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Supporting information

Electrochemical aptamer-based sensor prepared by utilizing strong interaction between DNA aptamer and diamond

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Calculations and curve fitting.

Curve fitting was carried out using Curve Fitting algorithm in Igor Pro 8. The following equations were used:

for signal-concentration curve (Langmuir isotherm)

$$D(c) = \frac{c}{c + K_d} D_{max}$$

and for flow measurement

$$\text{adsorption: } D(t) = \frac{D_{max} c}{K_d + c} \left(1 - \frac{1}{\exp(k_{on} c + k_{off}) t}\right)$$

$$\text{desorption: } D(t) = D_0 \exp(-k_{off} t)$$

where D is signal, D_{max} is saturation value of D, D_0 is initial signal before decrease, c is concentration of ligand (DOX in this case) in bulk solution, K_d (mol L^{-1}) is apparent equilibrium dissociation constant, k_{on} (mol L^{-1} min^{-1}) and k_{off} (min^{-1}) are association and dissociation constant, and t is time.
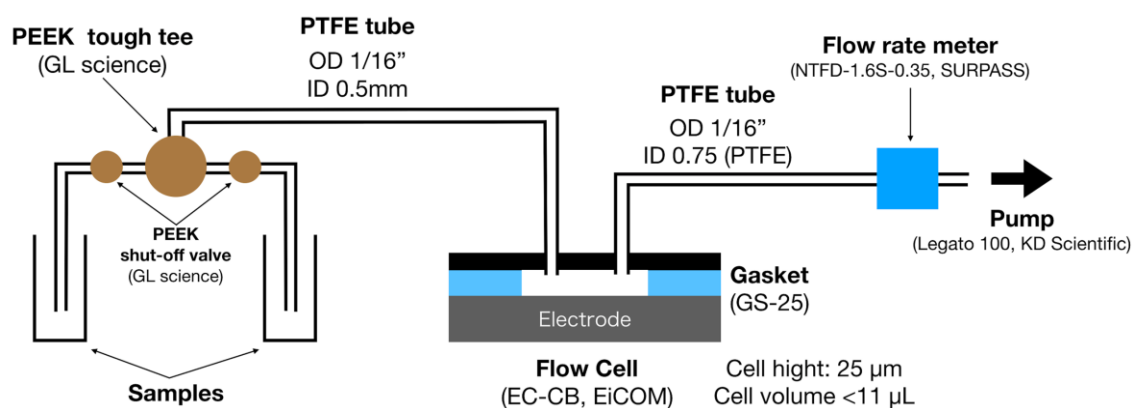
Fig. S1 Overview of the flow measurement setup.

Flow measurements were carried out using the system illustrated above. A flow rate of 10 mL/h (167 µL/min) was set in a cylinder pump and monitored by a flow rate meter to verify the flow rate. It takes less than 4 s for the flow to pass the cell volume. The time is slower enough than adsorption/desorption kinetics timescale, leading to reaction limited regime. Flowing sample was switched using two shut-off valves.
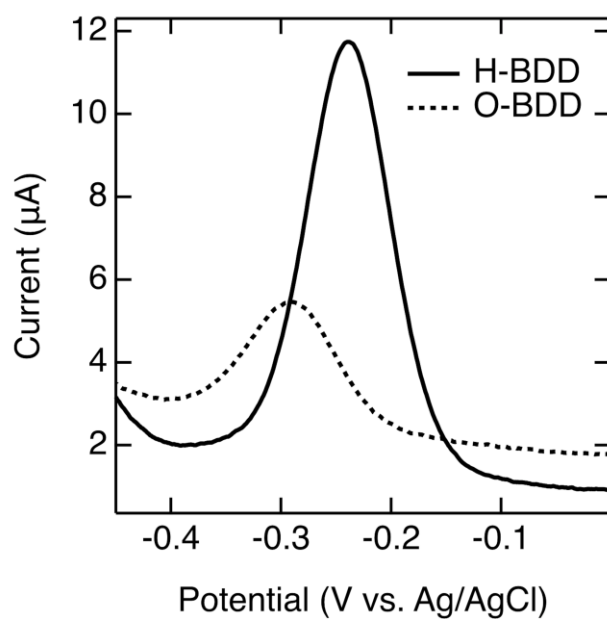
Fig. S2 Comparison of an SWV signal in PBS at BDD without any treatment (H-BDD) and BDD treated by oxygen plasma (O-BDD). Both electrodes were dipped in 1 μM aptamer solution for 1 h. Oxygen plasma treatment: 2 min, O_2 30 sccm, 100 W, PR301, Yamato Scientific Co., Ltd., Japan.
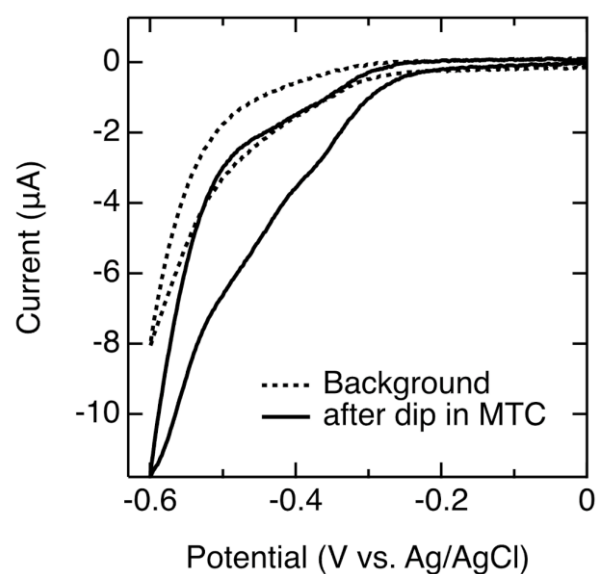
Fig. S3 Detection of mitomycin C (MTC) adsorption on BDD. Cyclic voltammetry was conducted before (dotted line) and after (solid line) dipping in 0.3 mM MTC solution in PBS (pH 7.4) for 5 min followed by 1 min rinse with flowing pure water. The reduction signal of MTC (around −0.45 V) was observed after the dipping treatment, indicating that MTC adsorbs quite strongly on BDD surface.