Oligomers Matrix-Assisted Dispersion of High Content of Carbon Nanotubes Into Monolithic Column for Online Separation and Enrichment of Proteins from Complex Biological Samples

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Supporting information

Supplement of experimental section

Oxidative Treatment of MWNTs. MWNTs were treated with an acid oxidative method. In a typical procedure, approximately 0.1 g of purified MWNTs were suspended in 50 mL of a 3:1 mixture of concentrated H_2SO_4 (98 wt%)/HNO_3(97 wt%) and refluxed in a water bath at 60 ^oC for 5 h. The solid was collected on a 100-nm-pore membrane filter and rinsed with deionized water until the pH of the filtrate was 7.

Dynamic Binding Capacity. The dynamic binding capacity (DBC) was calculated by the equation (1) :

$$DBC = C_0(V - V_0)/V_C \qquad (1)$$

where C_0 is the protein concentration (mg/L), V is the volume of protein solution pumped into the column at 50% breakthrough (mL), V_0 is the dead volume (mL), and V_C is the total column volume of the monolith (mL). In brief, the monolith was equilibrated with a loading buffer. After equilibration, elution of protein and regeneration of the monolith were carried out with the elution buffer.

Supplement of Figures

Figure S-1. Photograph images of OMAD-MMC with different MWNTs weight ratios: (A) 3 wt%, (B) 5 wt%.

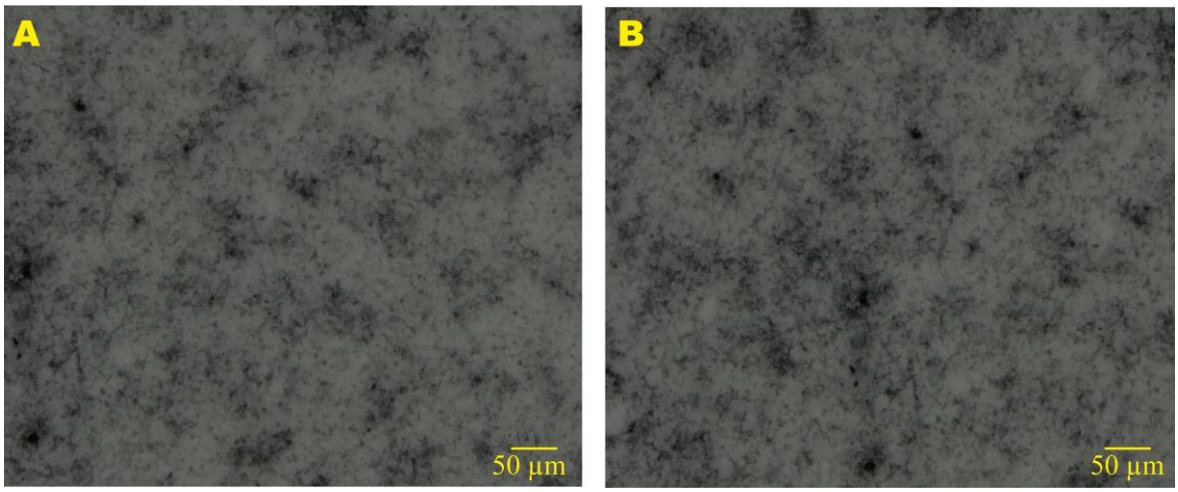

Figure S-2. Optical microscope image showing an overall morphology of a cross-section of OMAD-MMC with different MWNTs weight ratios: (a) 3 wt%, (b) 5 wt%.

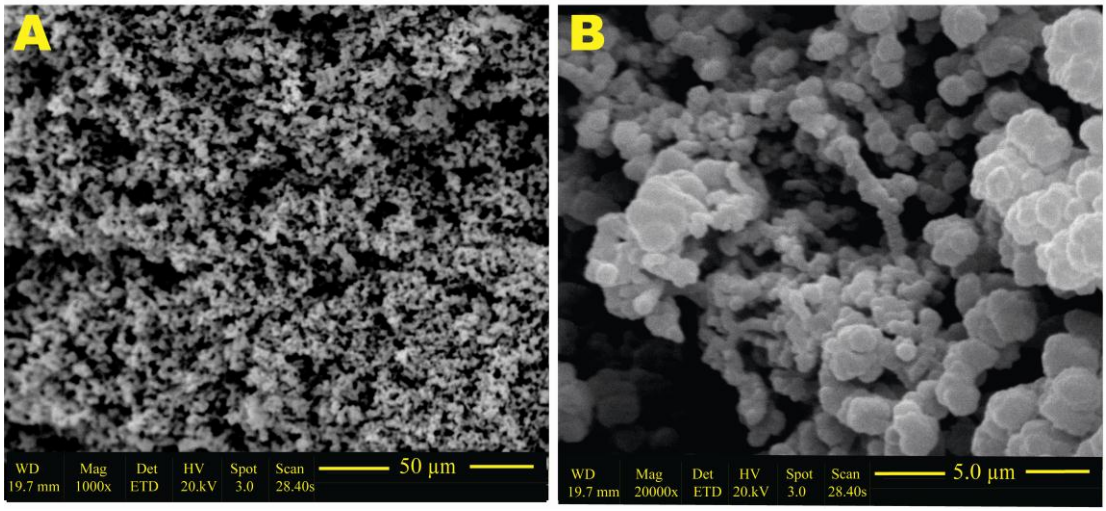

Figure S-3. Scanning electron micrographs of OMAD-MMC at magnifications of (A) 1000× and (B) 20000×.

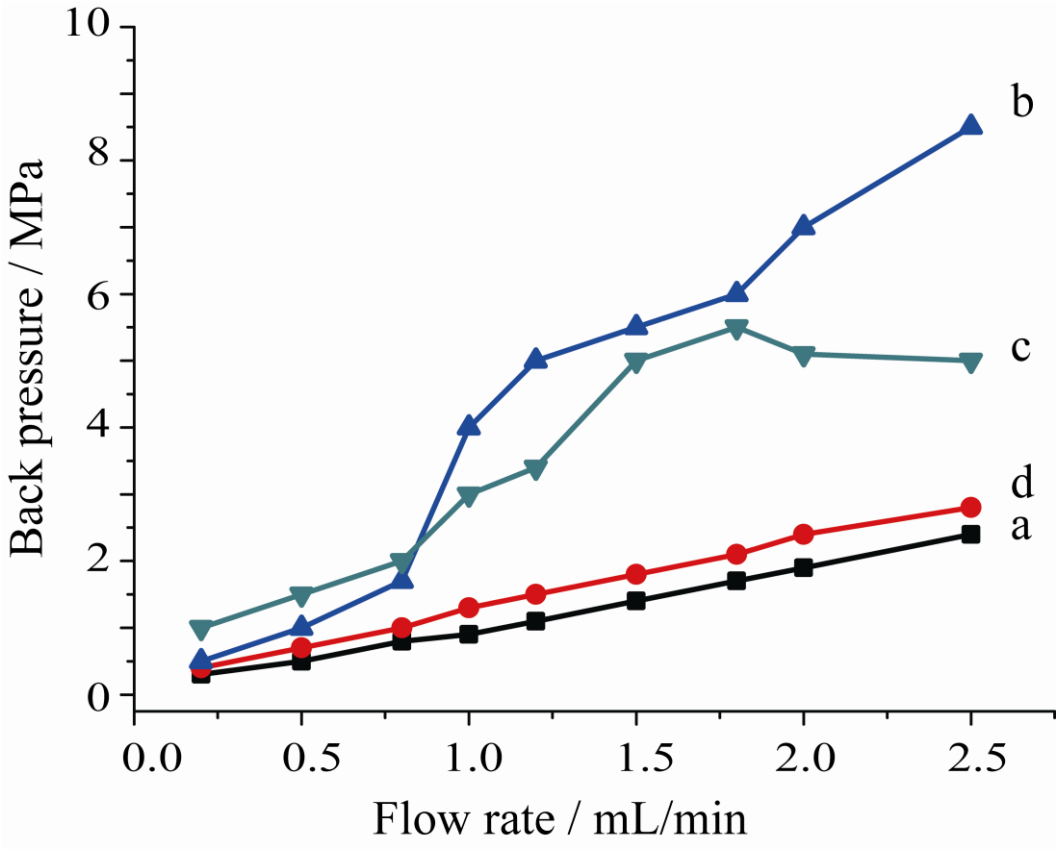

Figure S-4. Linear velocity and back-pressure drop on monolithic column. (a) PMC, (b) MMC-0, (c) MMC-10 and (d) OMAD-MMC. (column size: 100 mm×2.1 mm i.d.)

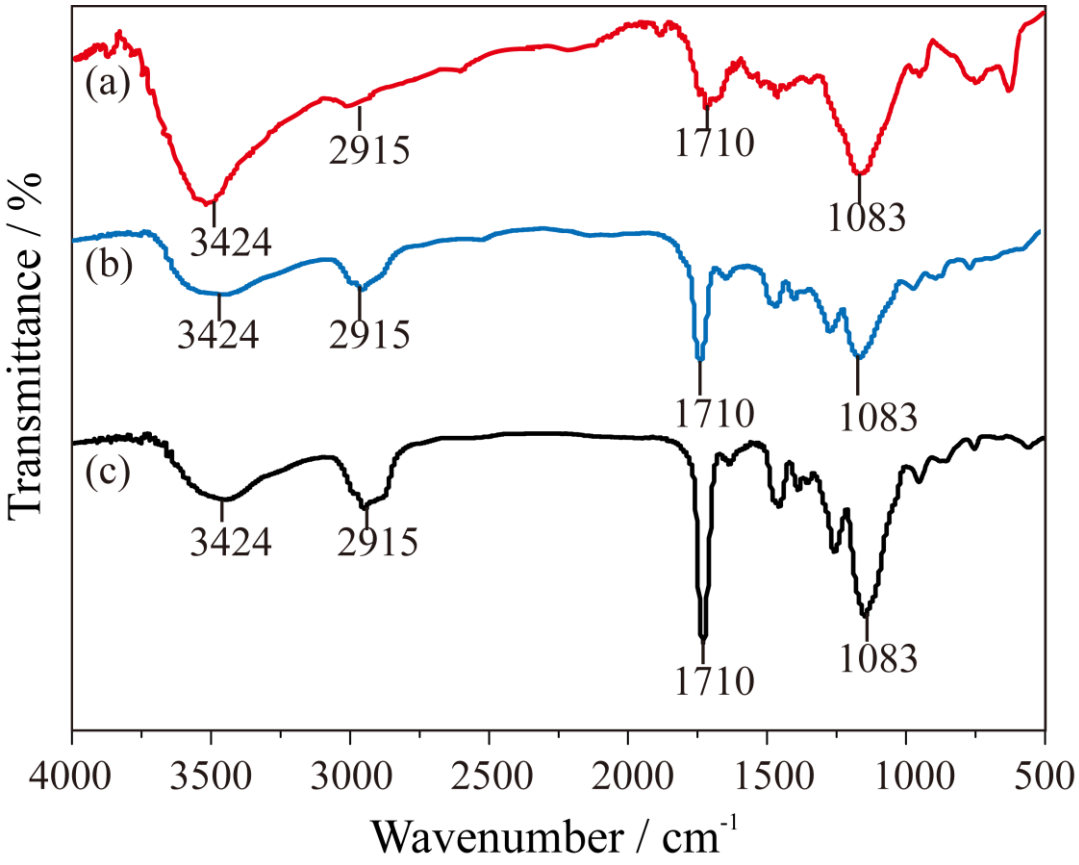

Figure S-5. Comparison of FT-IR spectra of (a) c-MWNTs, (b) PMC and (c) OMAD-MMC.

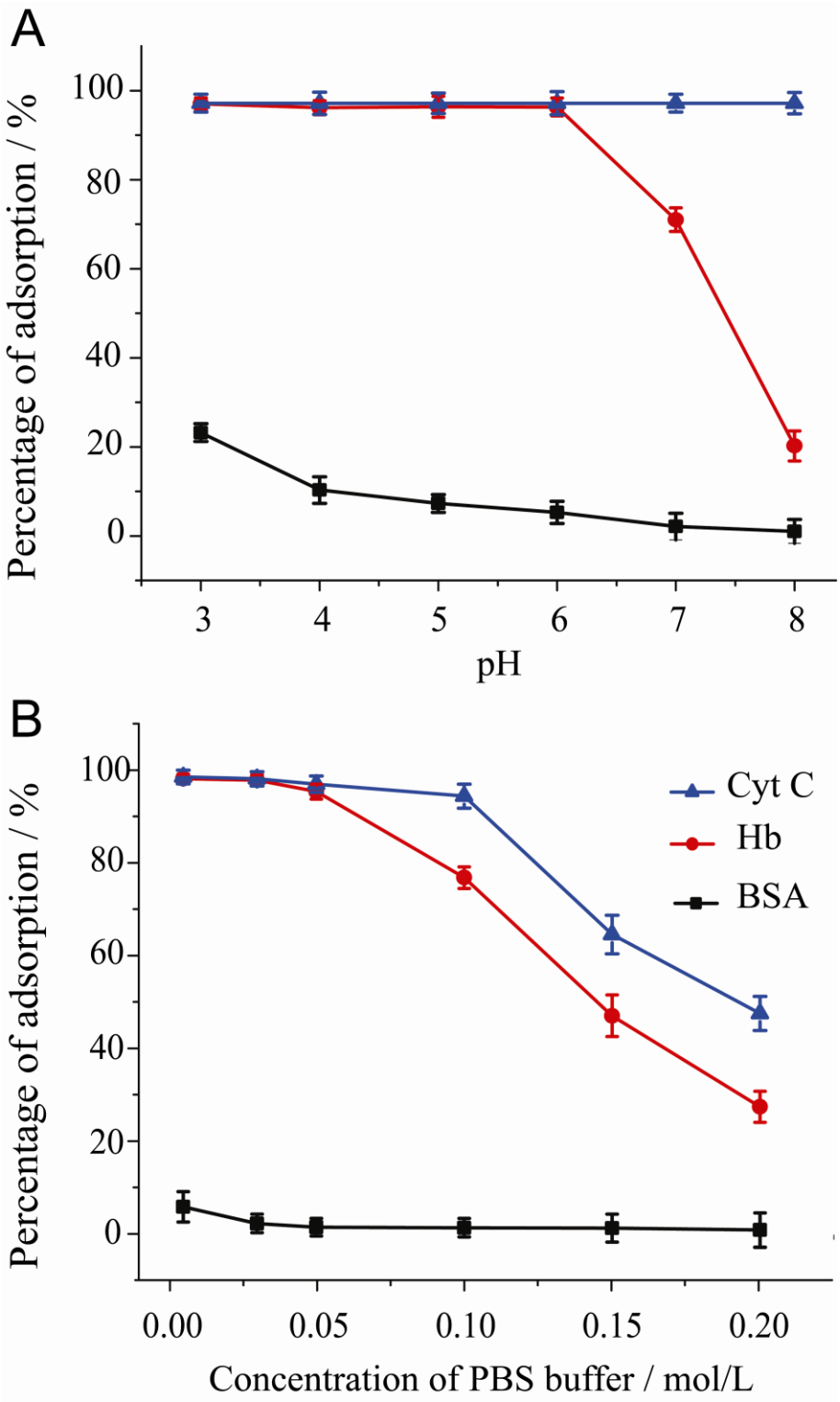

Figure S-6. Effect of pH value (A) and ionic strength (B) on adsorption of Hb, Cyt C and BSA. Sampling volume: 2 mL; Eluent Volumes: 500 μL; Flow rate: 20 μL/s ; Concentration of proteins in the original solution: 10 μg/mL. (Hb and Cyt C were detected at 406 nm, while BSA was detected at 208 nm); Errors bars show the standard deviation of the mean (n = 3).

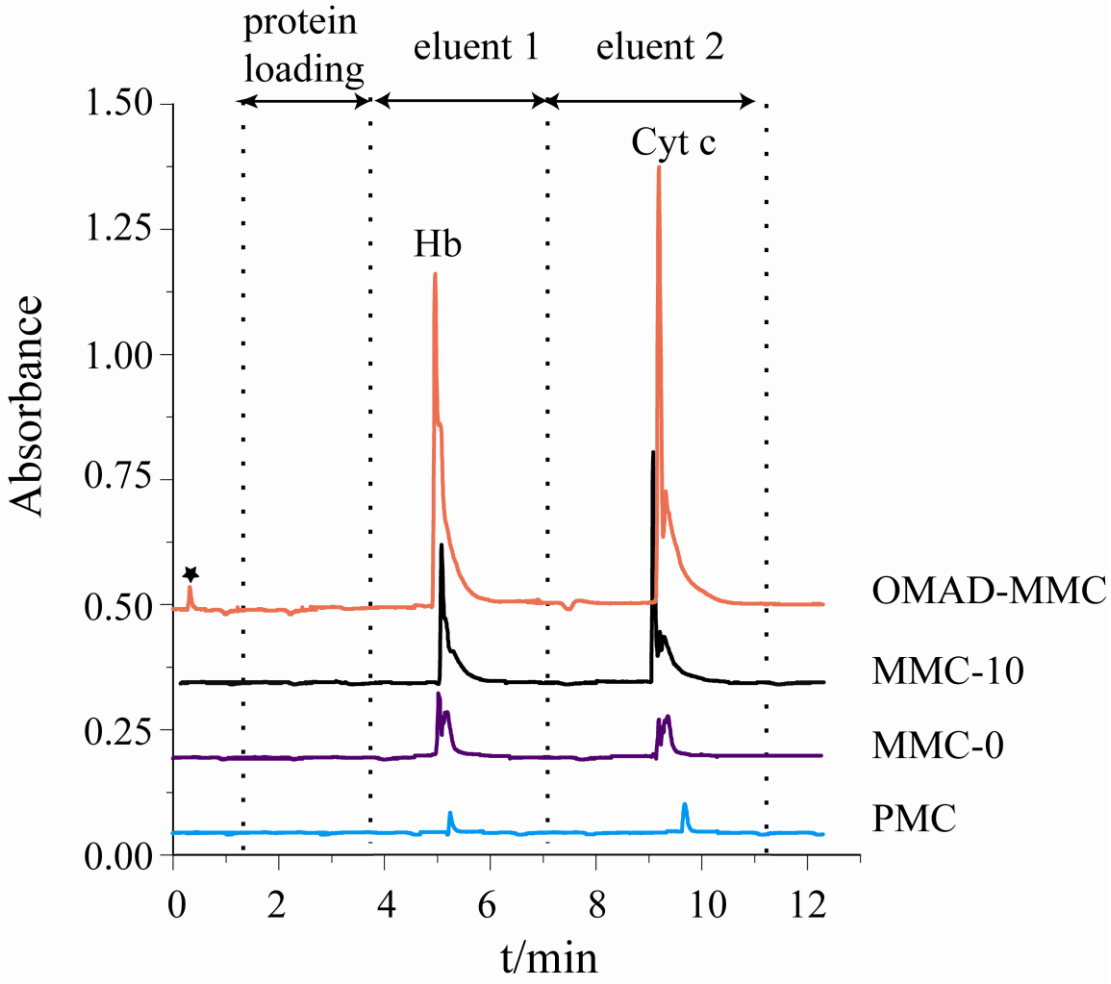

Figure S-7. Comparison of OMAD-MMC with MMC-0, MMC-10 and PMC for the selective adsorption of basic proteins from model protein mixtures. The peak marked with an asterisk is attributable to the original sample solution containing Hb and Cyt C without pretreatment. Experimental conditions: loading buffer: phosphate buffer (0.025 mol/L, pH 6); Eluent 1: pH 8.0, 0.1 mol/L PBS; Eluent 2: pH 11.0, 1 mol/L ammonium sulfate; Sampling volume: 2 mL; Eluent Volumes: 500 μL; Flow rate: 20 μL/s ; Detection wavelength: 406 nm; monolithic columns: 100 mm×2.1 mm i.d..

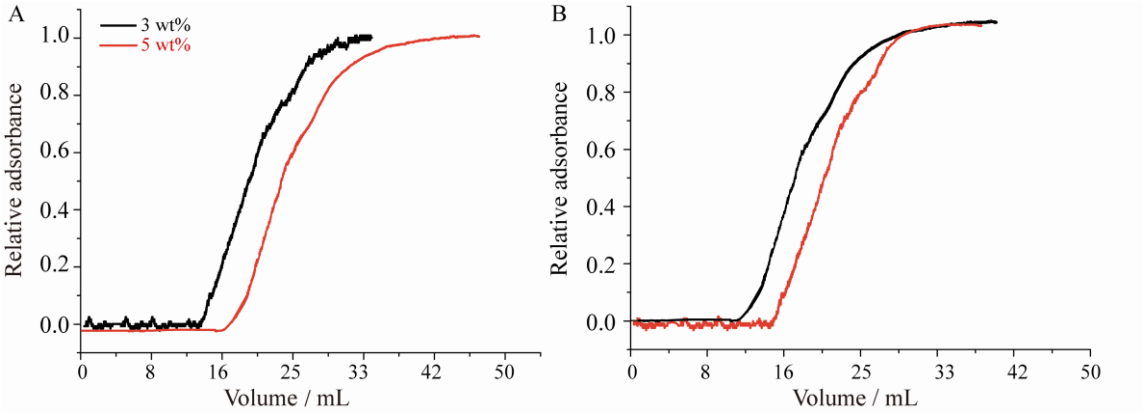

Figure S-8. Breakthrough curves of hemoglobin (A) and cytochrome c (B) demonstrating the effect of the content of MWNTs in the polymer matrix on loading capacity of OMAD-MMC. Conditions: monolithic columns 100 mm×2.1 mm i.d.; carrier solution: 0.025 mol/L phosphate buffer (pH 6.0); flow rate: 1mL/min; concentration of hemoglobin and cytochrome c solution: 0.1 mg/mL; detection wavelength, 406 nm.