DEVELOPMENT OF NANOMATERIAL BASED FRET SENSOR FOR ENVIRONMENT PROTECTION

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Abstract: By 2025, when world population is projected to be 8 billion, improving living standards without destroying the environment is a global challenge. Environmental pollution has been a major concern of today’s society. The environmental issues are complex due to the variety in contamination sources, the chemical composition of the contaminants, the environmental transport pathways, the effects on the natural environment and human health, the diversity of diseases, and the genomic responses to the polluted environment. Water pollution caused by fecal contamination is a serious problem due to the potential for contracting diseases from pathogens. Frequently, concentrations of pathogens from fecal contamination are small, and the number of different possible pathogens is large. As a result, it is not easy to test for pathogens in every water sample collected. The benefits of nanotechnology make it ideal for sensor development, for environmental and biological monitoring as well as for linking exposure, disease, and susceptibility. Their extremely small size enables them to access a variety of biological environments; their size also endows them with valuable size dependent properties that can be exploited in applications. Finally, their large surface areas are platforms for engineering multifunctional systems capable of recognizing and responding to disease states. Here we will discuss how you are using gold nano-particle based miniaturized, inexpensive and battery operated ultra-sensitive fluorescence resonance energy transfer (FRET) probe for screening toxic pathogens DNA in femtomolar level. Driven by the need to detect trace amount of mercury from environmental samples, here we will present gold nano-particle based miniaturized, inexpensive and battery operated ultra-sensitive fluorescence resonance energy transfer (FRET) probe for screening mercury levels in contaminated soil, water and fish which has excellent sensitivity (2 ppt) and selectivity for Hg$^{2+}$ over competing analytes, with the largest fluorescence enhancement to date for sensing Hg$^{2+}$ in environmental samples (1100-fold). The sensitivity of our probe to detect mercury level in soil, water and fish is about 2-3 orders of magnitude higher than the EPA standard limit. We will demonstrate that our probe is suitable to screen amount of mercury in different commercial fish, shellfish and water from different sources.

Keywords: Nano-sensor, FRET, pathogen detection, mercury detection

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