Supplementary Documents

Capillary-SERS Sensor Based on Aptamer-Mediated Inhibition of Nanozyme Catalysis for Ultrasensitive Detection of Homocysteine in Serum from Hepatocellular Carcinoma Patients

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Clinical Sample Characterization

HCC can be definitively diagnosed through imaging and pathological examinations. As shown in Fig. S1(a-b), hematoxylin-eosin (H&E) staining reveals that the tumor cells exhibit typical trabecular and pseudoglandular architectural patterns, with a markedly increased cellular density. The nuclei are irregular in shape with prominent nucleoli, findings that are consistent with the histopathological characteristics of HCC. Contrast-enhanced CT images acquired during the arterial, portal venous, and delayed phases (Fig. S1(c-e)) demonstrate a focal solid mass located at the top of a cystic hypodense lesion. This mass shows strong enhancement in the arterial phase, followed by rapid washout in the portal venous and delayed phases, representing the characteristic “wash-in and wash-out” hemodynamic enhancement pattern of HCC. Further multiplanar contrast-enhanced CT images (Fig. S1(f-h)) confirm that the solid tumor is situated above the cystic lesion, and its morphological features, enhancement behavior, and well-defined boundary with the surrounding normal liver parenchyma are all highly consistent with the imaging diagnostic criteria for HCC. Although contrast-enhanced CT plays an important role in the diagnosis of liver cancer, it is limited by radiation exposure and relatively high cost, while tissue biopsy is invasive and therefore unsuitable for large-scale population screening. Consequently, the capillary-SERS sensor developed in this study is expected to provide a convenient, rapid, and minimally invasive strategy for early screening of HCC, thereby better meeting the urgent clinical need for efficient screening tools.

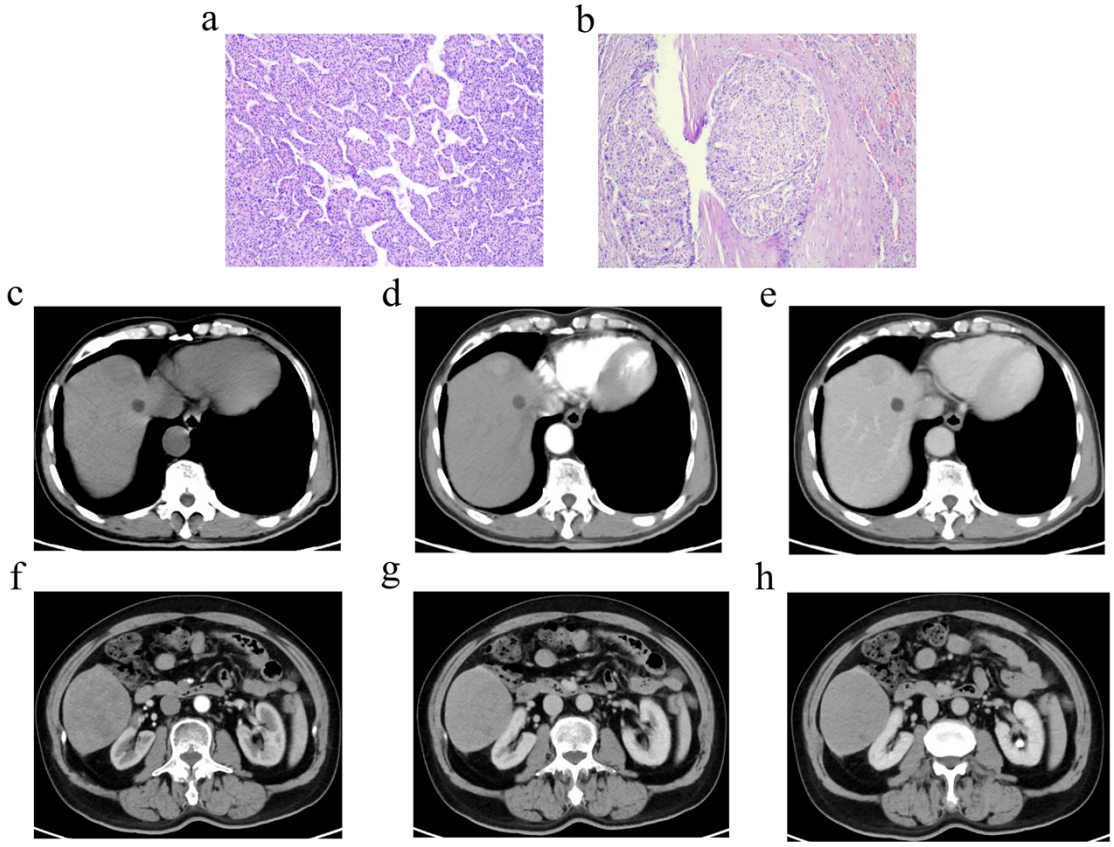

Figure S1. (a-b) HE-stained histological section of cancer tissue; (c-e) Enhanced CT image of the upper abdomen; (f-h) Enhancing CT Images at Different Levels.

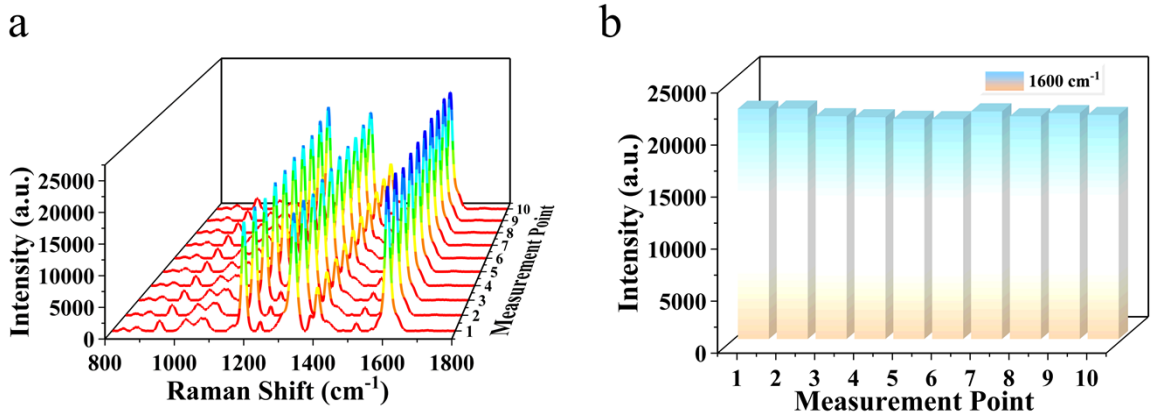

Figure S2. (a) SERS images of 10 arbitrary points on the sensor; (b) The histogram of 10 points of the sensor at 1600 cm^{-1}.

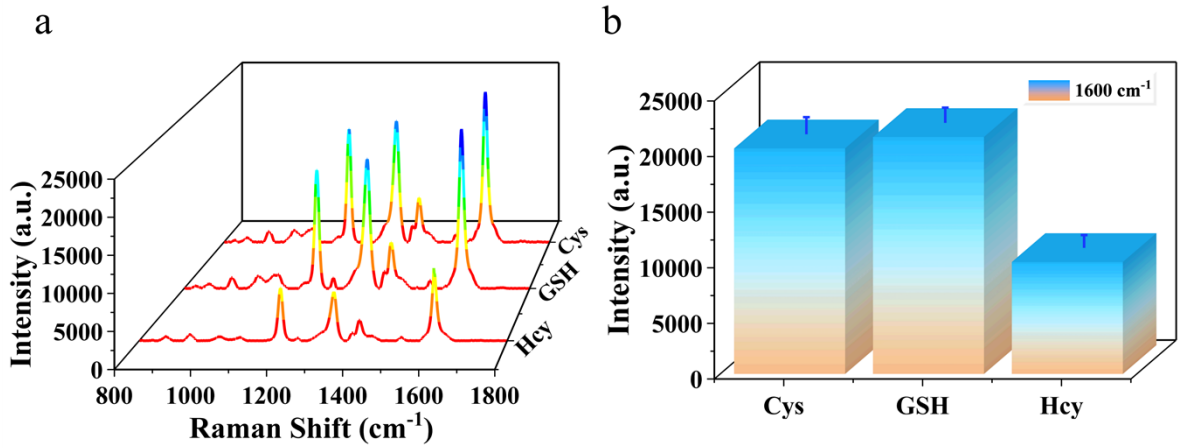

Figure S3. (a) SERS spectra in the presence of potential interferences (GSH, Cys, Hcy); (b) SERS intensity histogram of different interferents at 1600 cm^{-1}.

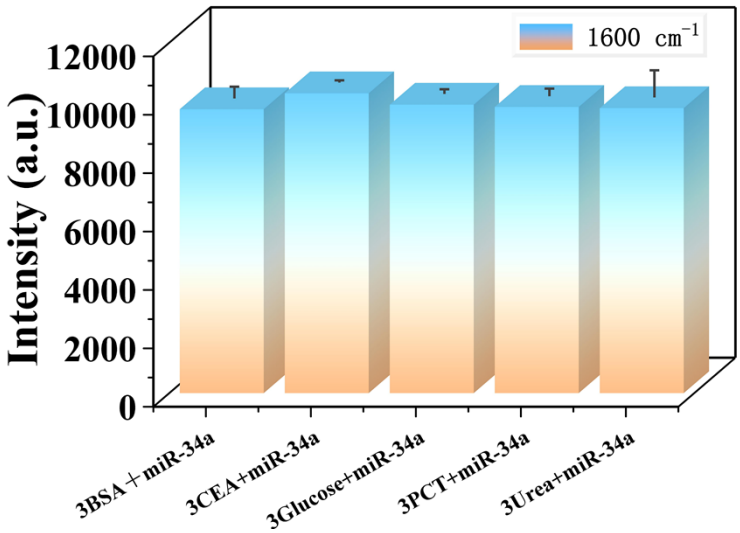

Figure S4. Interferents were tested at concentrations 3 times higher than Hcy