciens* **2019**, 1014, 559–601.
- (2) BI, Ran; BRION, Aurélien; PERRIN, Rémi; DORÉ, Clément; Piard, J.; L.Shi. Utilisation d'un Tampon Universel Pour l'étude d'indicateurs Colorés Acido-Basiques (Par Spectrophotométrie UV-Visible). *Bulletin de l'Union des Physiciens* **2019**, 1015, 661-.
- (3) Article Accepted. *Bulletin de l'Union des Physiciens*.