Conjugated Polymer Based Platform for Ultra-Sensitive and Selective Detection of Nitroexplosive – TNT

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CPs have been explored for sensing many vital analytes. It is their remarkable photophysical properties such as tunable broad absorption, high photoluminescence (PL) quantum yield, and ultrasensitivity due to the "Molecular Wire Effect", which makes them ideal for sensing applications [1]. Hence, few CPs have been reported for TNT sensing. Yet, many of them suffer from issues of sensitivity, selectivity, portability, and poor solubility in aqueous detection medium. [2,3] Moreover, achieving a limit of detection (LOD) covering the safety limit of TNT in drinking water has also remained elusive.

A rare combination of dual static and dynamic fluorescence quenching mechanisms is reported, while sensing the nitroexplosive trinitrotoluene (TNT) in water by a cationic conjugated copolymer PFPy. Since the fluorophore PFPy interacts with TNT in both ground state as well as the excited states, a greater extent of interaction is facilitated between PFPy and the TNT, as a result of which the magnitude of the signal is amplified remarkably. The existence of these collective sensing mechanisms provides additional advantages to the sensing process and enhances the sensing parameters, such as LoD and highly competitive sensing processes in natural water bodies irrespective of the pH and at ambient conditions. These outcomes involving dual sensing mechanistic pathways expand the scope of developing efficient sensing probes for toxic chemical analyte and biomarker detection, preventing environmental pollution and strengthening security at sensitive locations while assisting in early diagnosis of disease biomarkers.

KEYWORDS: Conjugated Polymer, Chemical Sensor, TNT, Explosives Detection, Fluorescence Quenching Assay

References

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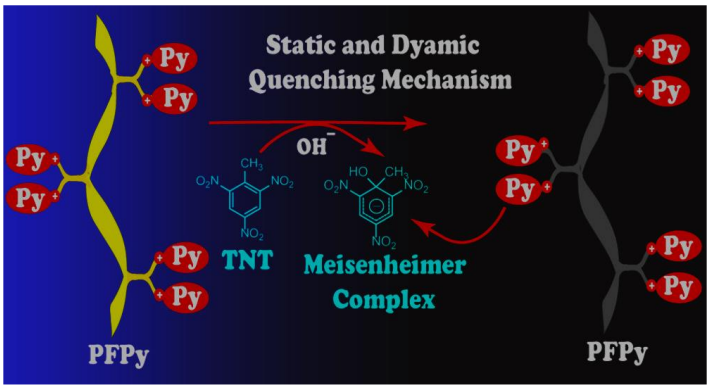

Figure 1 Illustrates ultrasensitive detection of TNT via a fluorescent conjugated ionic polymer with an occurrence of rare combination of both static and dynamic quenching mechanisms.