Laccase-based fiber-optic biosensor using silica-modified curcumin carbon dots for the detection of dopamine

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Carbon dots (CDs) are the emerging fluorescent nanomaterials with divergent features including cost-effectiveness, non-toxicity, optical, and photoluminescence properties. Herein, fiber-optic enzymatic biosensor was designed for the detection of neurotransmitter dopamine (DA). We synthesized CDs using curcumin through microwave irradiation reaction. Further, we functionalized CDs with 3-(aminopropyl)-triethoxysilane (APT-CDs). These were immobilized by laccase enzyme for sufficient detection of DA. Here, CDs have showed solvatochromism and green to orange colour emissions. Bioprobe exhibited fluorescence quenching against DA from the concentration range of 0-30 μM with a detection limit around 41.2 nM. Bioprobe was immobilized on the tapered optical fiber using ethyl cellulose and studied for multi-color imaging potentials. This tapered optical fiber has obtained the significant detection limit around 46.4 nM within the DA concentrations from 0-10 μM. Bioprobe delivered a durable photostability, biocompatibility, and thermal stability. A good cytotoxicity has shown by bioprobe in human neuroblastoma cells (SH-SY5Y) with multi-color imaging.