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Development of fluorimetric chemosensor for GBL detection in saliva and beverages

Jordi Roig [1,2] Carlos Herrera,[1,2] Salvador Gil, [1,2,3] Jose A. Sáez[1,2], Pablo Gaviña [1,2,3]
[1]Instituto Interuniversitario de Investigación de Reconocimiento Molecular y Desarrollo Tecnológico (IDM), Universitat Politècnica de València, Universitat de València, Spain
[2]Departamento de Química Orgánica, Universidad de Valencia,Doctor Moliner 50, 46100,Burjassot, Valencia, Spain
[3]CIBER de Bioingeniería, Biomateriales y Nanomedicina (CIBER-BBN), Spain

jordi.roig@uv.es

Summary:
γ-butyrolactone (GBL), a substance commonly used in various industries, has gained notoriety as a drug-facilitated sexual assault (DFSA) agent due to its rapid conversion to γ-hydroxybutyric acid (GHB) in human metabolism. The increasing illicit use of GBL has led to the development of assays for its rapid detection, thereby stimulating interest in optical sensors able to detect it. Herein we present a new fluorescent chemosensor that has been developed for the fast and reliable detection of GBL in saliva and soft drinks as well as alcoholic beverages.

Keywords: GBL, optical chemosensor, GHB, naphthoxazole, fluorescein

Background, Motivation and Objective

γ-butyrolactone (GBL) is a chemical substance that is commonly used as a solvent or additive in the manufacture of fertilizers, herbicides and pharmaceuticals. In recent years, it has been employed as a drug-facilitated sexual assault (DFSA) agent [1]. Following its oral intake, GBL is rapidly metabolized into γ-hydroxybutyric acid (GHB), one of the most used drugs in chemical submission assaults due to its sedative effect on the body [2]. The increasing illicit use of GBL has prompted us to develop simple yet sensitive assays for its in situ detection in alcoholic and soft drinks, as well as in biological matrices such as saliva.
Previously, we reported two new optical probes based on the naphthoxazole core to detect GHB in real-time in real samples of soft drinks and alcoholic beverages and saliva [3]. This discovery prompted us to design a fluorescent chemosensor to further increase the sensitivity and selectivity in the detection of GBL in saliva and in alcoholic beverages. The chemosensor is based on a fluorescein derivative in which a naphthoxazole ring is present.

Description of the New Method or System

To synthesize this new fluorescent chemosensor, 3-Amino-2-naphthoxazole was reacted with fluorescein-5-isothiocyanate and triethylamine to form the corresponding thiourea. Next, tetrabutylammonium iodide and hydrogen peroxide were added to form the corresponding 2-aminonaphthoxazole (see **Figure 1**).

The application of basic medium results in the activation of the lactone present in the fluorescein moiety of the new chemosensor, thereby initiating the generation of a fluorescent signal. From there, the acid-base properties of GBL are harnessed to induce a quenching of the fluorescence of the chemosensor (see **Figure 2**).

Results

The detection of GBL was conducted in aqueous media, saliva, and soft drinks/alcoholic beverages. A qualitative detection limit could be established visually in both aqueous media and saliva. Furthermore, optimal conditions for the detection of GBL in alcoholic beverages have been identified.

Illustrations, Graphs, and Photographs

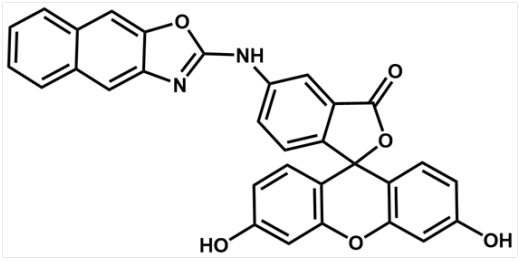

Fig. 1. Structure of the fluorescent chemosensor used in the detection of GBL.

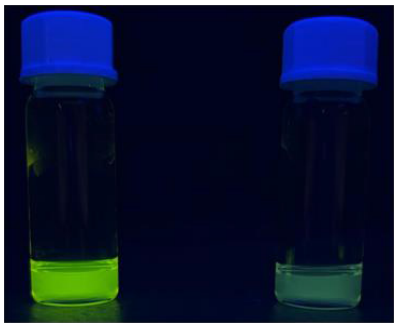

Fig. 2. ON-OFF fluorescence change observed under UV light of the chemosensor in the presence of GBL.

References

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