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Selective TNT fluorescent sensor from benzimidazole-isoquinolinone derivatives

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Three new pyrene-substituted benzimidazole-isoquinolinones which are different in the positions and numbers of the pyrene groups are designed and synthesized via imidation-condensation reaction and Suzuki coupling. The compounds are fully characterized by spectroscopic and spectrometric techniques. Interestingly, these compounds exhibit Aggregation-Induced Emission Enhancement (AIEE) in highly aqueous THF media and selective fluorescent quenching towards trinitrotoluene (TNT). The compound with two pyrene units has the best selectivity towards TNT and has a quenching efficiencies (Ksv) of 60,000 M-1, which leads to the estimation of the detection limit of 0.25 ppm TNT. The sensing mechanism involves the - interaction between the pyrene moieties and electron-poor TNT. In addition, the solid-state sensors are prepared by pipetting a solution of this sensor into 1-cm circular fluid reservoirs patterned by wax-printing technique on a piece of filter paper. The easy-to-use sensor can readily detect TNT in aqueous media by naked-eye observation at the concentration as low as 50 μM. It can also detect TNT vapor in closed chamber within 5 minutes of exposure at room temperature.

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