Supplementary Information

Pysanka-inspired Electrode Modification with Aptamer Encapsulation in ZIF-8 for Urine Creatinine Electrochemical Biosensing

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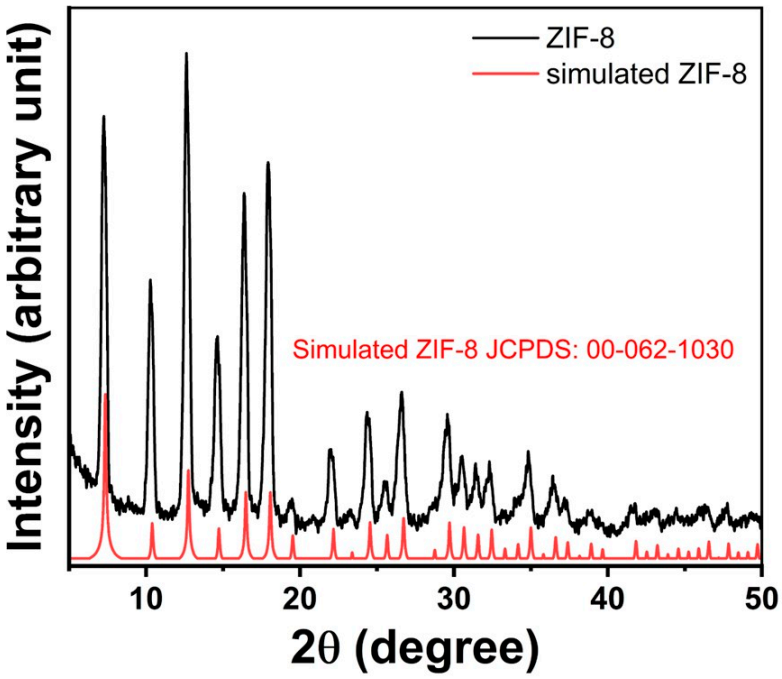

Figure S1. PXRD comparison of synthesized ZIF-8 and simulated ZIF-8 (JCPDS 00-062-1030) showing more than 95% peak matching depicting the purity of the synthesized ZIF-8.

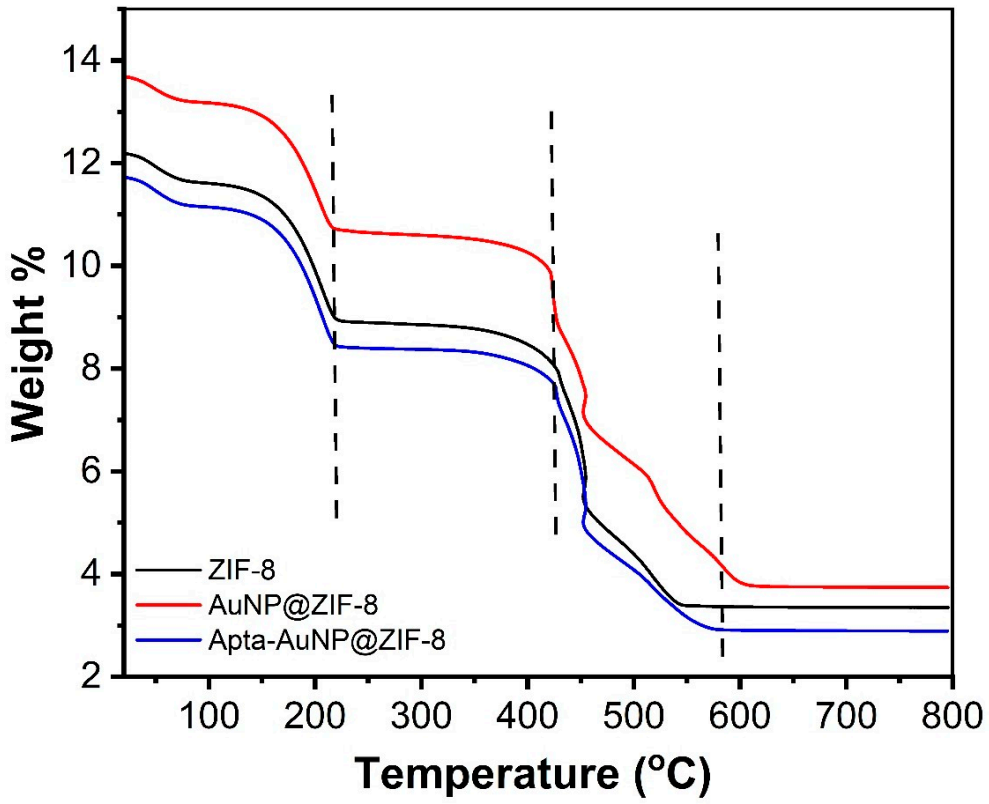

Figure S2. TGA comparative analysis of as-synthesized material having three distinct decomposition phases depicting rigidity and stability of the composite materials.

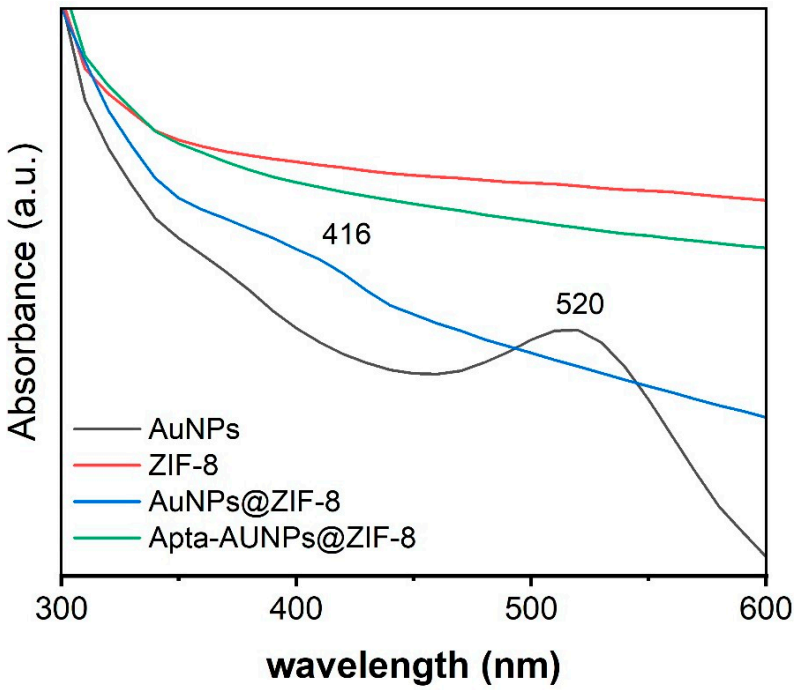

Figure S3. UV-Vis characteristics of AuNPs showing peak at 520 nm and depicting the size of the AuNPs as 5 nm.

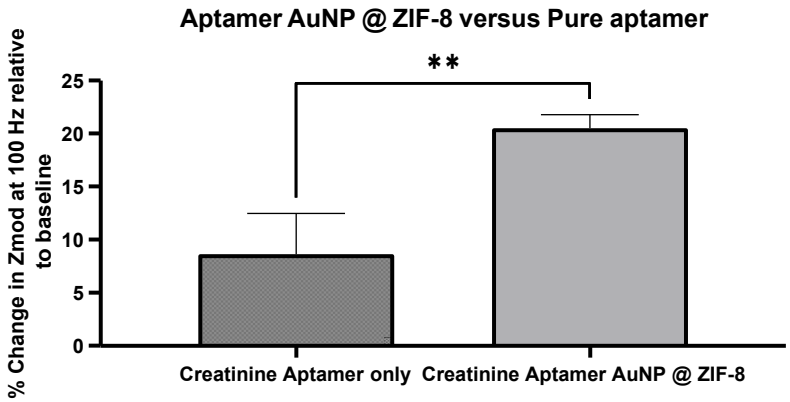

Figure S4. The EIS response of the novel creatinine aptamer AuNP@ ZIF-8 material was compared with that of the pure creatinine aptamer-only system using a similar electrochemical system at 0.1 µg/mL. As expected, we observed an enhancement in the output response (expressed as a relative change in modulus of impedance at 100 Hz with respect to the baseline dose) in the case of the novel material. The response due to the novel material was significantly different ($p<0.05$) and more than double that due to the plain aptamer-only system. This is because, in the proposed material, a layer of the gold nanoparticle and anti-creatinine aptamer encapsulated ZIF-8 complex is used to modify the working electrode. This encapsulated MOF results in a hybrid capture probe where the anti-creatinine aptamer lends it high specificity and the nano-porosity of the MOF layer and the gold nanoparticles provide high sensitivity and signal enhancement.

Table S1. Comparative table of current methods of creatinine detection.

Biosensing material/method	**Lower Limit of Detection (Sensitivity)**	**Linear Range**	**Specificity**	**References**
AuNP/Calix arene	0.01 µM	0.01-0.1 µM	High	[1,2]
Molecular Imprinting polymer	7 µM	9-100 µM	High	[3]
Polymeric ion	20 µM	20-2000 µM	High	[4]
Fe_3O_4	0.2 µM	1-38 µM	Low	[5]

Starch-AgNPs) on poly(pyrrole) thin film	0.19 µM	10-1000 µM	High	[6]
Capillary–gravitational valve (Jaffe's reaction)	900 µM	884 µM-11.49 mM	Low	[7,8]
AuNp (Colorimetric)	12.7nM	0.2-1.4 µM	High	[9]
PEG/Hg2+–AuNPs	9.68 nM	0-25 µM	High	[10]
Pysanka-inspired Electrode Modification withAptamer Encapsulation in ZIF-8 (Electrochemical biosensing)	884 nM	0.884 µM-8.84 mM	High	This work

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