Charge-transferrable Nano-Assembled Probes for Second Near-infrared Tumor Imaging and Biosensing

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Currently, optical molecular imaging has been quickly recognized as an effective platform to comprehensively evaluate the essential biomolecules including DNA, RNA, proteins and metabolites in diseases management, and more importantly, it can improve every aspect of precise diagnosis and treatment in clinical practice.[1] Among the various imaging modalities, the emerging technique of photoacoustic imaging (PAT), especially in the near infra-red (NIR) window, enables high resolution, deep-penetration and clinically reliable sensing, which thus attract considerable interests in industry and clinics, however, by right, only few contrast agents are available that can specifically respond to intricate biological environments, and which are biodegradable and biocompatible. Recently, we introduce a new class of pH-sensitive organic photoacoustic contrast agents that operate in the second NIR window (NIR-II, 960–1,700 nm), which are derived from the self-assembled charge-transferrable nano-complexes (CTN) and their dication structure (TMB++)[2-4]. Such unique NIR-II-responsive nano-complexes can not only specifically respond to micro-environment in the physiological range and thus allow noninvasive and sensitive visualization of the tumor status in living mice with higher signal-to-noise ratio.[5] But also, such CTN nanocomplexes can function as NIR-II absorption-based photo-thermal-responsive colorimetric biosensor for anti-interference onsite dietary Myr enzyme determination and realization of rapid visualized outputs with the aid of smartphone calculation. Furthermore, the CTN nanocomplexes are biodegradable under physiological conditions, which can greatly alleviate the biosafety concern of nanoparticle accumulation in vivo. These nano-assemblies show the great potential as a promising environmental responsive and biodegradable molecular probe for specific tumor PAT imaging and high throughput food products screening in the NIR-II region.

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