Electronic Supplementary Material (ESI) for Analytical Methods.

Supporting information

A label-free amperometric immunosensor with improved electrocatalytic 3D braided AuPtCu-SWCNTs@MoS$_2$-rGO for human growth differentiation factor-15 detection

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Contents

1. EDS spectrum of A@M nanocomposites

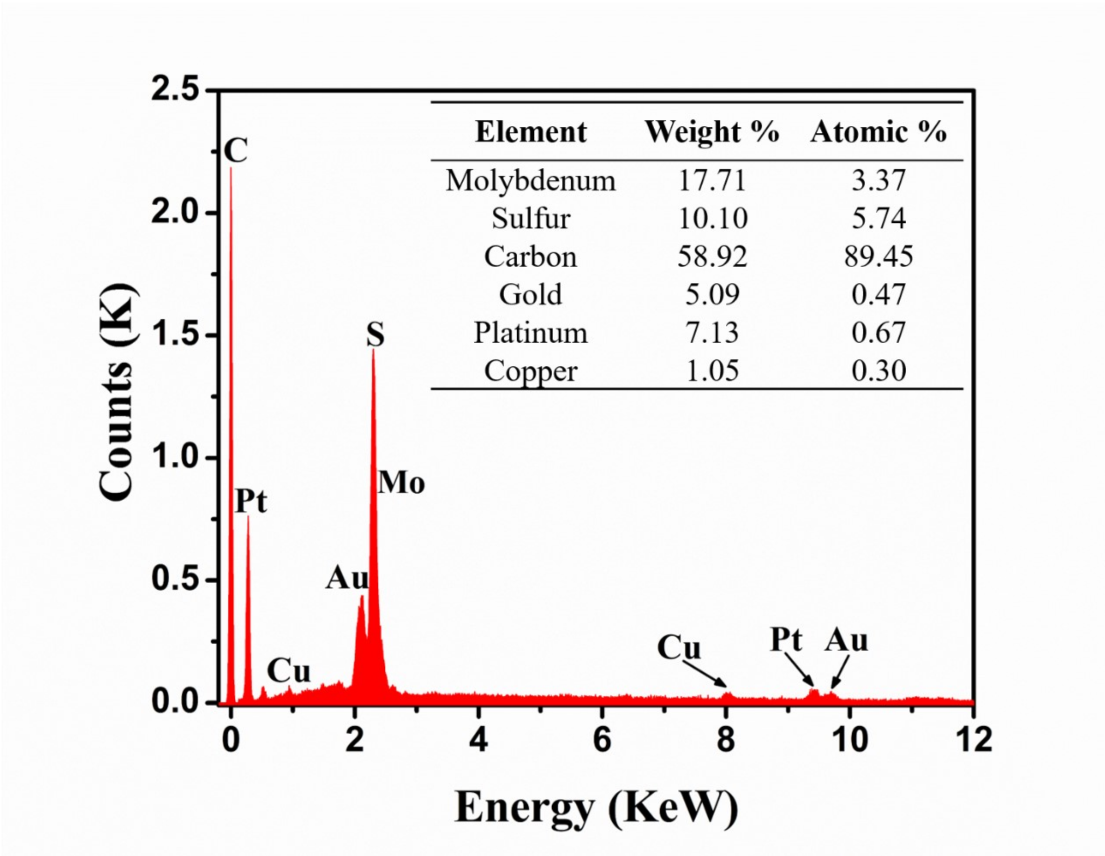

Fig S1. EDS spectrum of AuPtCu NFs-SWCNTs@MoS_2-rGO nanocomposites.

2. Optimization of experimental conditions

To obtain the optimal conditions for GDF 15 determination, the incubation volume of A@M, pH of PBS, and concentration of H_2O_2 were optimized.

The volume of the electrode surface modifies the thickness of the interfacial film. When the modification volume was very low, the interfacial film was too thin to achieve the highest electrical performance. However, excessive modification prevents the migration of electrons on the electrode surface. The results obtained after dropping different volumes of A@M on the surface of the GCE are shown in Fig. 4A. The current gradually increased when the volume of A@M was increased from 3 to 6 μL, and gradually decreased when the volume was further increased from 6 to 9 μL, illustrating that when the incubation volume was 6 μL, the working electrode surface had the best electrical properties.

PBS (10 mL, 10 mmol L^{-1}) was used as the electrolyte solution when detecting GDF 15. Studies have shown that the pH of PBS strongly impacts the detection results of immunosensors, as several bioactive substances are used during the self-assembly process of the immunosensor, and an extremely acidic or alkaline environment can destroy protein activity. The volume of A@M was retained at 6 μL, and PBS solutions with different pH values were tested using the amperometric I–T curve. The current slowly increased when pH increased from 5.55 to 7.46 (Fig. 4B), and then gradually decreased between pH 7.46 and 8.76. Thus, PBS (pH 7.46) was selected as the optimum electrolyte.

A@M facilitates catalytic reduction of H_2O_2, which can accelerate the electron migration rate on the electrode surface, amplify the electrical signals, and improve sensitivity. Therefore, we evaluated the reducibility of the sensor using different concentrations of H_2O_2. As shown in Fig. 4C, the current responses gradually increased with increasing concentrations of H_2O_2 over the range of 10–35 mmol·L^{-1}, and then stabilized when concentration varied from 35–45 mmol·L^{-1}. Thus, the optimal concentration of H_2O_2 was 35 mmol·L^{-1}.