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www.elsevier.com/locate/talanta

PII: S0039-9140(17)30964-5
DOI: http://dx.doi.org/10.1016/j.talanta.2017.09.019
Reference: TAL17922

To appear in: *Talanta*

Received date: 8 July 2017
Revised date: 2 September 2017
Accepted date: 7 September 2017

Cite this article as: Weijie He, Rijun Gui, Hui Jin, Benqian Wang, Xiangning Bu and Yongxin Fu, Ratiometric fluorescence and visual imaging detection of dopamine based on carbon dots/copper nanoclusters dual-emitting nanohybrids, *Talanta,* http://dx.doi.org/10.1016/j.talanta.2017.09.019

Ratiometric fluorescence and visual imaging detection of dopamine based on carbon dots/copper nanoclusters dual-emitting nanohybrids

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Abstract

In this article, blue-emitting carbon dots (CDs) were prepared *via* hydrothermal treatment of sodium citrate and NH_4HCO_3, and then combined with 3-aminophenylboronic acid (APBA) to prepare APBA modified-CDs. APBA acted as the receptor of dopamine (DA). Using bovine serum albumin (BSA) as a stabilizer and $N_2H_4{\cdot}H_2O$ as a reducing reagent, BSA-stabilized and red-emitting copper nanoclusters (CuNCs) were prepared. By carbodiimide-activated coupling, novel nanohybrids consisting of CDs and CuNCs were constructed and exhibited dual-emitting fluorescence (FL). In the presence of DA, marked FL (at 440 nm) quenching of nanohybrids was detected. Specific coupling interactions between boric acid of APBA and cis-glycol of DA induced the combination of DA and APBA on the surface of CDs. As a superior electron receptor, DA triggered the electron transfer from CDs to DA, resulting in the FL quenching of CDs in nanohybrids. The FL (at 640 nm) of CuNCs in nanohybrids was almost unchanged after the addition of DA, and so further used for a reference FL to develop a novel ratiometric FL probe for DA detection. In addition to high sensitivity and selectivity, superior analytical performances of this probe were confirmed in applications, including dual-signal FL sensing of DA and naked-eye visual FL imaging of DA in aqueous solution and on filter paper.