Electronic Supplementary Material (ESI) for Analytical Methods.

Supplementary data

Impedimetric graphene-based biosensor for the detection of *Escherichia coli* DNA

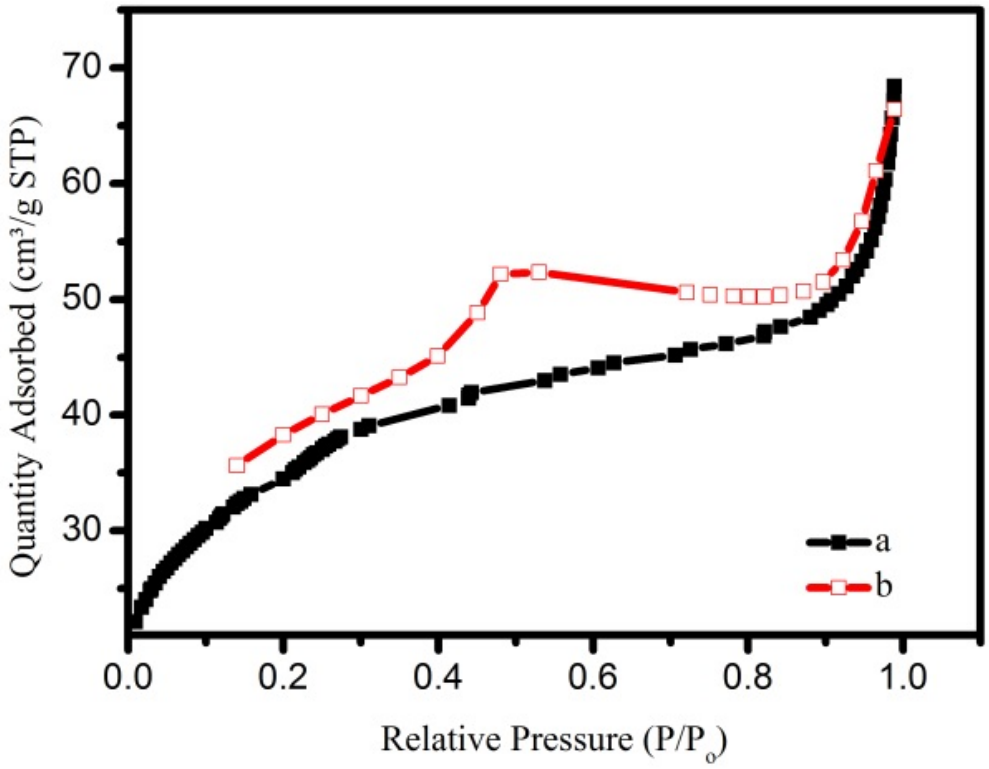
Nurulasma Zainudin,[a] Mohd Hairul Ab. Rahim,[a] Mashitah Mohd Yusoff,[a] Ling Ling Tan[b] and Kwok Feng Chong*[a]

[a] Faculty of Industrial Sciences & Technology, Universiti Malaysia Pahang, 26300 Gambang, Kuantan. Pahang. Malaysia.

[b] Southeast Asia Disaster Prevention Research Initiative (SEADPRI-UKM), LESTARI, Universiti Kebangsaan Malaysia, 43600 UKM Bangi, Selangor, Malaysia

* Corresponding author: ckfeng@ump.edu.my (Tel.: +609 5492403 ; Fax: +609 5492766)

Surface area analysis



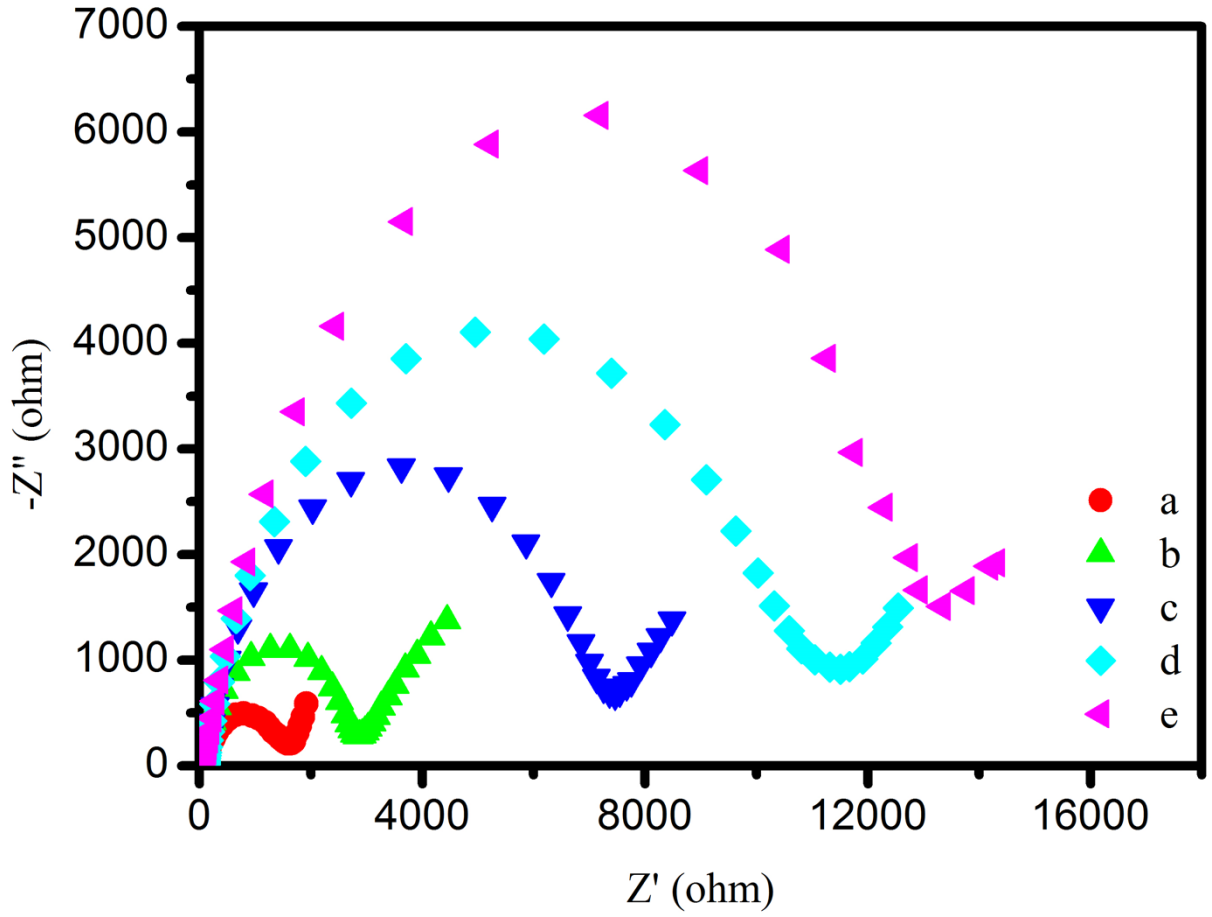
N2 adsortion-desoprtion isotherm of rGO. (a: adsorption; b: desorption)

cDNA conversion to number of cells

- Total molecular weight of 30bp cDNA (CGT CGC GGT ATA AGT AAT GGT ATC GGC GTT) = 14,695 g/mol
- Mass of 1 copy of 30bp cDNA = 14,695 / (6.022×10^{23}) = 2.44×10^{-20} g
- 100 μL of cDNA solution was used for the hybridization process.
- cDNA concentration of 0.7×10^{-15} M ≡ (0.7×10^{-15}M) (100×10^{-6} L) ≡ 7×10^{-20} mol
- Mass of cDNA concentration = 7×10^{-20} mol × 14,695 g/mol = 1.03×10^{-15} g
- Number of cDNA copies = (1.03×10^{-15} g) / (2.44×10^{-20} g) ≈ 42213 copies
- Only 1 copy of eaeA gene is available in the genome of E. coli strain. Hence, 42213 copies of eaeA gene is available in 42213 *E. coli* cells as only one copy of the complementary sequence for 30bp of cDNA is available in each single cell of *E. coli*.
- Hence, detection limit is 42213 cells in 100 μL solution or **4.22×10^5 cells/mL**.
- Similar calculation was applied to convert linear response range from molar into cells/mL as follows:

E. coli concentration (M)	cells/mL
1.0×10^{-10}	6.02×10^9
1.0×10^{-11}	6.02×10^8
1.0×10^{-12}	6.02×10^7
1.0×10^{-13}	6.02×10^6
1.0×10^{-14}	6.02×10^5

EIS results on selectivity



Nyquist plots of pDNA-PyBA-rGO modified hybridization processes with (a) ncDNA, (b) four-base mismatch, (c) double-base mismatch, (d) single-base mismatch, (e) cDNA. All DNA strains were tested at 1.0×10^{-10} M.