

Electronic Supplementary Information (ESI) for Lab on a Chip

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***Aptamer Sandwich-based Carbon Nanotube Sensors for
Single-Carbon-Atomic-Resolution Detection of Non-polar
Small Molecular Species***

Supplementary Information

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Material Preparation.

For BPA aptamer selection, BPA (4,4'-dihydroxy-2,2-diphenylpropane, Sigma-Aldrich, USA) was dissolved in 50% dimethylformamide (DMF) at a final concentration of 20 mM. Epoxy-activated Sepharose 6B resin (GE Healthcare Bio-Sciences Corp., USA) was used for immobilization of BPA via ether linkages to hydroxyl groups. Then, acridine yellow affinity column (Bio-Rad, USA) was used for housing BPA coupled resin. For preparation of a random ssDNA library for aptamer selection, a random ssDNA library with a collection of the following sequences : 5'-GGGCCGTTCTGAACACGAGCATG-N₆₀-GGACAGTACTCAGGTCATCCTAGG-3' – was chemically synthesized (Genotech Inc., Korea). And BPA similar structured chemicals – BPB (Bisphenol B), 6F (6F Bisphenol A) and BP (4,4'-Biphenol) – were purchased (TCI, Japan).

In vitro selection of BPA aptamers.

Firstly, for immobilization of BPA, epoxy-activated resin in coupling buffer (50% DMF, pH 13.0) was mixed with 20 mM BPA, and coupling of BPA to the resin was allowed to proceed overnight. The BPA coupled resin was washed and hydroxyl groups that remained unoccupied were blocked. A separate aliquot of naked resin coated with only ethanolamine was also prepared as a negative control for the aptamer selection step. Secondly, for preparing the aptamer library, synthesized ssDNA was further amplified by asymmetric PCR, and this initial pool contained 10¹⁵ ssDNA molecules.¹ Then, twelve cycles of aptamer selection and amplification were performed as described¹ with some modification. In detail, the BPA-coupled resin described above was washed with binding buffer (25 mM Tris-HCl, 100 mM NaCl, 25 mM KCl, 10 mM MgCl₂, 5% DMSO, pH 8.0) before each round of the SELEX process. The random ssDNA library pool was introduced at first round of SELEX. Then in the every selection round, 19 μmols of BPA were mixed with the random ssDNA pool and incubated at room temperature for 1 hour. The unbound ssDNA was

removed by washing the resin with binding buffer. ssDNA that bound to the BPA-coupled resin was eluted with elution buffer (50 mM BPA, 100 mM Tris-HCl, 200 mM NaCl, 25 mM KCl, 10 mM MgCl₂, 50% DMSO, pH 8.0). A negative selection step to remove non-specific ssDNA was included in the procedure after the third SELEX cycle. The aptamer pools eluted from the BPA resin after the 11th and 12th selection rounds were cloned using the pGEM-T easy vector system (Promega, USA), and individual clones were sequenced (Solgent Inc., Korea).

Determination of Secondary Structures.

Analysis of the secondary structure of the isolated aptamers was performed with a free energy minimization algorithm using the *Mfold* program (<http://frontend.bioinfo.rpi.edu/applications/mfold/cgi-bin/dna-form1.cgi>).

References

1. M. Jo, J. Lee, S. Hong, J. W. Yoo, S. Lee, J.-Y. Ahn, D.-k. Lee*, S. Hong*, S. Kim*, unpublished work.

Supplementary Figures

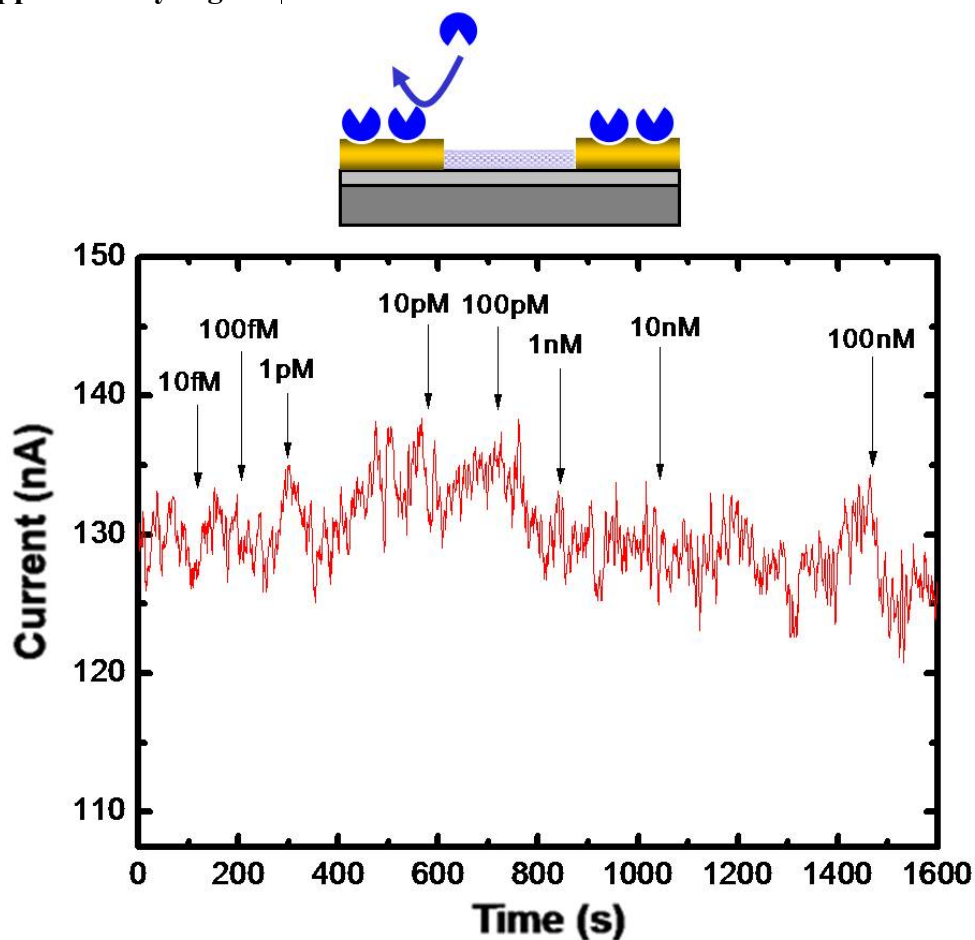


Figure S1. Non-specific sensor response test. The upper drawing shows a schematic of non-specific detection in the absence of BPA. The data in the graph (Lower) show that no significant signal was detected up to an aptamer concentration of 100 nM. Therefore, the signal in figure 3C truly comes from BPA specific binding.