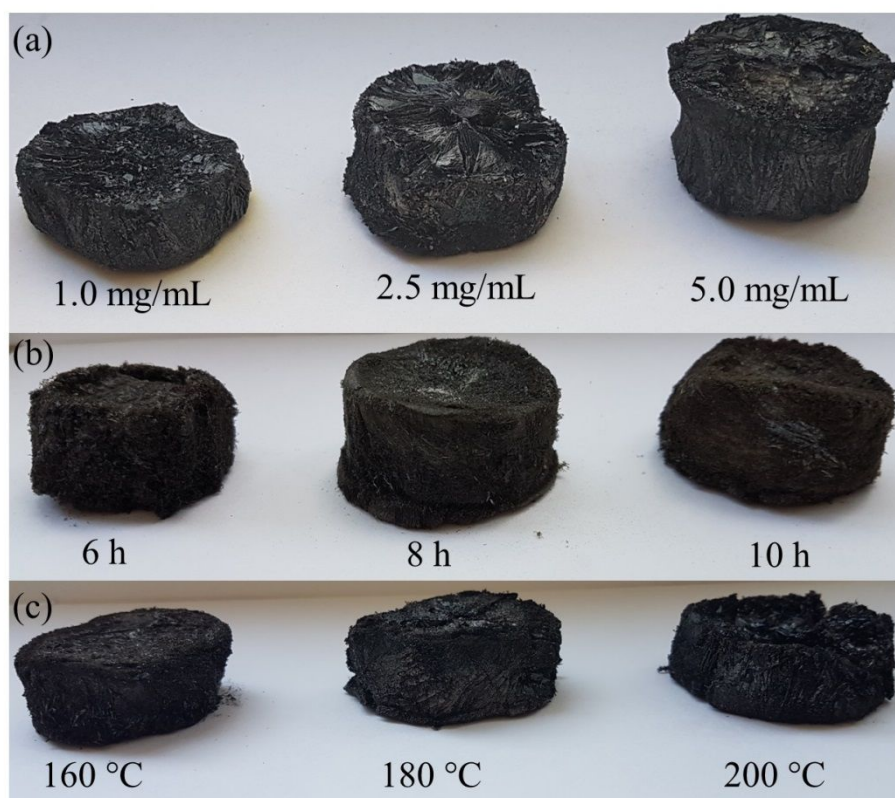


## Supporting Information

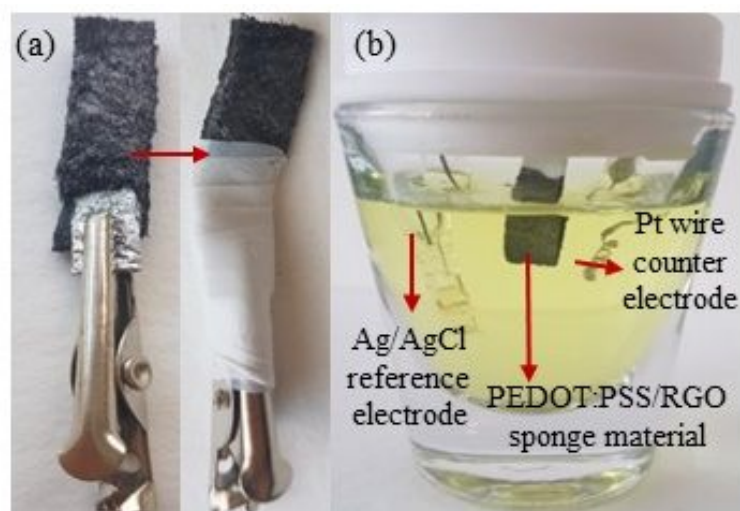
### Conducting Polymer-Reduced Graphene Oxide Sponge Electrode for Electrochemical Detection Based on DNA Hybridization

Kader Dağcı Kırarşan<sup>a\*</sup> and Ezgi Topçu<sup>a</sup>

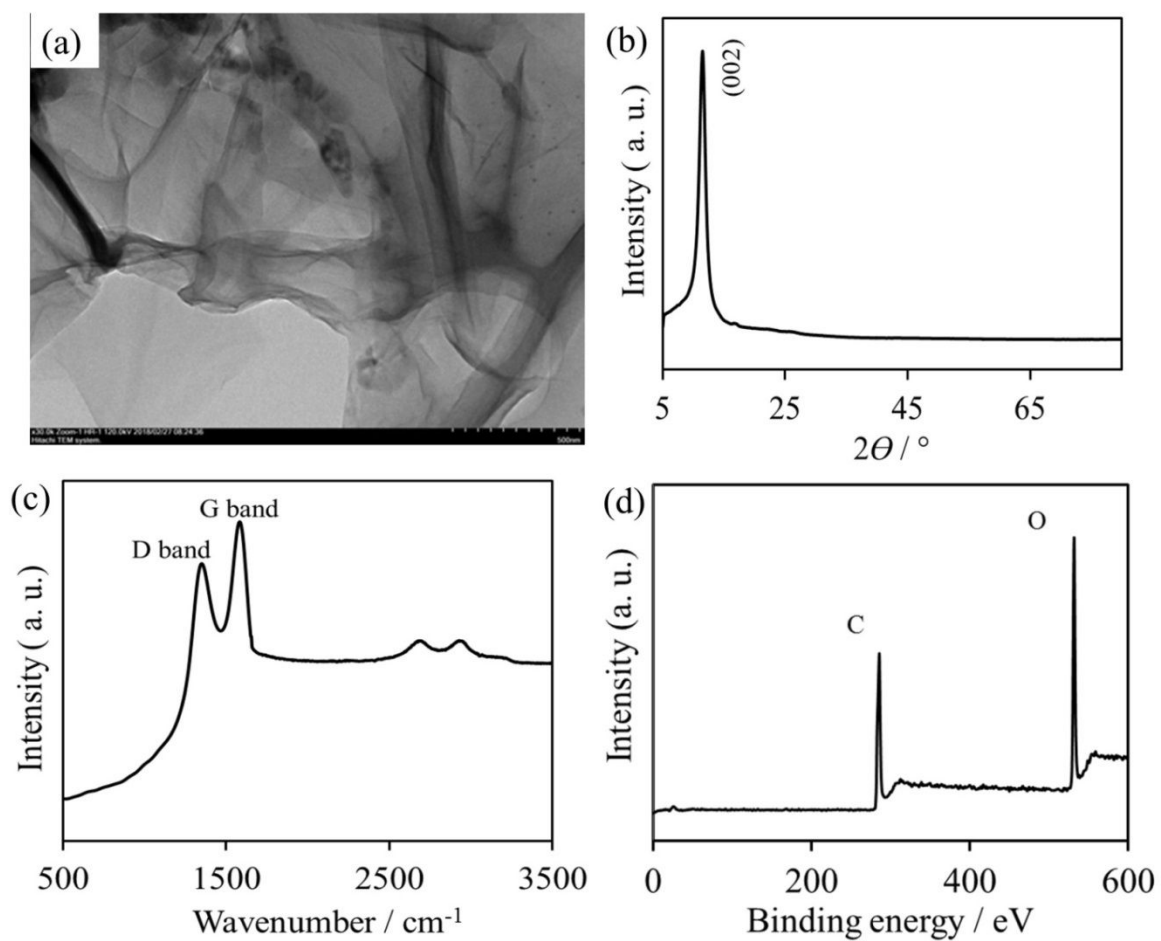
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[kdagci@atauni.edu.tr](mailto:kdagci@atauni.edu.tr)



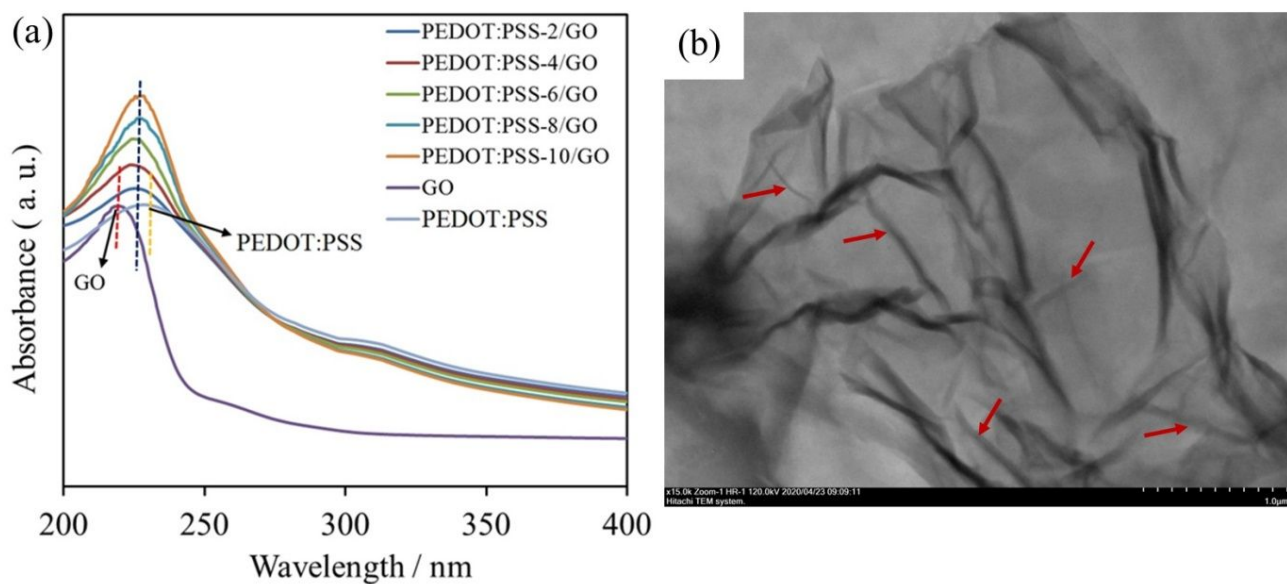
**Figure S1.** Digital camera photographs of PEDOT:PSS/RGO sponge materials obtained at (a) GO concentration of 1.0, 2.5, 5.0 mg/mL, (b) hydrothermal treatment time of 6, 8, 10 h, (c) hydrothermal temperature of 160, 180, 200°C.



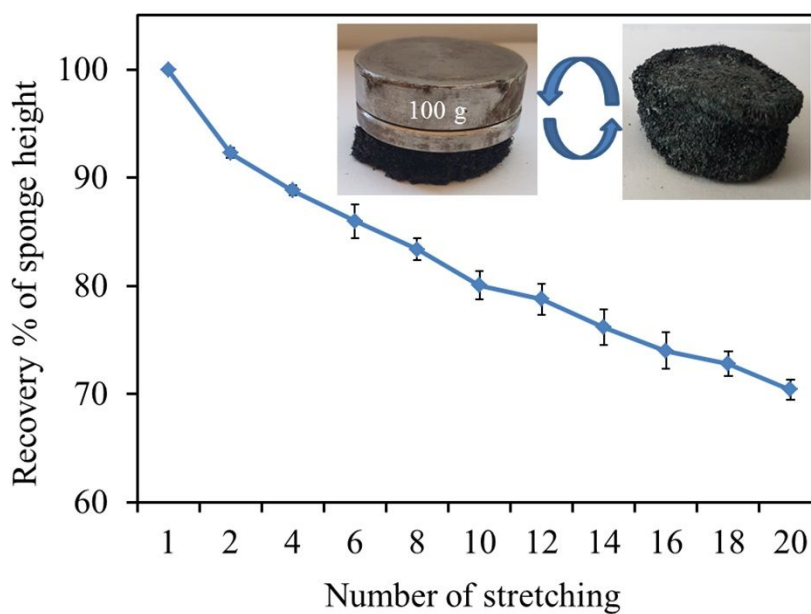
**Figure S2.** Digital camera photographs of (a) sponge material prepared as a working electrode, (b) the electrochemical cell.



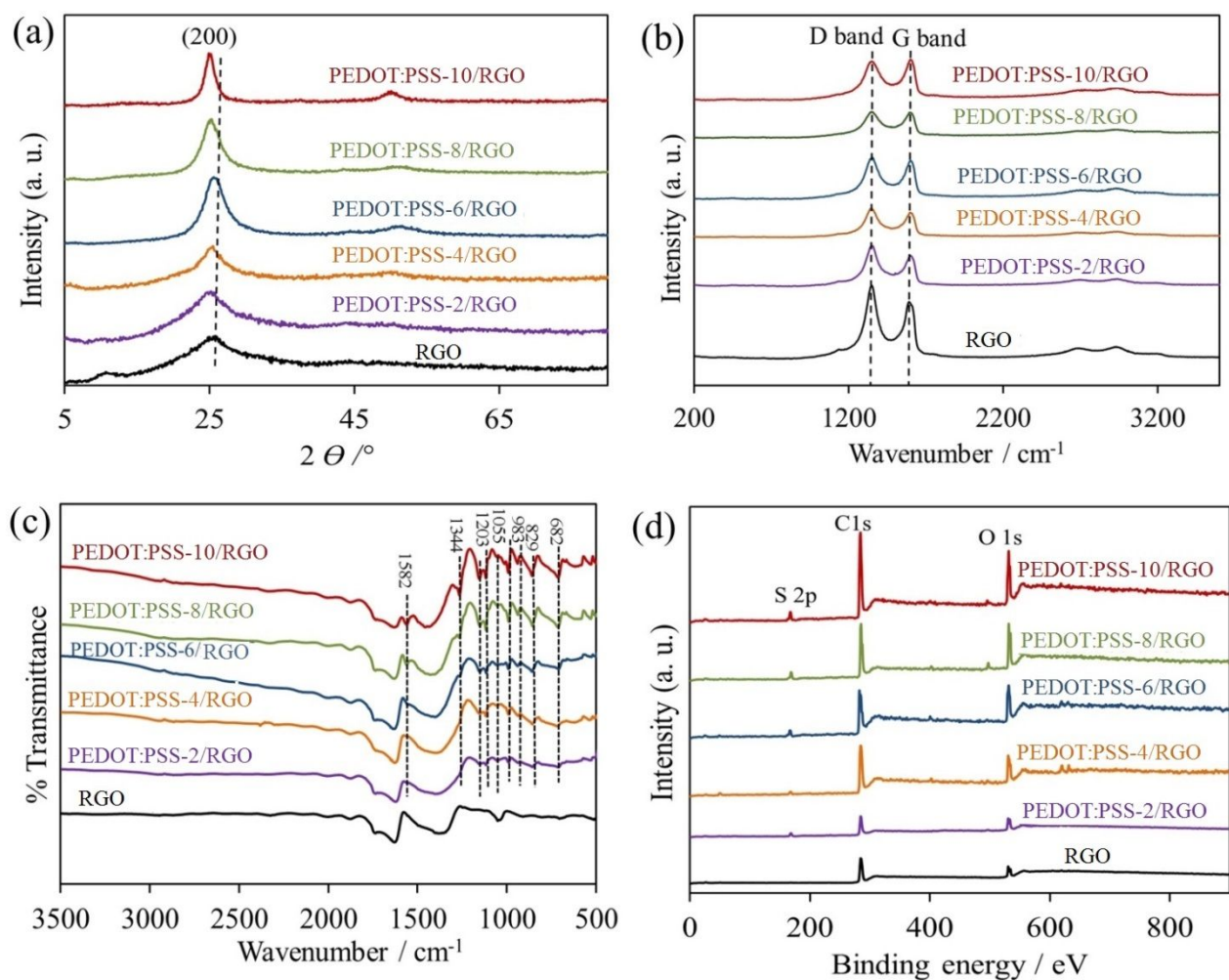
**Figure S3.** (a) TEM image of GO dispersion. (b) XRD, (c) Raman and (d) XPS spectrum of GO.



**Figure S4.** (a) UV-vis absorption spectra of GO dispersion, PEDOT:PSS solution and PEDOT:PSS/GO composite structures prepared in different compositions. (b) TEM image of PEDOT:PSS-8/GO composite dispersion.



**Figure S5.** The % change in height of PEDOT:PSS-8/RGO depending on the number of stretch cycles. Inset: the digital camera photograph of the experimental cycling process.

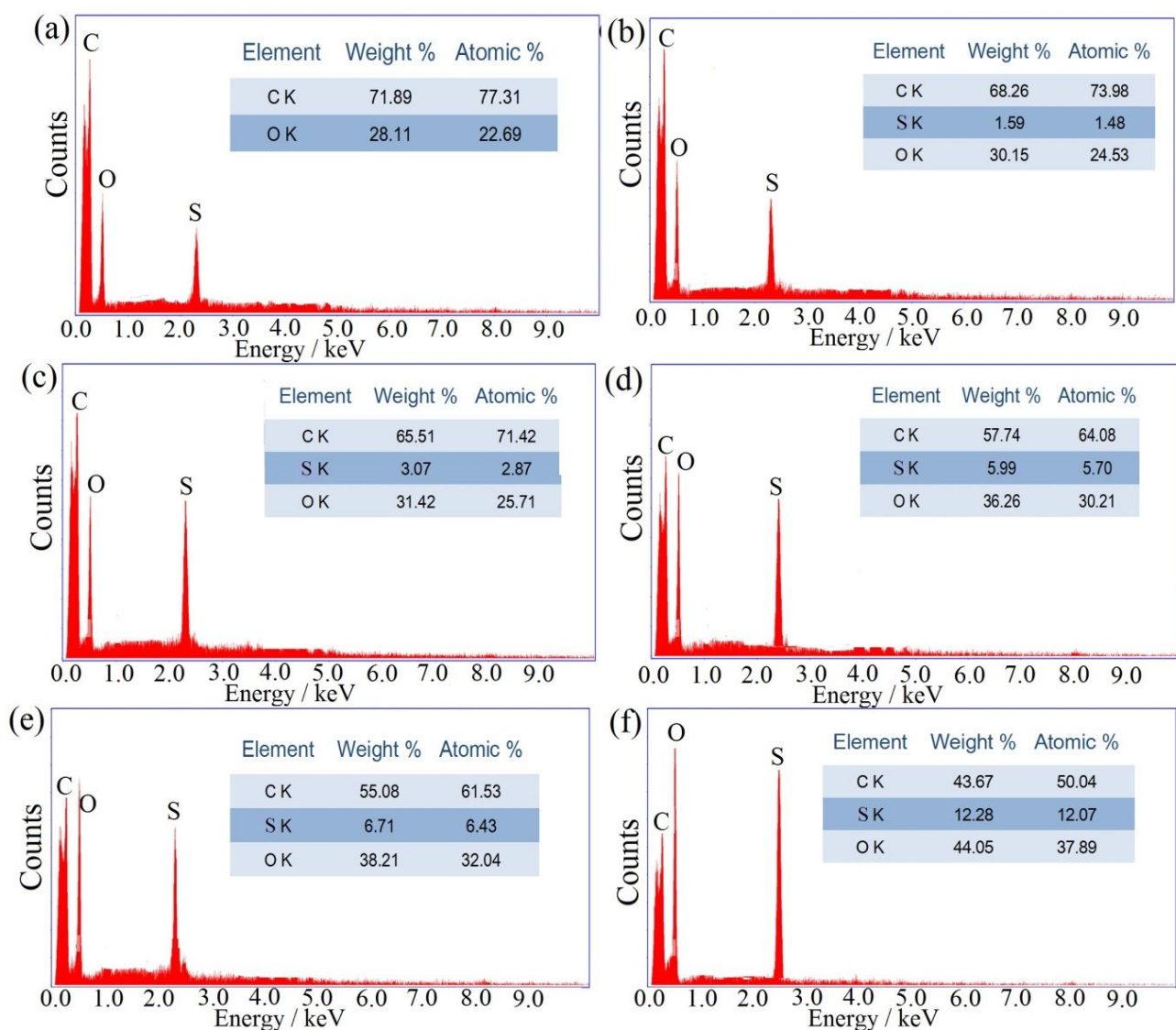


**Figure S6.** (a) XRD patterns, (b) Raman spectra, (c) XPS spectra, and (d) FTIR spectra of RGO sponge and PEDOT:PSS/RGO sponge materials prepared in different compositions.

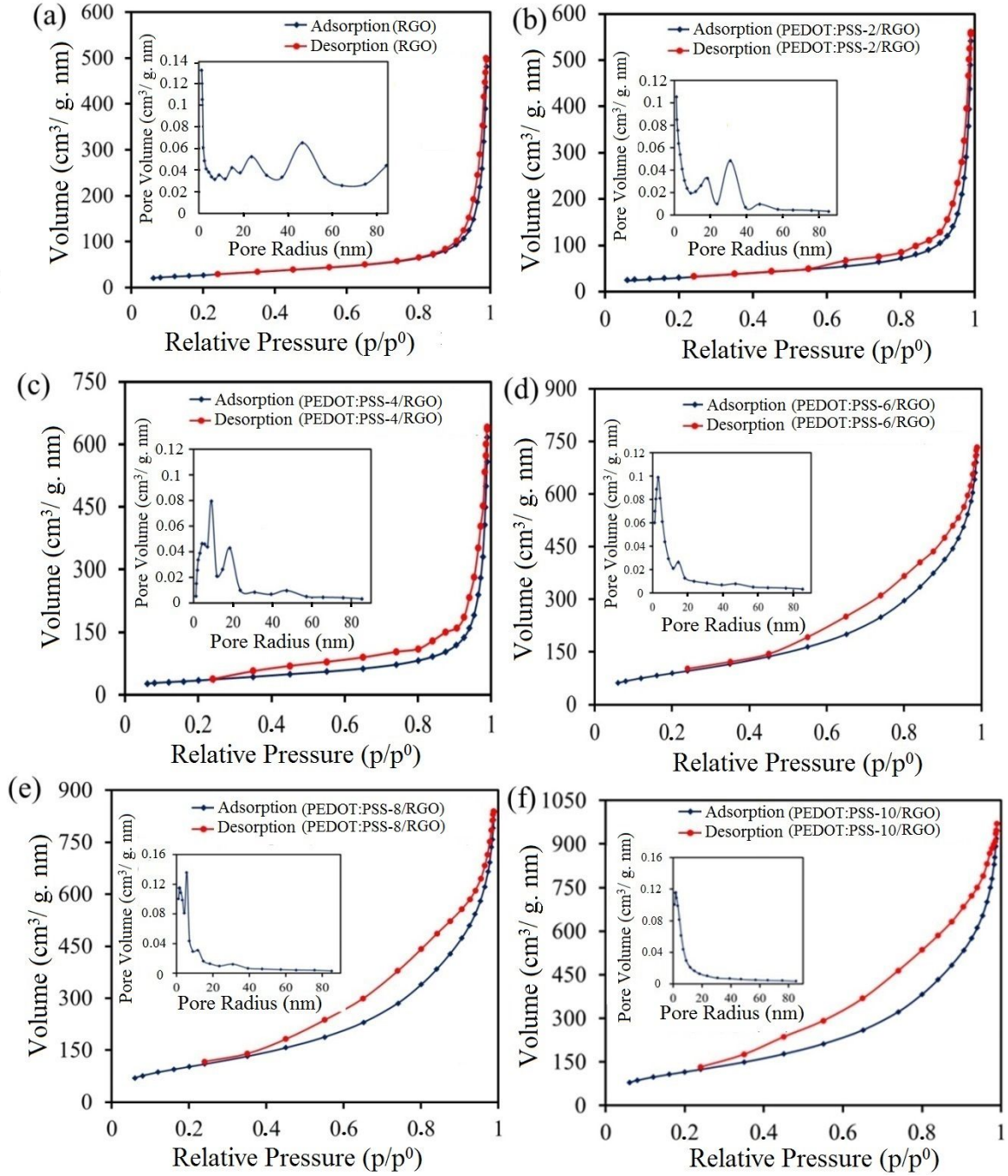
**Table S1.** Atomic ratio % of elements in sponge materials.

Sponge materials	% Atomic weight		
	C 1s	O 1s	S 2p
RGO	83.6	16.4	-
PEDOT:PSS-2/RGO	74.5	23.7	1.8
PEDOT:PSS-4/RGO	74.1	23.6	3.2
PEDOT:PSS-6/RGO	70.1	24.6	5.3
PEDOT:PSS-8/RGO	67.4	26.3	6.2
PEDOT:PSS-10/RGO	59.2	30.7	10.1

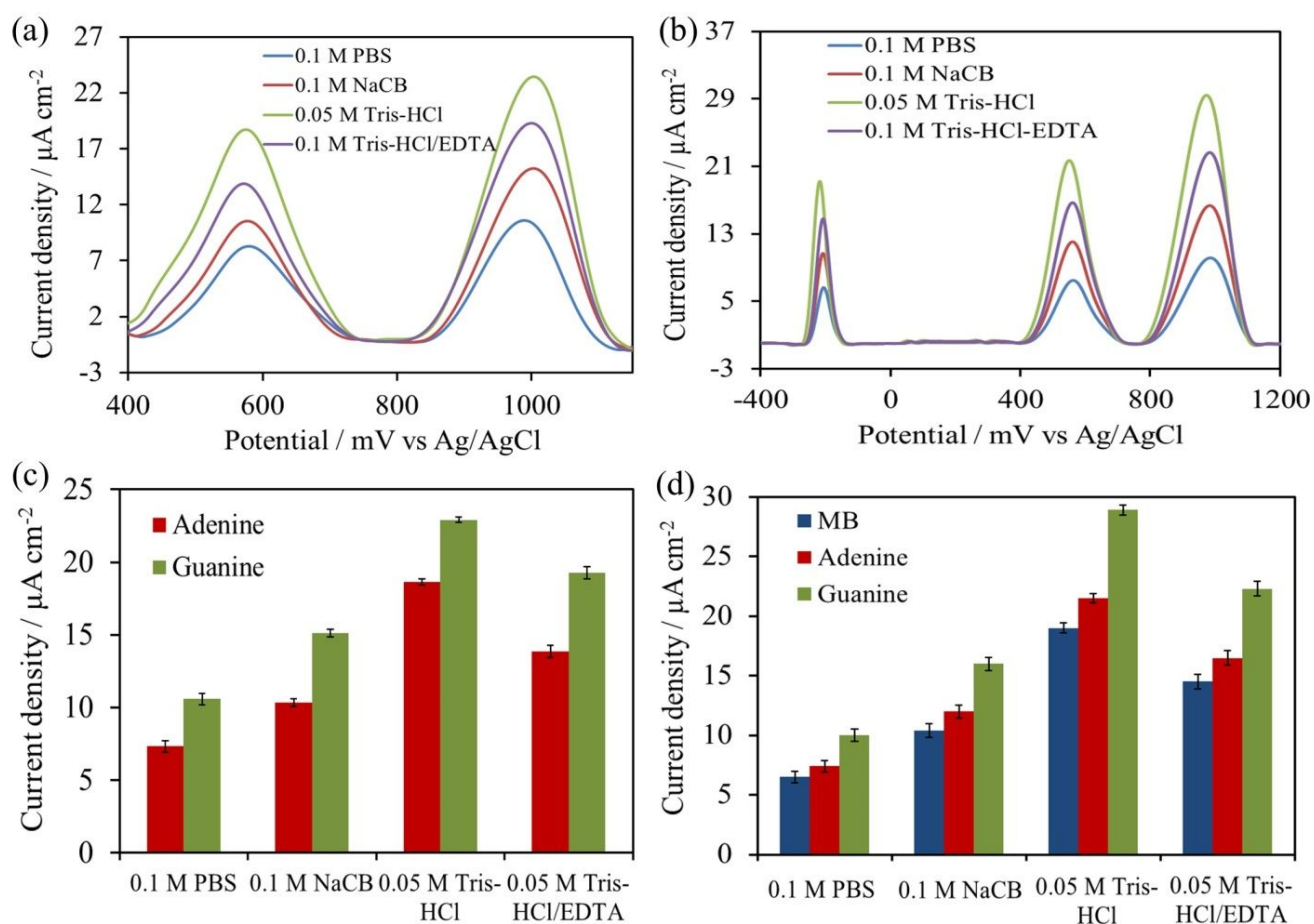




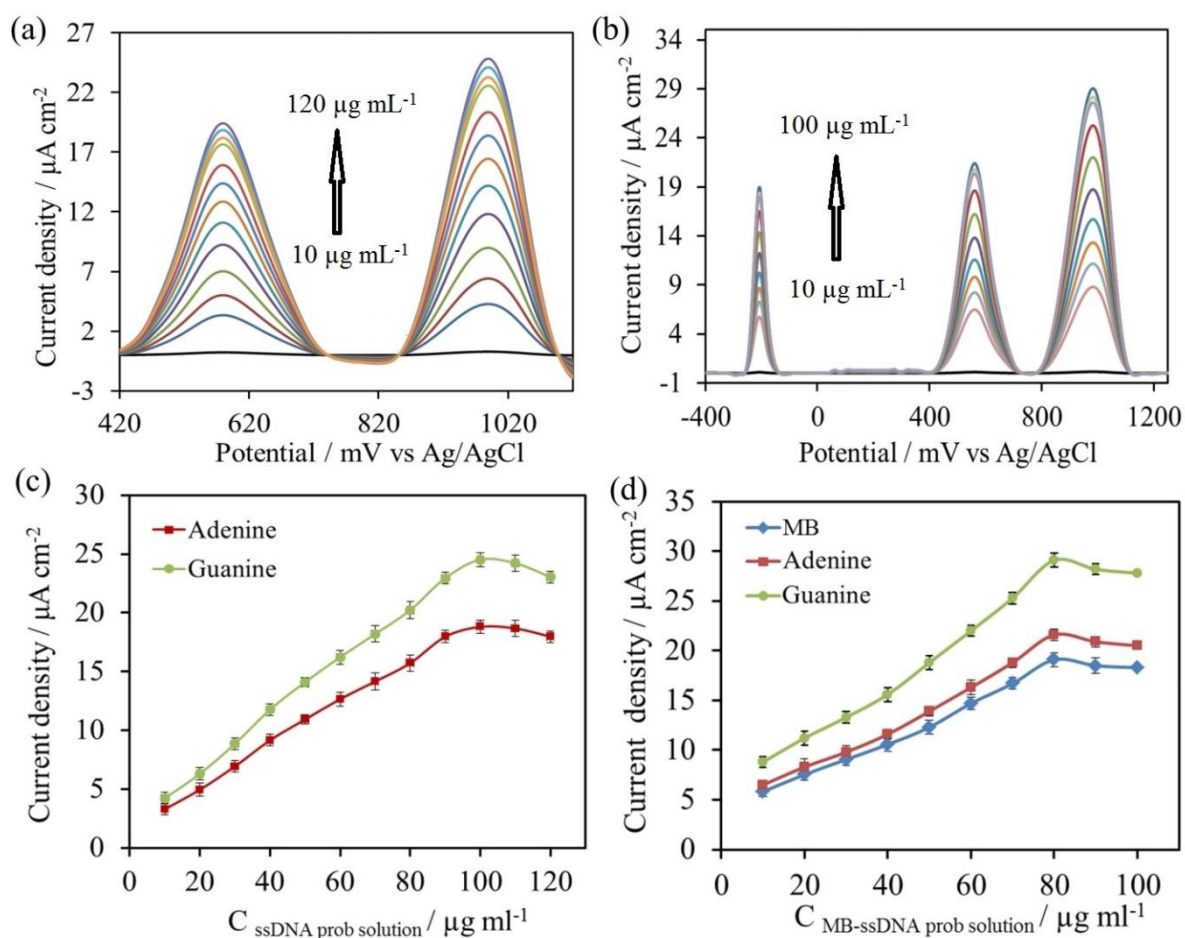
**Figure S7.** EDX of (a) RGO, (b) PEDOT:PSS-2/RGO, (c) PEDOT:PSS-4/RGO, (d) PEDOT:PSS-6/RGO, (e) PEDOT:PSS-8/RGO, and (f) PEDOT:PSS-10/RGO sponge materials.



**Figure S8.**  $N_2$  adsorption-desorption isotherms of RGO sponge and PEDOT:PSS/RGO composite sponge materials prepared in different compositions. Inset: BJH pore size distributions of RGO sponge and PEDOT:PSS/RGO composite sponge materials prepared in different compositions.

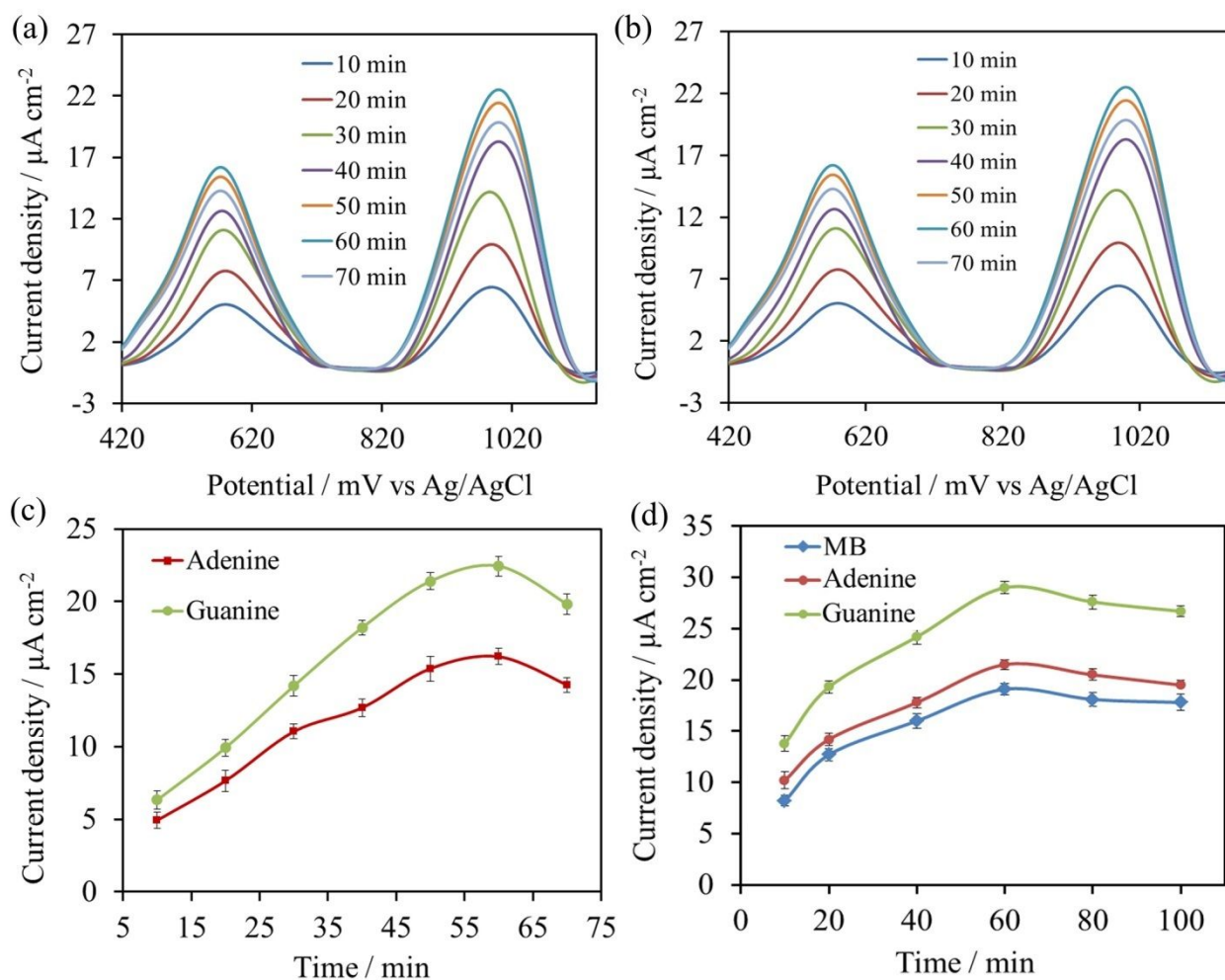


**Figure S9.** DPV curves of PEDOT:PSS-8/RGO composite sponge immersing in different buffer solutions containing (a) 100  $\mu\text{g mL}^{-1}$  ssDNA and (b) 80  $\mu\text{g mL}^{-1}$  MB-ssDNA for 30 min. Current density values in the different buffer solutions for the immobilization of (c) ssDNA and (d) MB-ssDNA probes.

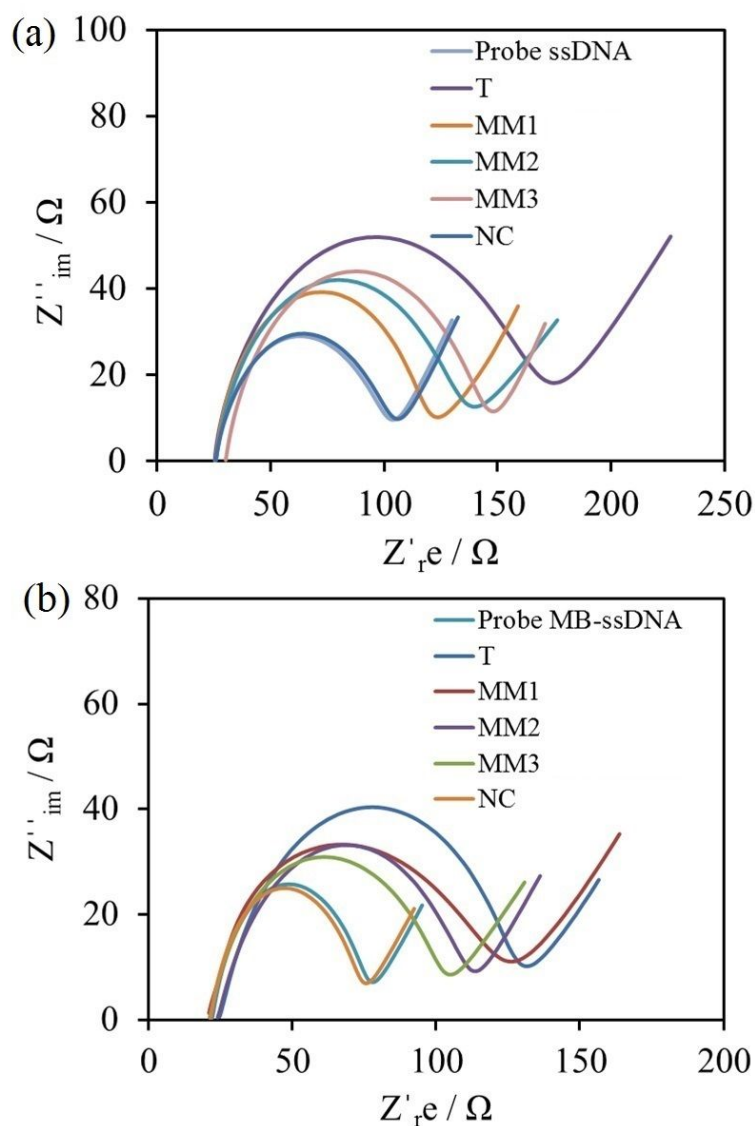


**Figure S10.** DPV curves of PEDOT:PSS-8/RGO composite sponge immersing in 0.05 M Tris-HCl solutions containing different concentrations of (a) ssDNA and (b) MB-ssDNA probes for 30 min. Current density values at different probe concentrations for immobilization of (c) ssDNA and (d) MB-ssDNA probes.





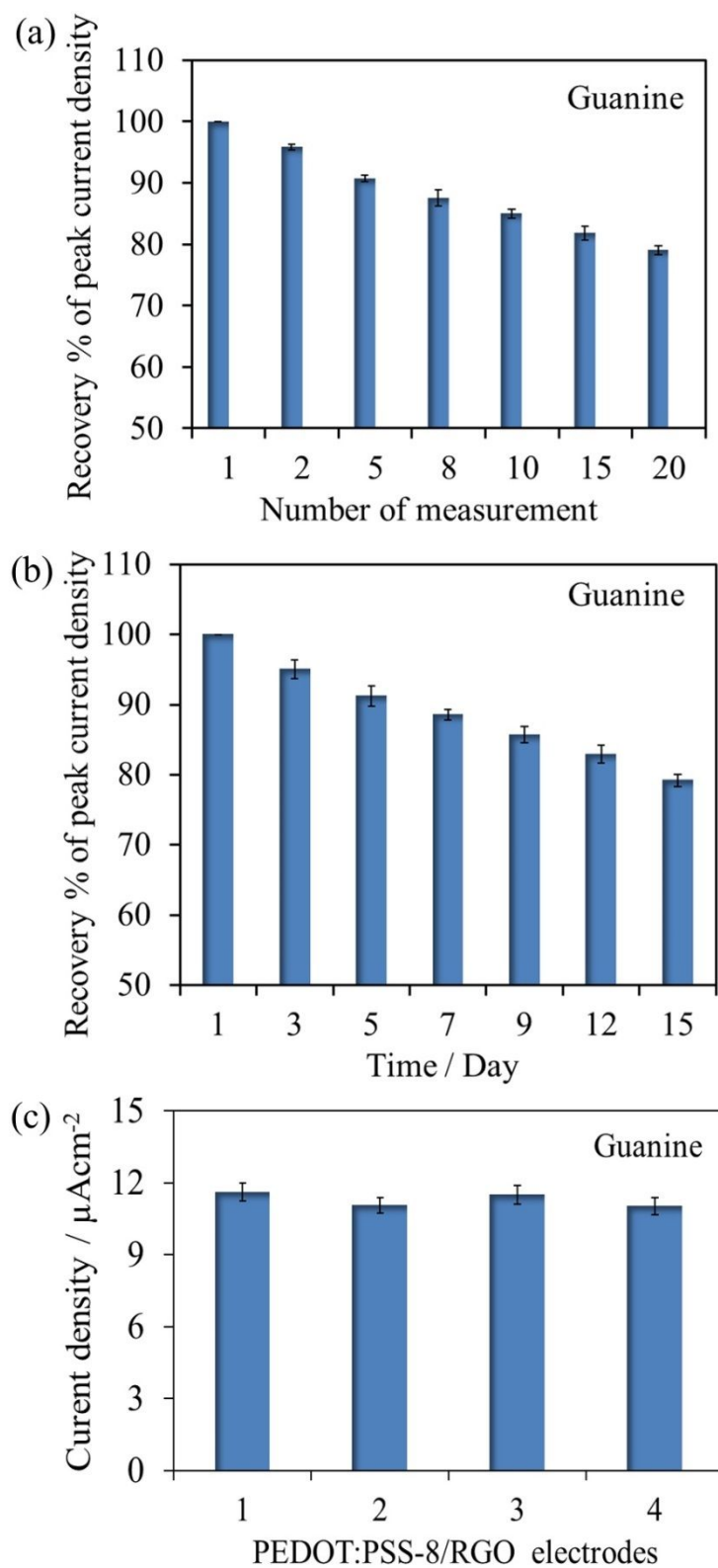
**Figure S11.** DPV curves of PEDOT:PSS-8/RGO composite sponge immersing in 0.05 M Tris-HCl solution containing (a) 100  $\mu\text{g mL}^{-1}$  ssDNA and (b) 60  $\mu\text{g mL}^{-1}$  MB-ssDNA probes for different immobilization times. Current density values for different immobilization times of ssDNA (c) and MB-ssDNA (d) probes.



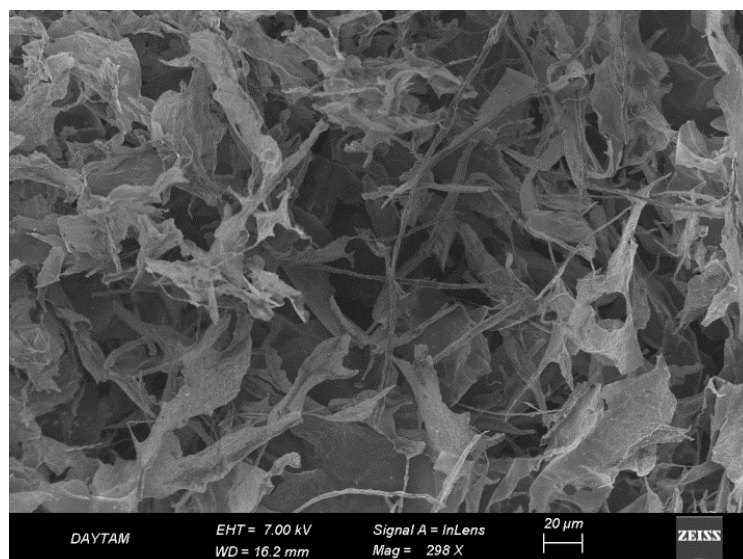
**Figure S12.** Nyquist plots of sponge samples in 0.05 M Tris-HCl buffer solution, probe immobilized (a) ssDNA-PEDOT:PSS-8/RGO and (b) MB-ssDNA-PEDOT:PSS-8/RGO after hybridization with the target sequence, one-base mismatched, two-base mismatched, three-base mismatched, four-base mismatched and non-complementary sequences.

**Table S2.**  $R_p$  and  $R_u$  values of ssDNA and MB-ssDNA calculated from Nyquist curves.

	ssDNA		MB-ssDNA	
	$R_p (\Omega)$	$R_u (\Omega)$	$R_p (\Omega)$	$R_u (\Omega)$
Probe	80	25	78	25
Target	160	24	154	24
One-base mismatched	100	28	98	28
Two-base mismatched	119	24	117	25
Three-base mismatched	134	26	128	24
Non-complementary	83	25	79	24



**Figure S13.** (a) Reusability, (b) time stability, and (c) reproducibility of PEDOT:PSS-8/RGO sponge sensor for the electrochemical detection of DNA.



**Figure S14.** FESEM image of PEDOT:PSS-8/RGO composite sponge material after electrochemical DNA detection.