Electronic Supplementary Material (ESI) for RSC Advances.

Facile Preparation of Novel Au-Polydopamine Nanoparticles Modified by 4-Mercaptophenylboronic acid for Glucose Sensor

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Experimental

Materials

Dopamine Hydrochloride, poloxamer (F108), gold (III) chloride trihydrate, 4-Mercaptophenylboronic acid (MPBA), Tris(hydroxymethyl)aminomethane (Tris), D-glucose and other reagents were supplied by Aladdin Reagent Co., Ltd without any purification. Milli-Q water was utilized through the whole experiment.

Synthesis of PDA microspheres

Tris (10mM, pH=8.5), F108 (750mg, 1.25mg/m) were completely dissolved in 600mL distilled H_2O with mechanical agitation. Then dopamine hydrochloride (480mg, 0.8mg/mL) was added into the mixture and its color changed from red to black for about 10minutes. After rection for about 20h, PDA microspheres was obtained by centrifugation and freeze-drying. The precipitates were washed with deionized water and ethanol for three times.

Preparation of Au-PDA microspheres

Gold (III) chloride trihydrate solution (30mL, 0.1 mg/mL) and PDA microspheres were mixed and agitated mechanically for about 12h while light avoided. The final Au-PDA spheres were collected by centrifugation and freeze-drying. The precipitates were washed with deionized water and ethanol for three times.

Preparation of MPBA-Au-PDA nanocomposites

MPBA (24.0mg) and Au-PDA microspheres (100mg) were added into 30mL distilled H_2O, agitated mechanically for about 6h. The resultants were obtained by centrifugation and freeze-drying. The precipitates were washed with deionized water and ethanol for three times.

Characterization

Dynamic light scattering (DLS) measurements were performed in aqueous solution using a HORIBA Zetasizer LB-550V apparatus at 25°C. The morphologies were investigated by ULTRA-55 field-emission scanning electron microscopy (FE-SEM) and JSM-2100

transmission electron microscopy (TEM) equipped with an energy dispersive X-ray spectrum (EDS, Inca Energy-200) at an accelerating voltage of 200kV. Fourier transform infared (FT-IR) spectra were recorded on a Nicolet 5700 spectrophotometer using an ATR cell or KBr pellets for samples.Thermogravimetric analysis (TGA) was performed on a Pyris Diamond 1 instrument (America) at a heating rate of 20 °C/min from 10°C to 800°C in a flow of nitrogen. A CHI 660D electrochemical workstation was employed to accomplish the electrochemical experiments with platinum electrode as an auxiliary electrode, a saturated calomel electrode (SCE) as the reference electrode and a glassy carbon electrode as the working electrode. Microstructures of the as-prepared samples were analyzed with a SIEMENS Diffraktometer D5000 X-ray diffractometer using Cu Kα radiation source at 35kV, with a scan rate of 0.02°s^{-1} in the 2θ range of 10-80°.

Calculation of the size of Au NPs:

The size of Au NPs on the PDA particles were calculated as following [1]:

$$d = \frac{K\lambda}{w\cos\theta}$$

where d is the particle size, λ is the wavelength of the radiation, θ is the angle of the considered Bragg reflection, w is the width on a 2θ scale, and K is a constant close to unity.

Specific figures were as follows:

K=0.89, λ=1.54056, w=1.44, θ=19°, d=9.63nm.

Calculation of LOD:

The limit of detection (LOD) were calculated using the following equations:

LOD = 3 σ/R

where σ is the standard deviation of the peak current of the lowest concentration of the linearity ran, R is slope of the fitted curve.

Specific figures were as follows:

σ=1.6588 × 10^{-8}, R=0.9953, LOD=5.0 × 10^{-8}M.

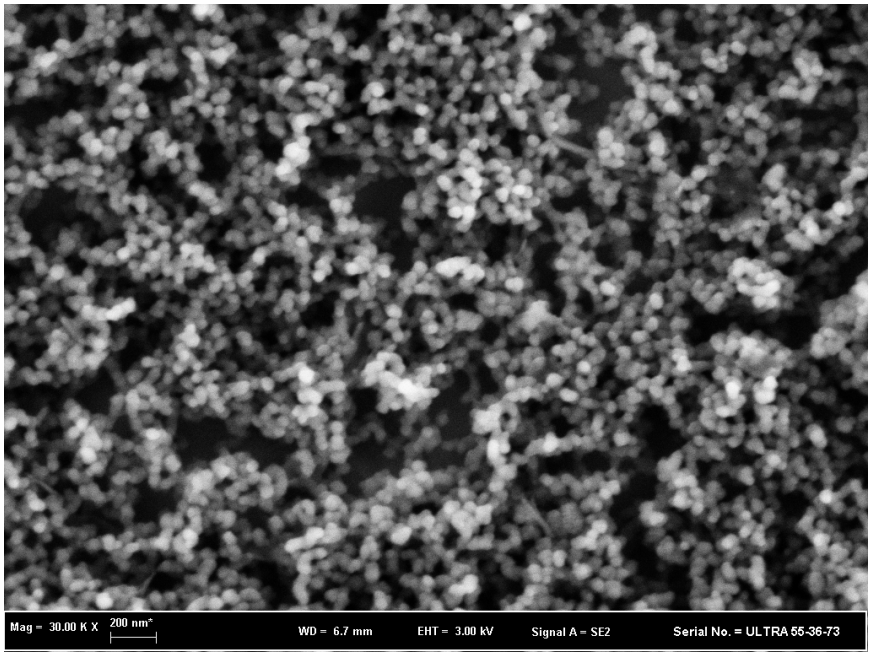

Fig. S1 The SEM image of PDA particles.

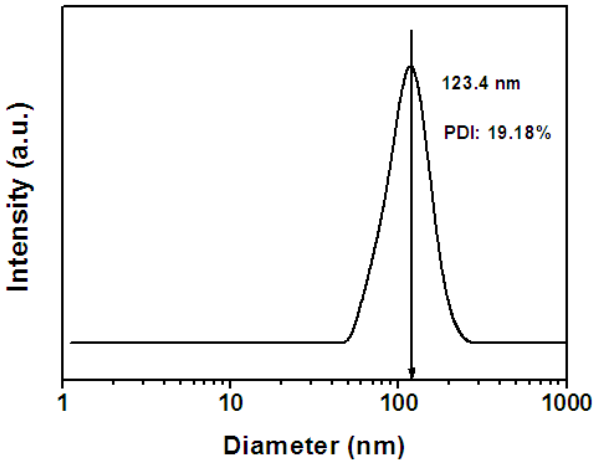

Fig. S2 The DLS curves of PDA particles.

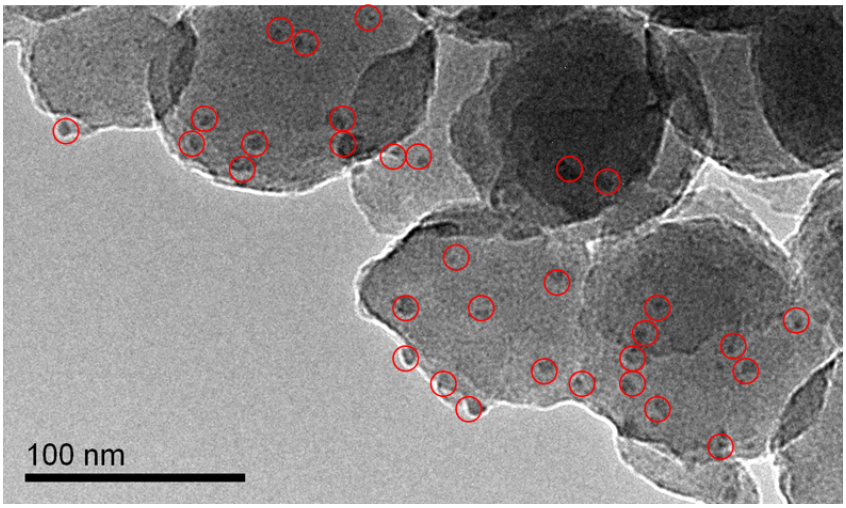

Fig. S3 TEM image of Au-PDA particles.

References:

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[2] Zhenzhen Wang, Kun Shang, Jing Dong, Ziqiang Ceng, Shiyun Ai. Microchim Acta, 2012, 227-234.