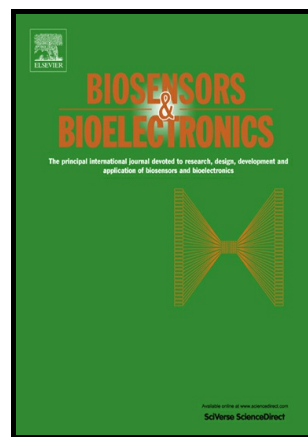


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An efficient ratiometric fluorescence sensor based on metal-organic frameworks and quantum dots for highly selective detection of 6-mercaptopurine

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Abstract

The development of a simple and accurate quantitative method for the determination of 6-mercaptopurine (6-MP) is of great importance because of its serious side effects. Ratiometric fluorescence (RF) sensors are not subject to interference from environmental factors, and exhibit enhanced precision and accuracy. Therefore, a novel RF sensor for the selective detection of 6-MP was developed based on a dual-emission nanosensor. The nanosensor was fabricated by combining a blue-emission metal-organic framework (MOF) NH₂-MIL-53(Al) ($\lambda_{em} = 425$ nm) with green-emission 3-mercaptopropionic acid-capped CdTe quantum dots (MPA-CdTe QDs) ($\lambda_{em} = 528$ nm) under a single excitation wavelength (335 nm). Upon addition of 6-MP, the fluorescence of NH₂-MIL-53(Al) in the nanohybrid was selectively quenched due to strong inner filter effects, while the fluorescence of the MPA-CdTe QDs was enhanced. The novel RF sensor exhibited higher selectivity towards 6-MP than CdTe QDs alone, and higher sensitivity than MOFs alone. 6-MP could be detected in the range of 0-50 μ M with a detection limit of 0.15 μ M (S/N = 3). The developed sensor was applied for the determination of 6-MP in human urine samples and satisfactory results were obtained. Overall, a novel and efficient fluorescence-based method was developed for the detection of 6-MP in biosamples.

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