Ultrasensitive uranyl ion detection using DNAzyme catalytic reaction-combined NW SERS sensor

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We developed a surface-enhanced Raman scattering (SERS) sensor combined with a DNAzyme-cleaved reaction for the ultrasensitive and specific detection of uranyl ion ($UO2^{2+}$). The presence of $UO2^{2+}$ in sample induces the cleavage of DNAzyme into enzyme strands and released strands, which include Raman-active molecules. The released strands bind with capture DNAs on the nanowire (NW) sensor and this complex provides SERS signal. The sensing performance of this sensor exhibits a detection limit of 1 pM and high selectivity. Furthermore, we successfully detect uranyl ion in diverse $UO2^{2+}$-contaminated natural water. Based on these results, we anticipate that the practical usefulness of this sensor can be expanded to detect diverse toxic metal ions by applying various ion-specific DNA-based ligands to NW sensors.