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Biologically-Inspired Selective and Sensitive Trinitrotoluene Sensors Using Conjugated Lipid-like Polymer Nanocoatings for CNT-FET Sensors

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Miniaturized sensors capable of both sensitive and selective real-time monitoring of target analytes are tremendously valuable for various applications ranging from hazard detection to medical diagnostics. The wide-spread use of such sensors is currently limited due to insufficient selectivity for target molecules. We developed selective nanocoatings by combining trinitrotoluene (TNT) receptors bound to conjugated polydiacetylene (PDA) with single-walled carbon nanotube-field effect transistors (SWNT-FET). Selective binding events between TNT molecules and phage display derived TNT receptors were effectively transduced to sensitive SWNT-FET conductance sensors through the PDA coating. The resulting sensors exhibited unprecedented 1 fM sensitivity toward TNT in real time, with excellent selectivity over various similar aromatic compounds. Our biomimetic receptor coating approach may be useful for the development of sensitive and selective micro and nano-electronic sensor devices for various other target analytes.

Keywords: lipid membrane receptor, polydiacetylene, trinitrotoluene, carbon nanotube