Electronic Supporting Material

Label-free electrochemical aptasensor based on reduced graphene oxide-hemin-chitosan nanocomposite for determination glypican-3

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1. Preparation of the RGO-hemin nanocomposite

Reductive graphene oxide (RGO) was prepared according to the Huang et al method [1]. Take 10.0 mL of 0.1 mg·mL^{-1} RGO solution and 1.0 mL 1.0 mg·mL^{-1} of hemin solution together, mix thoroughly for 10 min. Then, 8.0 μL of hydrazine hydrate was added and fevered at 60 $^{\circ}$C for 4 h. After the reaction finished, centrifuged at 3000 r min^{-1} to obtain the RGO-hemin solution.

2. Characterisation of RGO-H-CS nanocomposites

The Zeta potential of RGO, RGO-hemin and RGO-H-CS is analysed and the consequences are illustrated in Fig. S1A. No substantial change in the Zeta potential before and after the combination was observed because RGO, hemin and CS are uncharged neutral substances. The Zeta potential values of the three materials were −1.57 mV, but with the gradual combination of materials, the total number of particles in the composite also increased, and the number of particles combined with RGO-H-CS nanocomposites was the highest, indicating that RGO-H-CS nanocomposites have a good dispersion and stability.

The four solutions of RGO, hemin, CS and RGO-H-CS were appropriately diluted and characterised by UH5300 UV-vis spectrophotometer. The UV-visible spectrum is indicated in Fig. S1B. RGO has a distinct absorption peak at 265 nm. Hemin had a distinct absorption peak at around 390 nm, and CS showed a characteristic absorption peak at 210 nm. The RGO-H-CS nanocomposites had corresponding characteristic absorption peaks at 210, 265 and 390 nm. This finding shows that the RGO-H-CS nanomaterial is well synthesised.

Fig. S1C shows that RGO is a translucent sheet-like structure, and Fig. S1D shows that the black granules are well scattered on the lamelleted RGO, indicating that hemin is successfully integrated on RGO to form RGO-hemin.
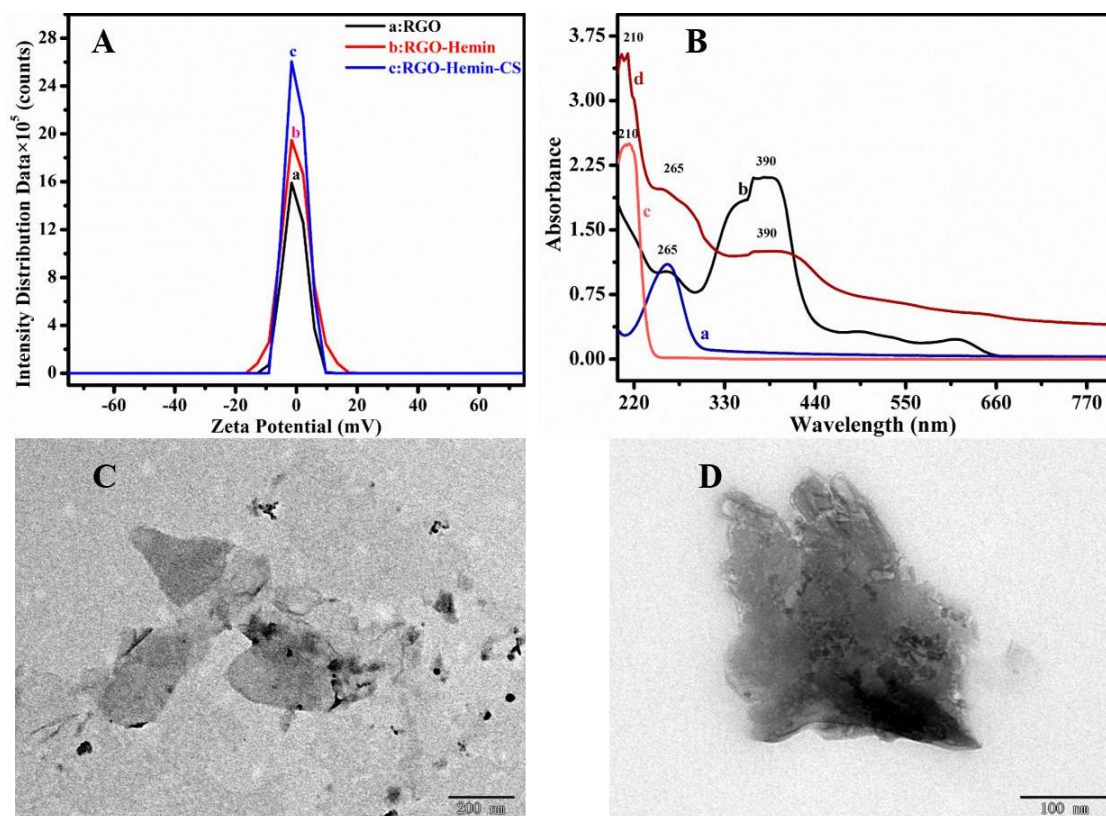
Fig. S1 (A) Zeta potential analysis diagram of RGO (curve a), RGO-hemin (curve b) and RGO-H-CS nanocomposites (curve c); (B) UV image of RGO (curve a), hemin (curve b), CS (curve c) and RGO-H-CS (curve d); (C) TEM image of RGO; (D) TEM image of RGO-hemin nanocomposites

References

1. Y. Huang, Y. Xue, J. Zeng, S. Li, Z. Wang, C. Dong, G. Li, J. Liang and Z. Zhou, *Mat. Sci. Eng. C-Mater*, 2018, **92**, 590-598.