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Highly selective and sensitive determination of dopamine in biological samples via tuning the particle size of label-free gold nanoparticles

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Abstract

Herein, a rapid, sensitive and selective approach for the colorimetric detection of dopamine (DA) was developed utilizing unmodified gold nanoparticles (AuNPs). This assay relied upon the size-dependent aggregation behavior of DA and three other structurally similar catecholamines (CAs), offering highly specific and accurate detection of DA. By means of this study, we attempted to overcome the tedious procedures of surface premodifications and achieve selectivity through tuning the particle size of AuNPs. DA could induce the aggregation of the AuNPs via hydrogen-bonding interactions, resulting in a color change from pink to blue which can be monitored by spectrophotometry or even the naked-eye. The proposed colorimetric probe works over the 0.1 to 4 μM DA concentration range, with a lower detection limit (LOD) of 22 nM, which is much lower than the therapeutic lowest abnormal concentrations of DA in urine (0.57 μM) and blood (16 μM) samples. Furthermore, the selectivity and potential applicability of the developed method in spiked actual biological (human plasma and urine) specimens were investigated, suggesting that the present assay could satisfy the requirements for clinical diagnostics and biosensors.

Keywords: Dopamine; Colorimetric probe; Large-size Gold nanoparticles; Aggregation; Biological samples.