Protein Binding by Functionalized Multiwalled Carbon Nanotubes is Governed by the Surface Chemistry of Both Parties and the Nanotube Diameter

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Supplementary Information

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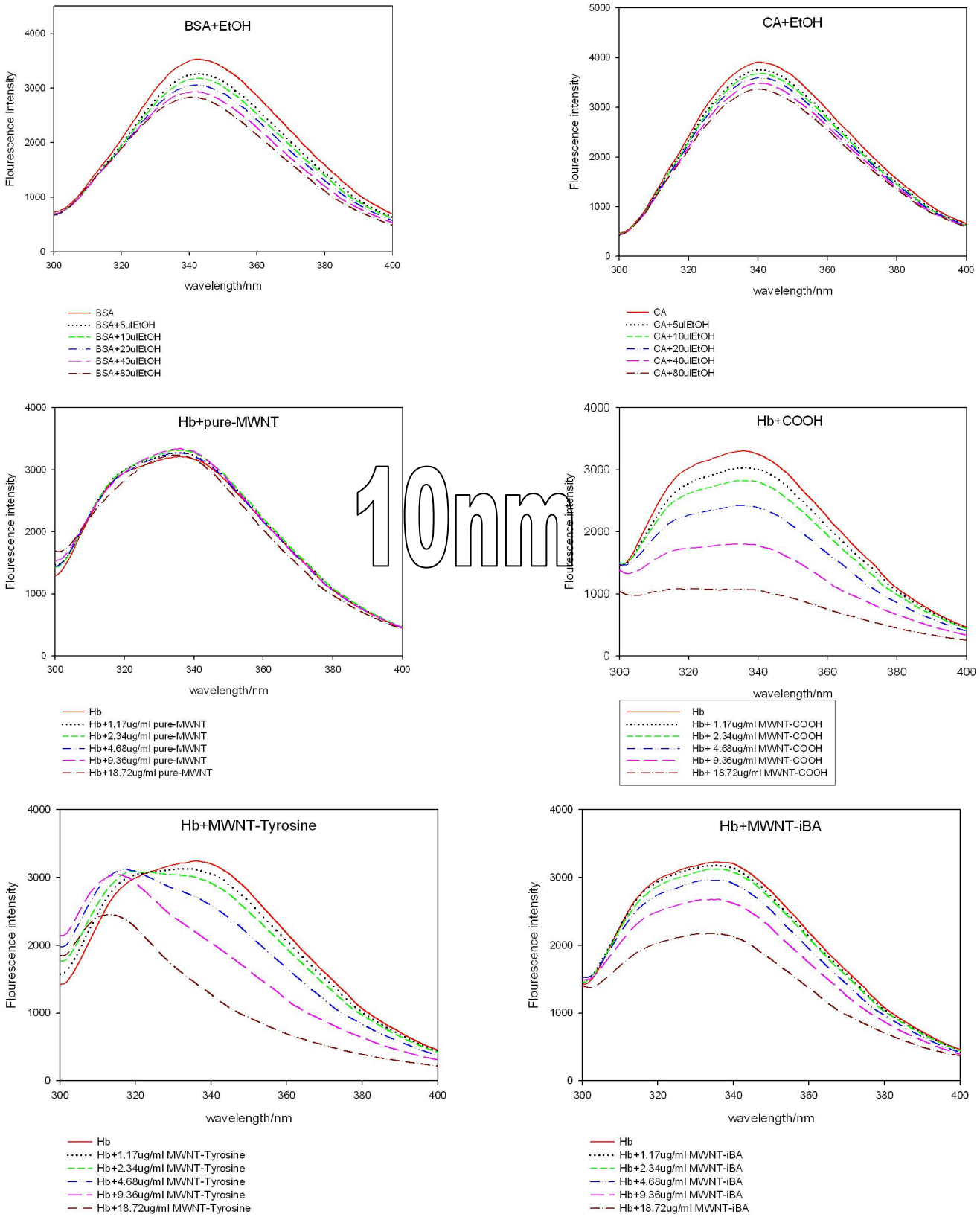
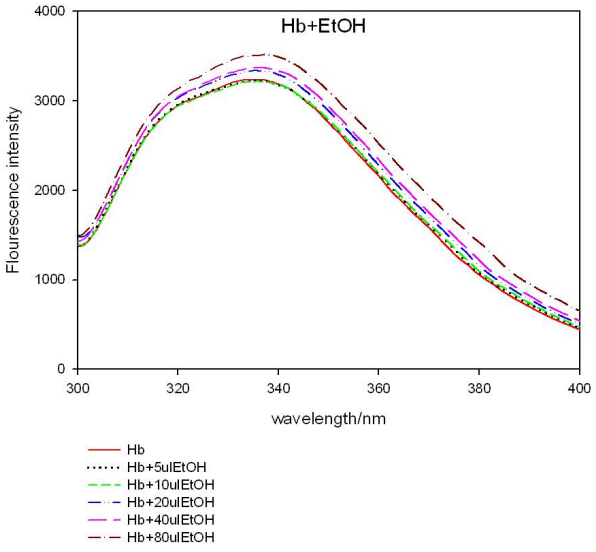
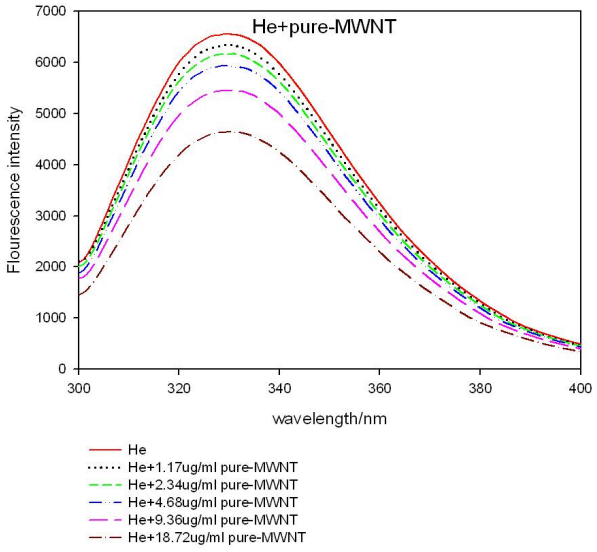
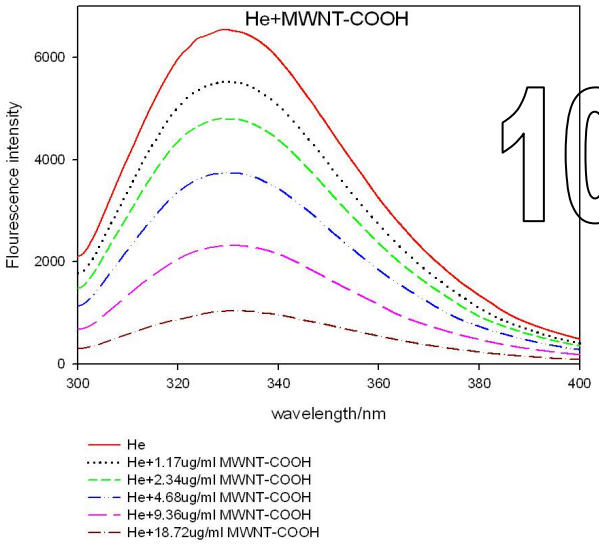
SI_Fig 1. Fluorescence spectra of proteins before and after f-MWNT addition. Final concentrations of f-MWNT in solutions is 0, 1.17, 2.34, 4.68, 9.36, 18.72 μg/mL, respectively. As shown in different colors.

(a) 10nm f-MWNT

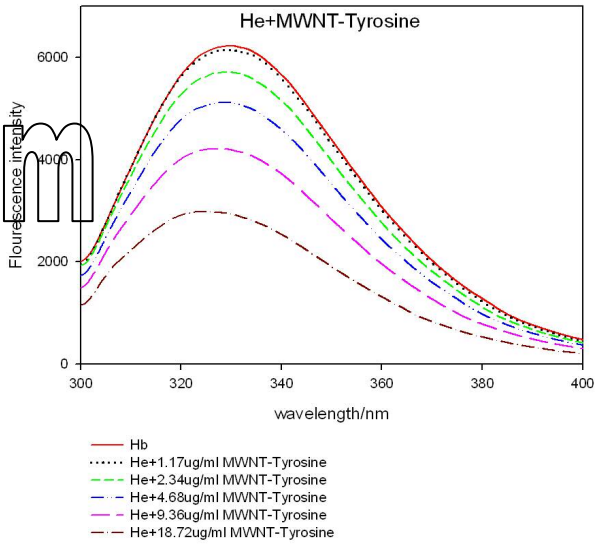


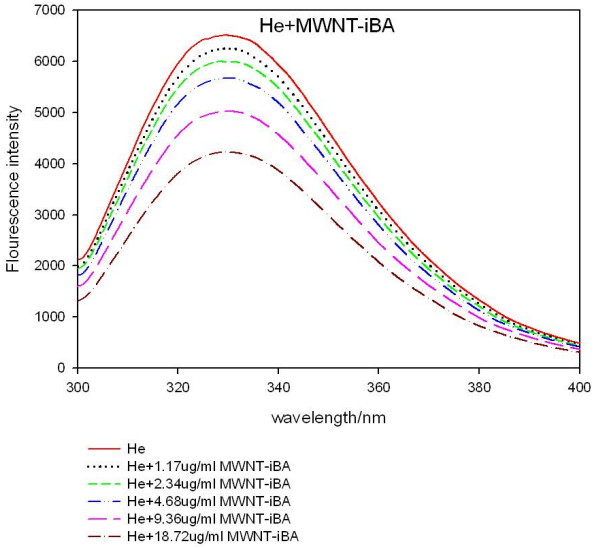

Hb+EtOH
Flourescence intensity
wavelength/nm
Hb
Hb+5ulEtOH
Hb+10ulEtOH
Hb+20ulEtOH
Hb+40ulEtOH
Hb+80ulEtOH

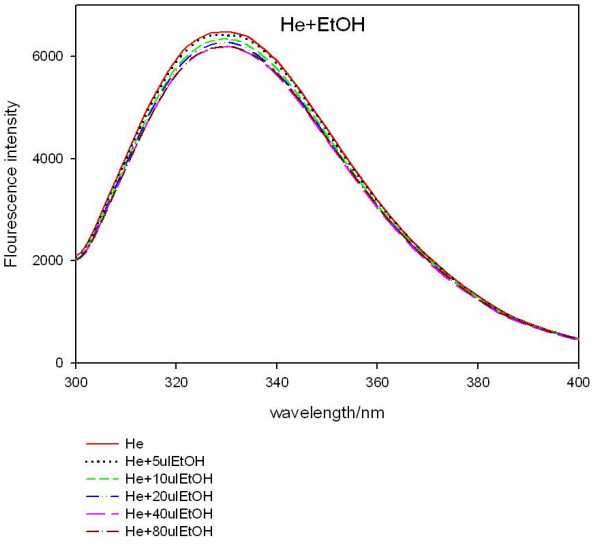

He+pure-MWNT
Flourescence intensity
wavelength/nm
He
He+1.17ug/ml pure-MWNT
He+2.34ug/ml pure-MWNT
He+4.68ug/ml pure-MWNT
He+9.36ug/ml pure-MWNT
He+18.72ug/ml pure-MWNT

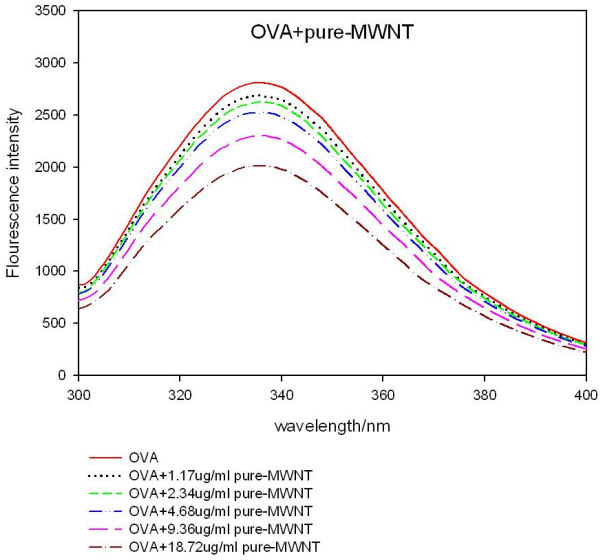

He+MWNT-COOH
Flourescence intensity
wavelength/nm
He
He+1.17ug/ml MWNT-COOH
He+2.34ug/ml MWNT-COOH
He+4.68ug/ml MWNT-COOH
He+9.36ug/ml MWNT-COOH
He+18.72ug/ml MWNT-COOH

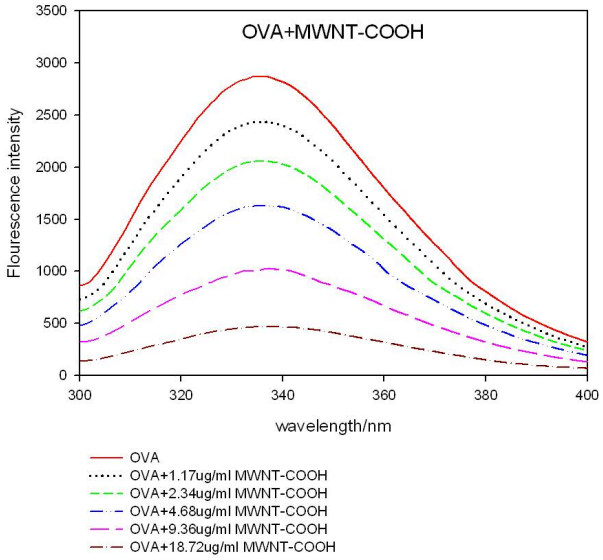
10nm

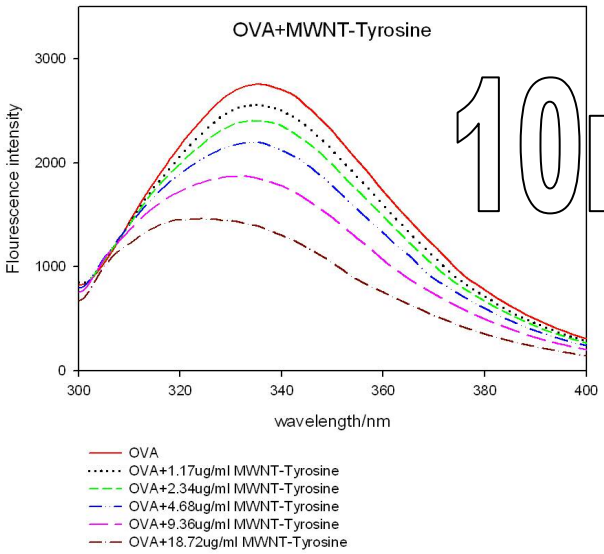

He+MWNT-Tyrosine
Flourescence intensity
wavelength/nm
Hb
He+1.17ug/ml MWNT-Tyrosine
He+2.34ug/ml MWNT-Tyrosine
He+4.68ug/ml MWNT-Tyrosine
He+9.36ug/ml MWNT-Tyrosine
He+18.72ug/ml MWNT-Tyrosine


He+MWNT-iBA
Flourescence intensity
wavelength/nm
He
He+1.17ug/ml MWNT-iBA
He+2.34ug/ml MWNT-iBA
He+4.68ug/ml MWNT-iBA
He+9.36ug/ml MWNT-iBA
He+18.72ug/ml MWNT-iBA

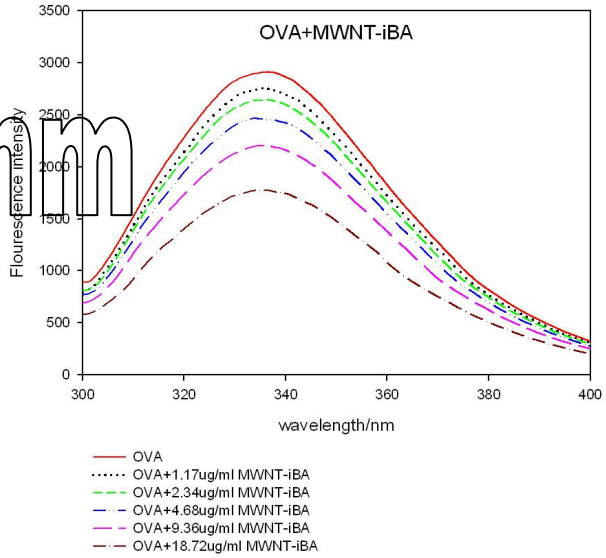

He+EtOH
Flourescence intensity
wavelength/nm
He
He+5ulEtOH
He+10ulEtOH
He+20ulEtOH
He+40ulEtOH
He+80ulEtOH

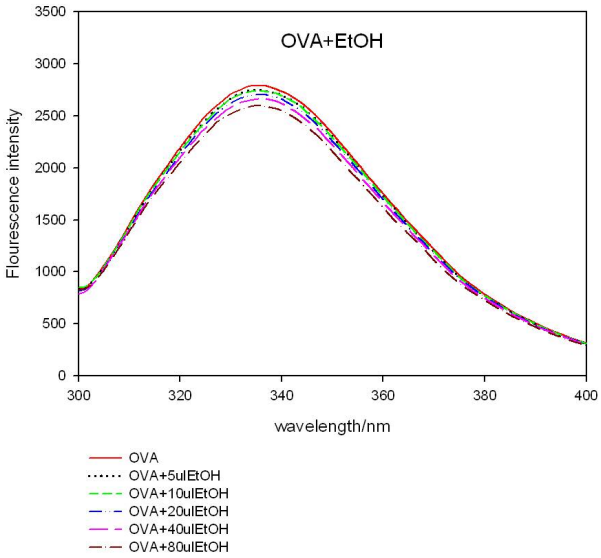

OVA+pure-MWNT
Flourescence intensity
wavelength/nm
OVA
OVA+1.17ug/ml pure-MWNT
OVA+2.34ug/ml pure-MWNT
OVA+4.68ug/ml pure-MWNT
OVA+9.36ug/ml pure-MWNT
OVA+18.72ug/ml pure-MWNT


OVA+MWNT-COOH
Flourescence intensity
wavelength/nm
OVA
OVA+1.17ug/ml MWNT-COOH
OVA+2.34ug/ml MWNT-COOH
OVA+4.68ug/ml MWNT-COOH
OVA+9.36ug/ml MWNT-COOH
OVA+18.72ug/ml MWNT-COOH

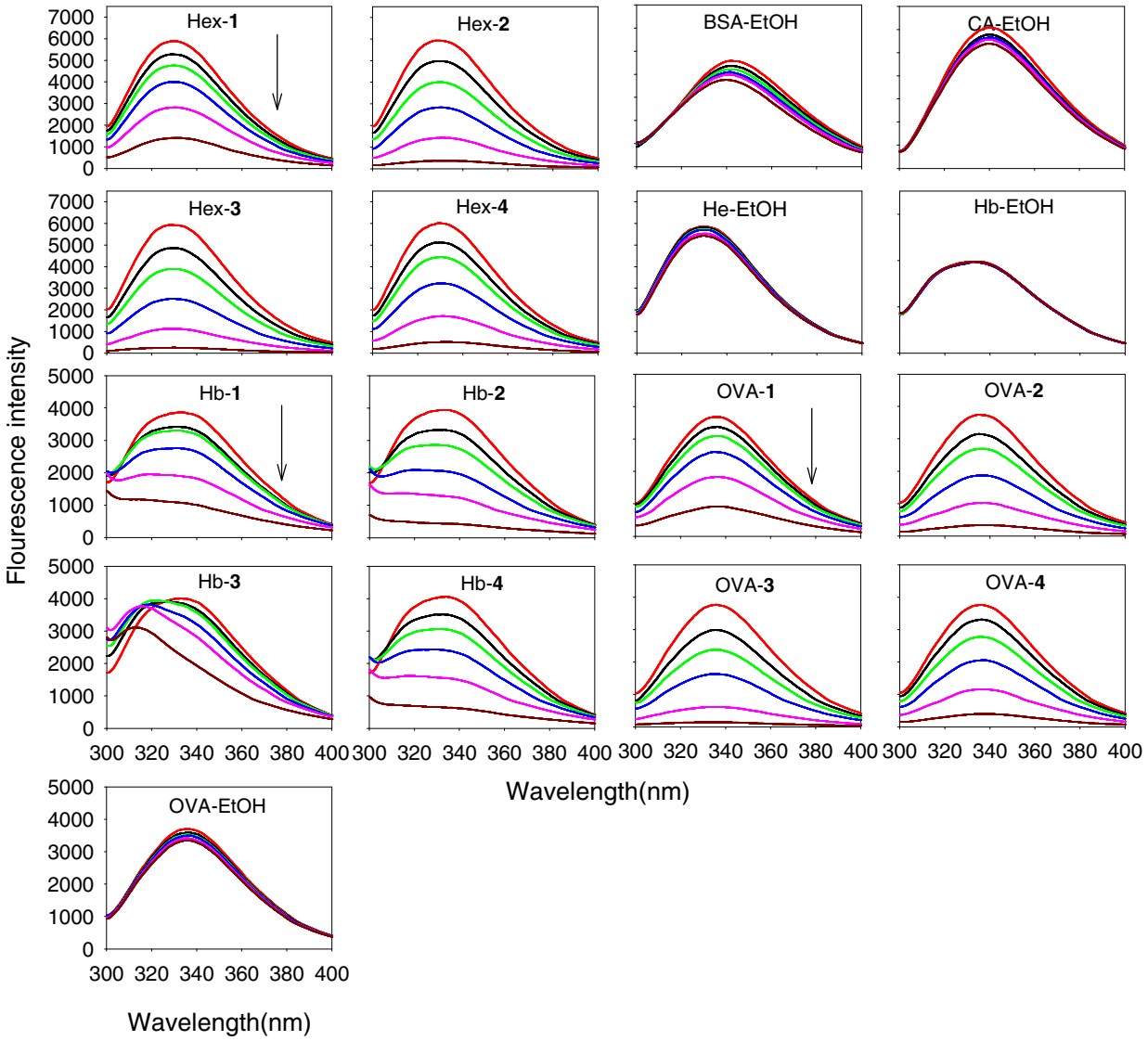

OVA+MWNT-Tyrosine
Flourescence intensity
wavelength/nm
OVA
OVA+1.17ug/ml MWNT-Tyrosine
OVA+2.34ug/ml MWNT-Tyrosine
OVA+4.68ug/ml MWNT-Tyrosine
OVA+9.36ug/ml MWNT-Tyrosine
OVA+18.72ug/ml MWNT-Tyrosine

10nm

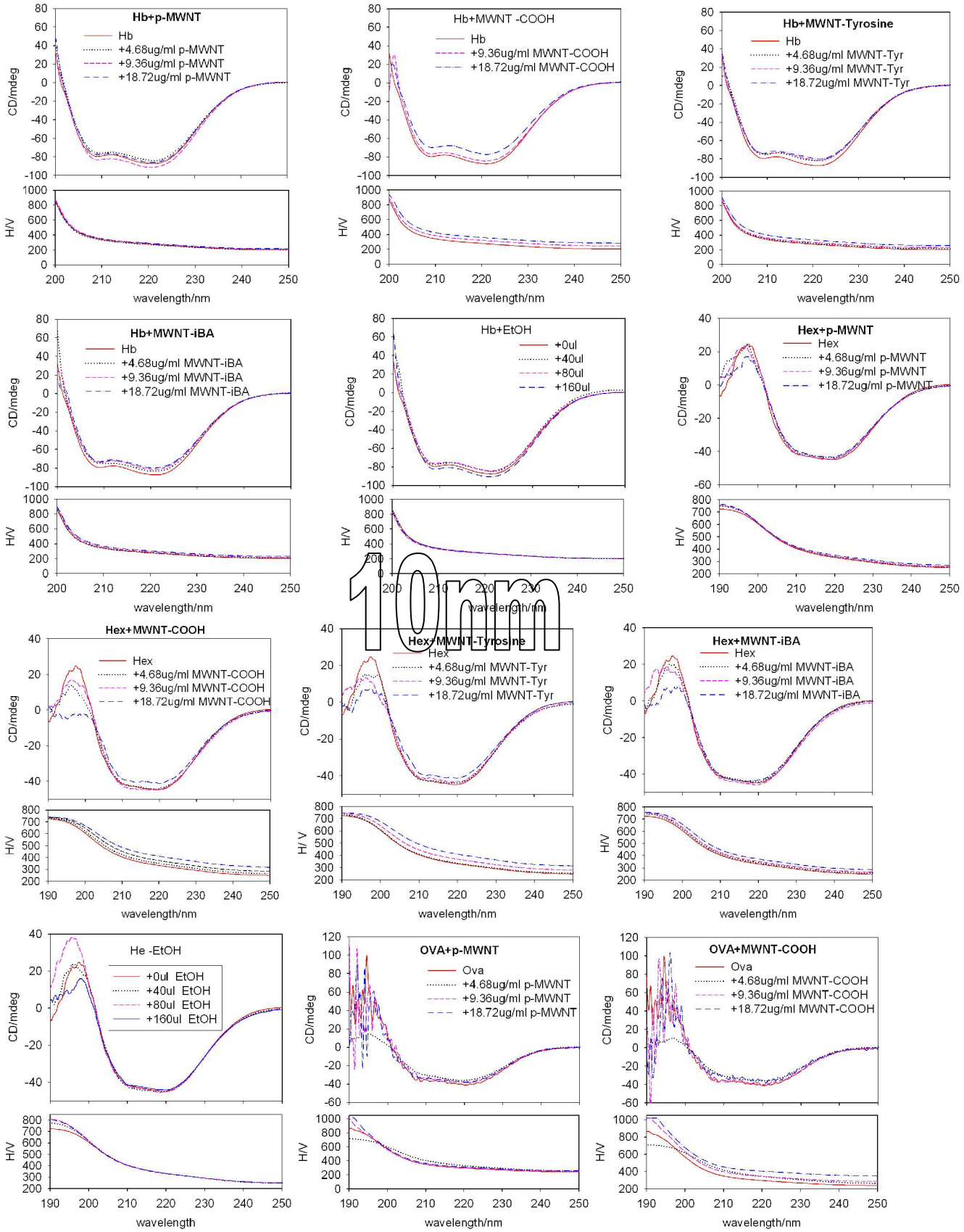

OVA+MWNT-iBA
Flourescence intensity
wavelength/nm
OVA
OVA+1.17ug/ml MWNT-iBA
OVA+2.34ug/ml MWNT-iBA
OVA+4.68ug/ml MWNT-iBA
OVA+9.36ug/ml MWNT-iBA
OVA+18.72ug/ml MWNT-iBA

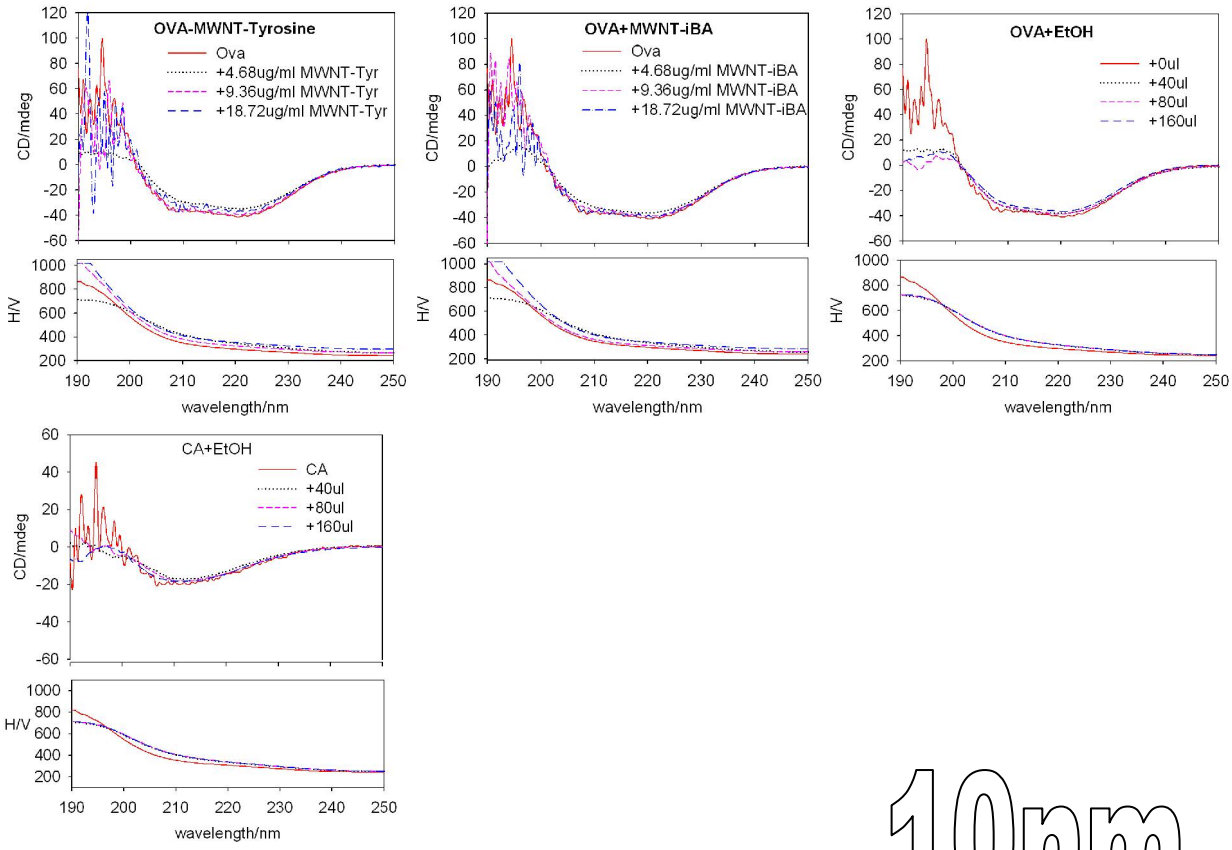

OVA+EtOH
Flourescence intensity
wavelength/nm
OVA
OVA+5ulEtOH
OVA+10ulEtOH
OVA+20ulEtOH
OVA+40ulEtOH
OVA+80ulEtOH

(b) 40nm f-MWNT


Hex-1
Hex-2
BSA-EtOH
CA-EtOH
Hex-3
Hex-4
He-EtOH
Hb-EtOH
Hb-1
Hb-2
OVA-1
OVA-2
Hb-3
Hb-4
OVA-3
OVA-4
OVA-EtOH
Flourescence intensity
Wavelength(nm)
0
1000
2000
3000
4000
5000
6000
7000
300 320 340 360 380 400

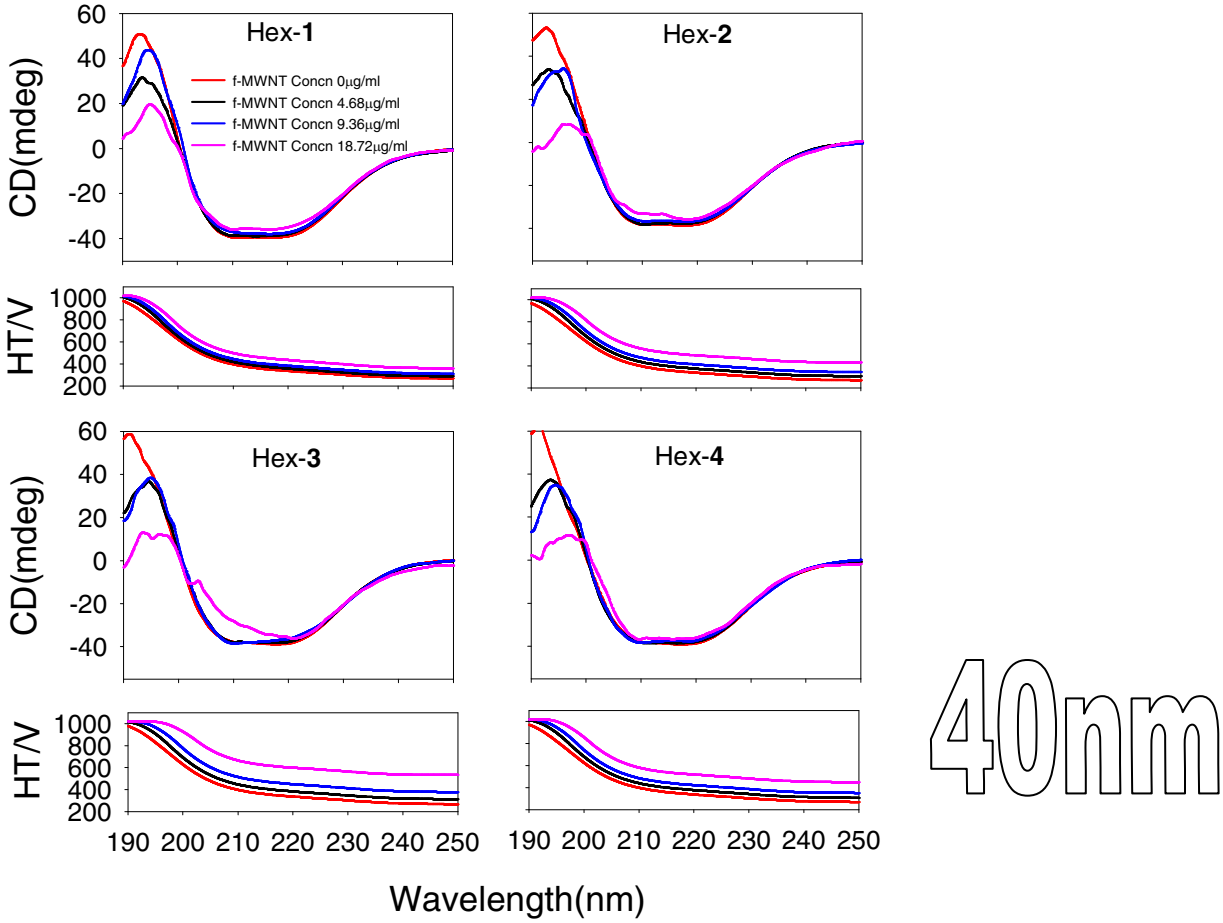
SI_Fig 4. CD spectra of HB, HK (Hex), Oval before and after f-MWNTs addition and wavelength dependent high voltage on the photomultiplier. The final concentration of f-MWNT is shown. (a) 10nm f-MWNT

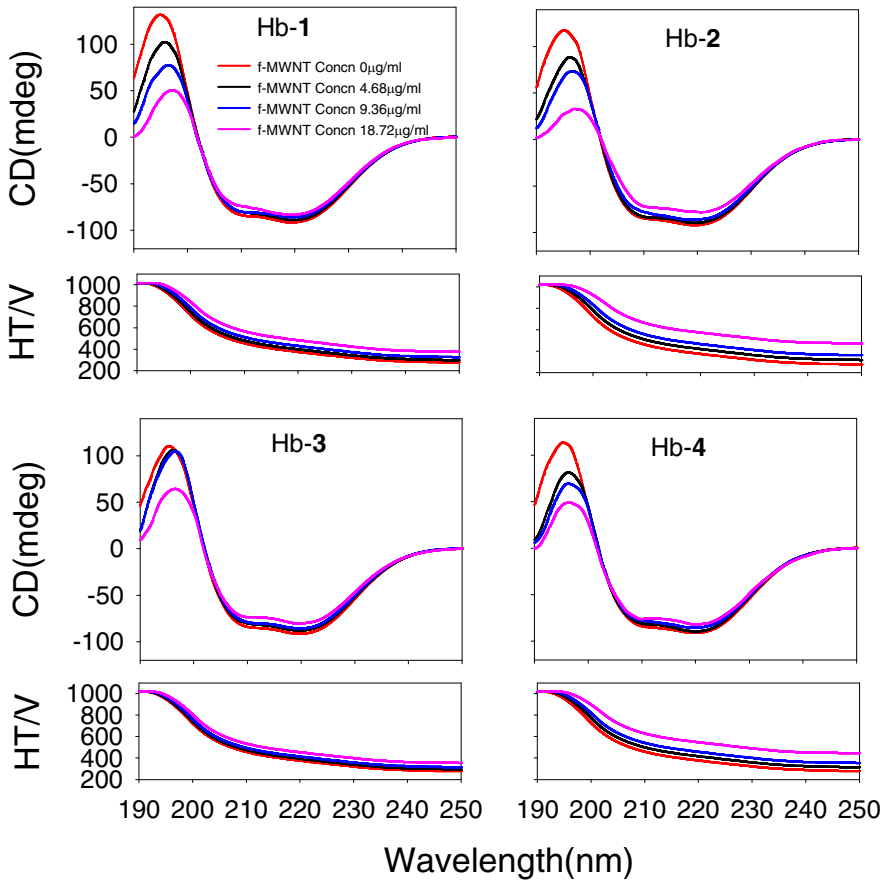



OVA-MWNT-Tyrosine
Ova
+4.68ug/ml MWNT-Tyr
+9.36ug/ml MWNT-Tyr
+18.72ug/ml MWNT-Tyr
OVA+MWNT-iBA
Ova
+4.68ug/ml MWNT-iBA
+9.36ug/ml MWNT-iBA
+18.72ug/ml MWNT-iBA
OVA+EtOH
+0ul
+40ul
+80ul
+160ul
CA+EtOH
CA
+40ul
+80ul
+160ul
CD/mdeg
H/V
wavelength/nm

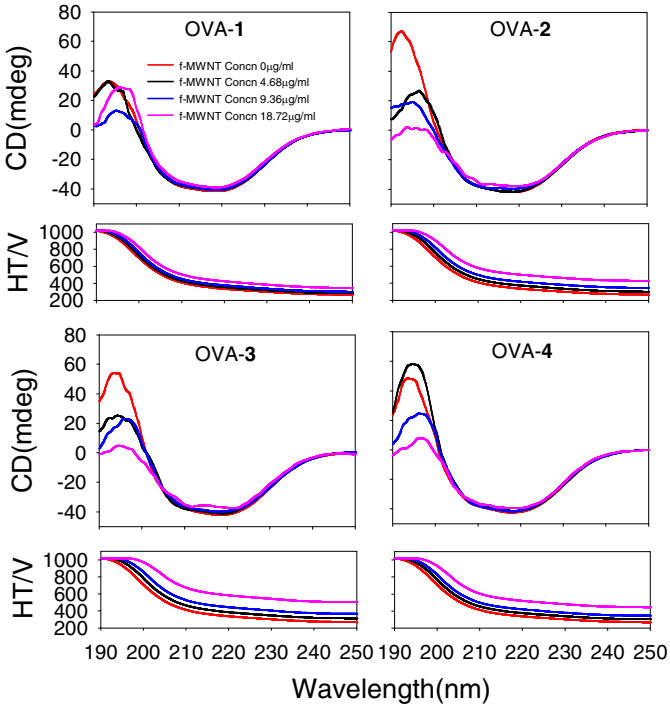
10nm

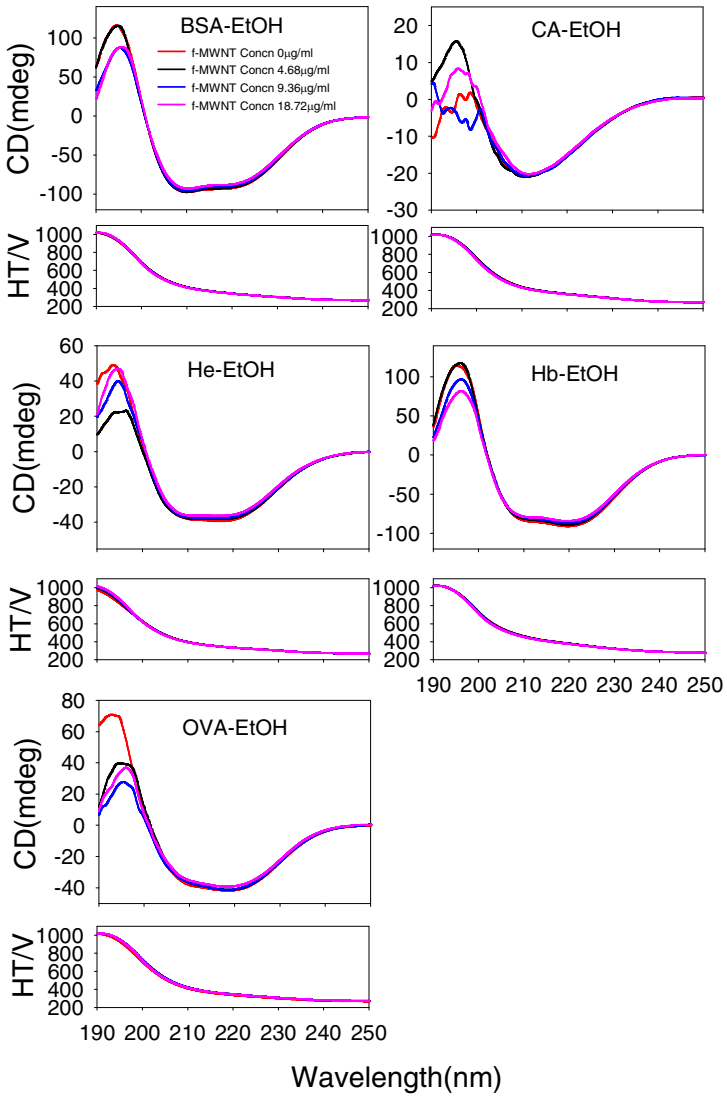
(b) 40nm f-MWNT


Hex-1
Hex-2
Hex-3
Hex-4
f-MWNT Concn 0μg/ml
f-MWNT Concn 4.68μg/ml
f-MWNT Concn 9.36μg/ml
f-MWNT Concn 18.72μg/ml
CD(mdeg)
HT/V
Wavelength(nm)
40nm


Hb-1
Hb-2
Hb-3
Hb-4
f-MWNT Concn 0μg/ml
f-MWNT Concn 4.68μg/ml
f-MWNT Concn 9.36μg/ml
f-MWNT Concn 18.72μg/ml
CD(mdeg)
HT/V
Wavelength(nm)

40nm

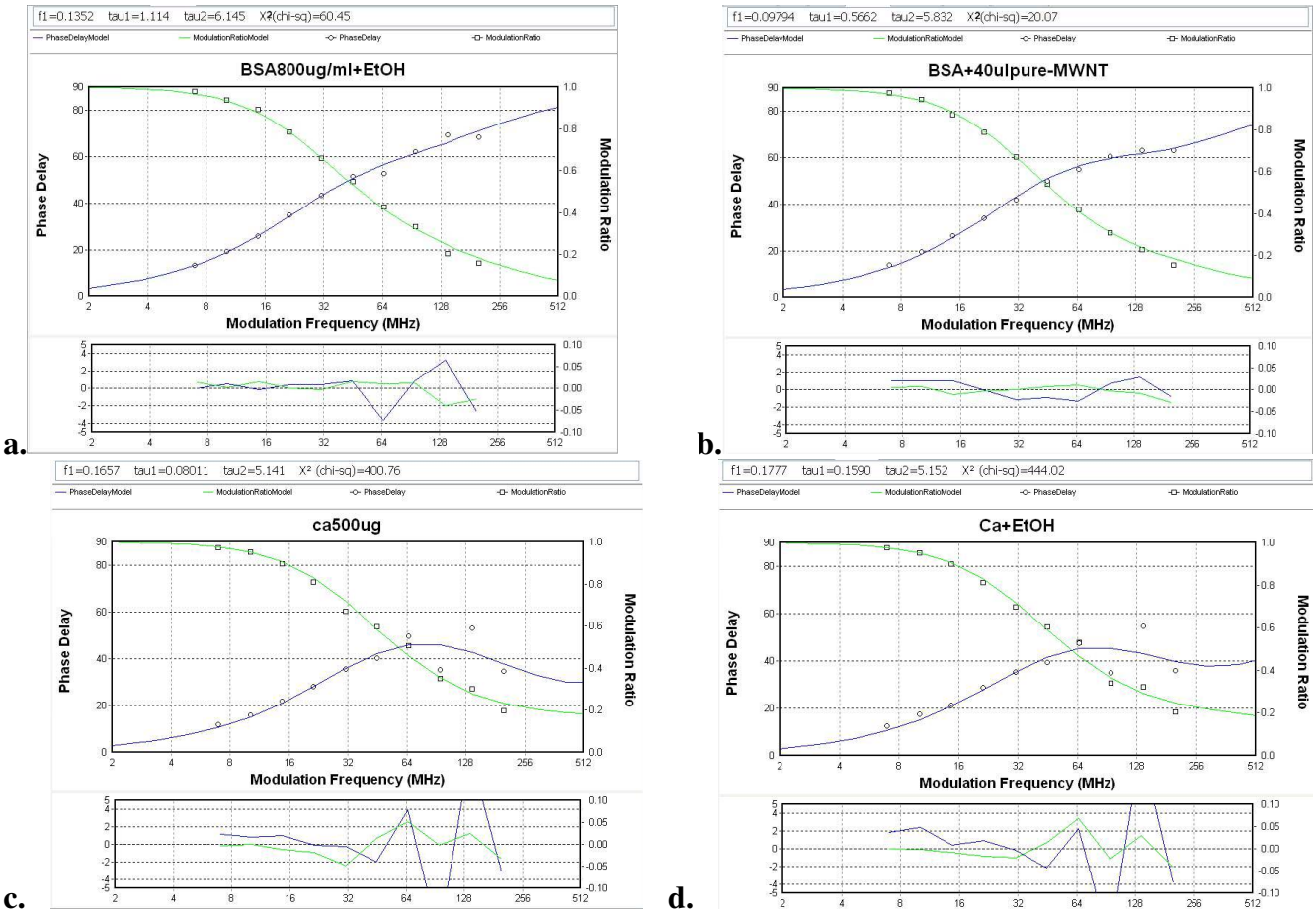

OVA-1
OVA-2
OVA-3
OVA-4
f-MWNT Concn 0μg/ml
f-MWNT Concn 4.68μg/ml
f-MWNT Concn 9.36μg/ml
f-MWNT Concn 18.72μg/ml
CD(mdeg)
HT/V
Wavelength(nm)

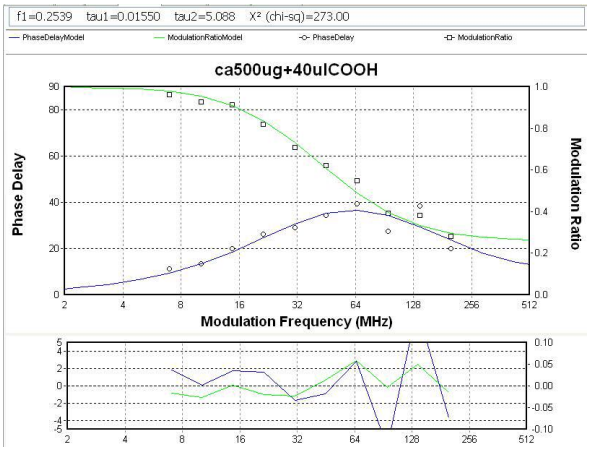

BSA-EtOH
f-MWNT Concn 0μg/ml
f-MWNT Concn 4.68μg/ml
f-MWNT Concn 9.36μg/ml
f-MWNT Concn 18.72μg/ml
CA-EtOH
He-EtOH
Hb-EtOH
OVA-EtOH
CD(mdeg)
HT/V
Wavelength(nm)

40nm

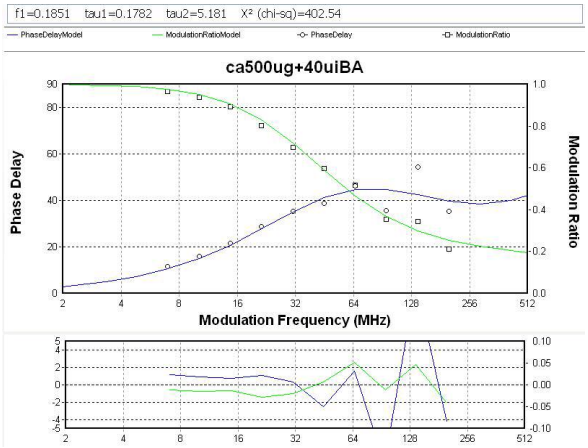
SI_Fig 3: Phase-modulation data and two exponential fitted for proteins with and without f-MWNT (blue: phase delay; green: modulation ratio) and data points of phase and modulation. Hemoglobin has very low signal and hasn't been selected for lifetime measurement.

a. BSA at 800µg/ml with 40µl ethanol
b. BSA at 800µg/ml with 40µl 350µg/ml f-MWNT **1**
c. Carbonic anhydrase at 500µg/ml
d. Carbonic anhydrase at 500µg/ml with 40µl ethanol
e. Carbonic anhydrase at 500µg/ml with 40µl 350µg/ml f-MWNT **2**
f. Carbonic anhydrase at 500µg/ml with 40µl 350µg/ml f-MWNT **4**
g. Carbonic anhydrase at 500µg/ml with 40µl 350µg/ml f-MWNT **3**
h. Carbonic anhydrase at 500µg/ml with 40µl 350µg/ml f-MWNT **1**
i. Hexokinase at 500µg/ml with 40µl ethanol
j. Hexokinase at 500µg/ml
k. Hexokinase at 500µg/ml with 40µl 350µg/ml f-MWNT **2**
l. Hexokinase at 500µg/ml with 40µl 350µg/ml f-MWNT **4**
m. Hexokinase at 500µg/ml with 40µl 350µg/ml f-MWNT **3**
n. Hexokinase at 500µg/ml with 40µl 350µg/ml f-MWNT **1**
o.Ovalbumin at 500µg/ml with 40µl 350µg/ml f-MWNT **1**
p. Ovalbumin at 500µg/ml
q. Ovalbumin at 500µg/ml with 40µl 350µg/ml f-MWNT **2**
r. Ovalbumin at 500µg/ml with 40µl 350µg/ml f-MWNT **4**
s. Ovalbumin at 500µg/ml with 40µl 350µg/ml f-MWNT **3**
t. Ovalbumin at 500µg/ml with 40µl ethanol

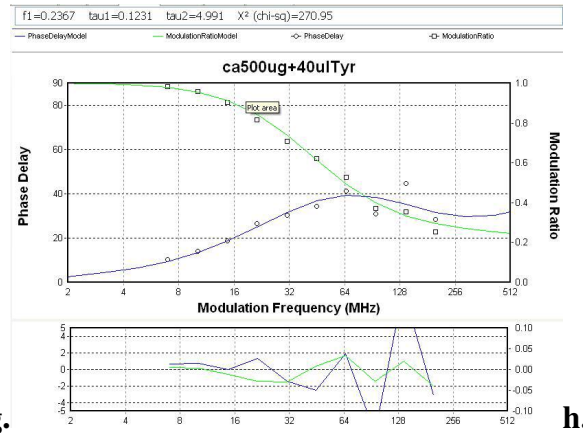



f1=0.2539 tau1=0.01550 tau2=5.088 X² (chi-sq)=273.00
PhaseDelayModel
ModulationRatioModel
PhaseDelay
ModulationRatio
ca500ug+40uICOOH
Phase Delay
Modulation Ratio
Modulation Frequency (MHz)

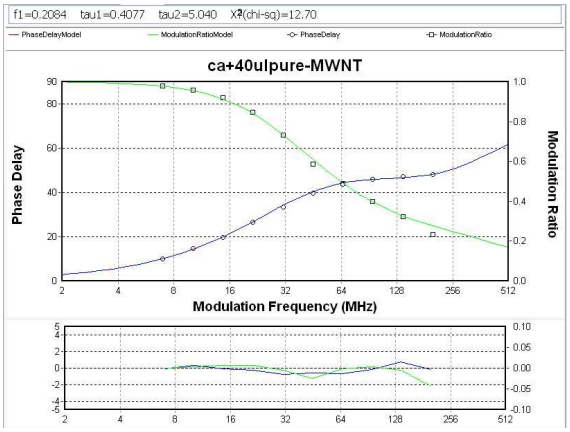
e.


f1=0.1851 tau1=0.1782 tau2=5.181 X² (chi-sq)=402.54
PhaseDelayModel
ModulationRatioModel
PhaseDelay
ModulationRatio
ca500ug+40uiBA
Phase Delay
Modulation Ratio
Modulation Frequency (MHz)

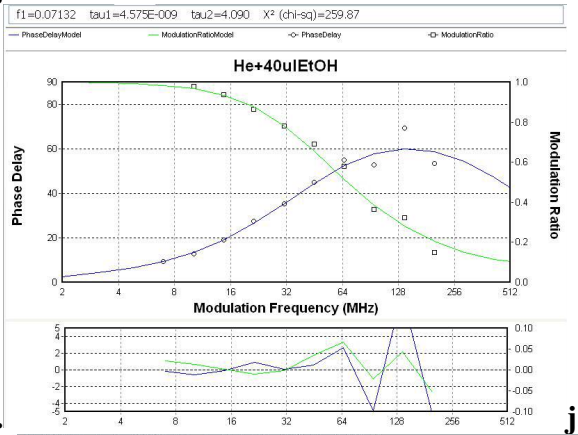
f.


f1=0.2367 tau1=0.1231 tau2=4.991 X² (chi-sq)=270.95
PhaseDelayModel
ModulationRatioModel
PhaseDelay
ModulationRatio
ca500ug+40uITyr
Plot area
Phase Delay
Modulation Ratio
Modulation Frequency (MHz)

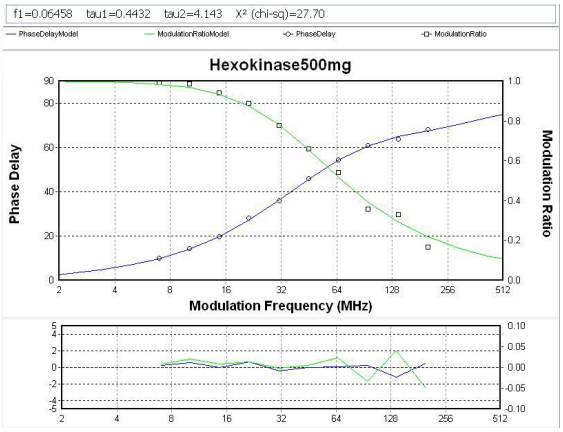
g.


f1=0.2084 tau1=0.4077 tau2=5.040 X² (chi-sq)=12.70
PhaseDelayModel
ModulationRatioModel
PhaseDelay
ModulationRatio
ca+40ulpure-MWNT
Phase Delay
Modulation Ratio
Modulation Frequency (MHz)

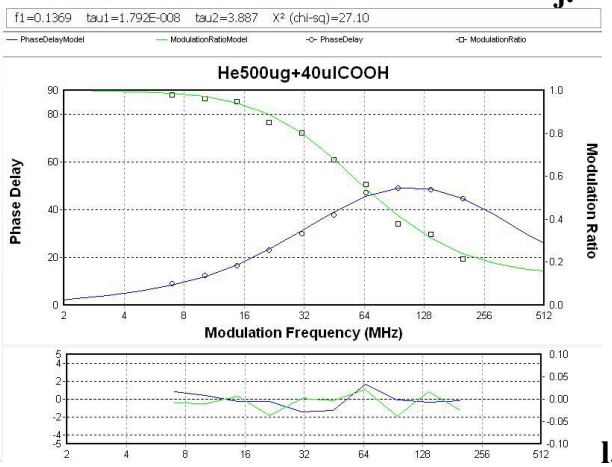
h.


f1=0.07132 tau1=4.575E-009 tau2=4.090 X² (chi-sq)=259.87
PhaseDelayModel
ModulationRatioModel
PhaseDelay
ModulationRatio
He+40uIEtOH
Phase Delay
Modulation Ratio
Modulation Frequency (MHz)

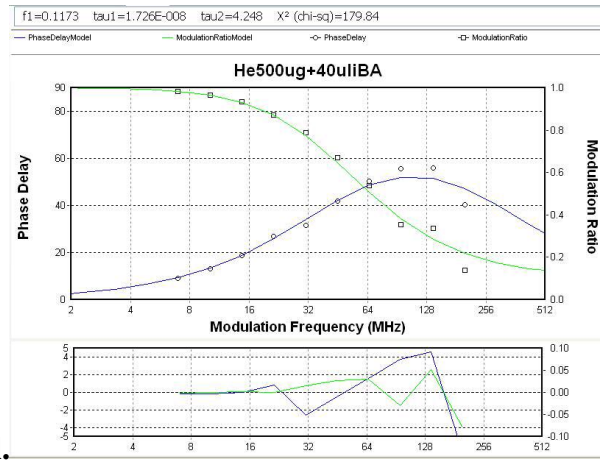
i.


f1=0.06458 tau1=0.4432 tau2=4.143 X² (chi-sq)=27.70
PhaseDelayModel
ModulationRatioModel
PhaseDelay
ModulationRatio
Hexokinase500mg
Phase Delay
Modulation Ratio
Modulation Frequency (MHz)

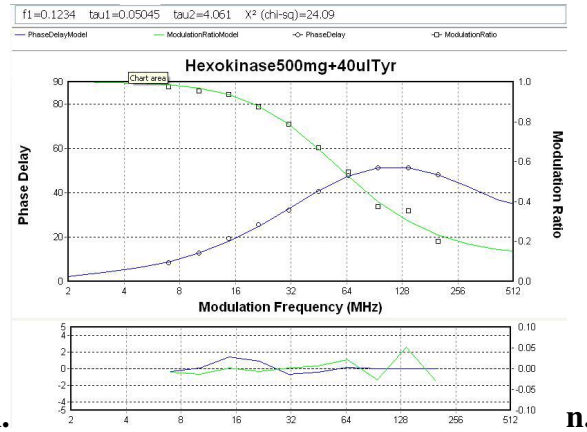
j.


f1=0.1369 tau1=1.792E-008 tau2=3.887 X² (chi-sq)=27.10
PhaseDelayModel
ModulationRatioModel
PhaseDelay
ModulationRatio
He500ug+40uICOOH
Phase Delay
Modulation Ratio
Modulation Frequency (MHz)

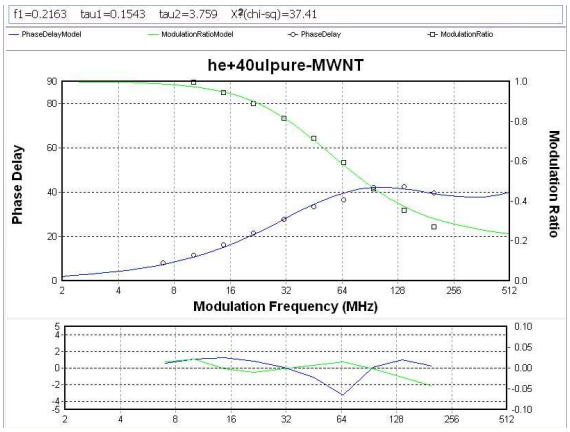
k.


f1=0.1173 tau1=1.726E-008 tau2=4.248 X² (chi-sq)=179.84
PhaseDelayModel
ModulationRatioModel
PhaseDelay
ModulationRatio
He500ug+40uIiBA
Phase Delay
Modulation Ratio
Modulation Frequency (MHz)

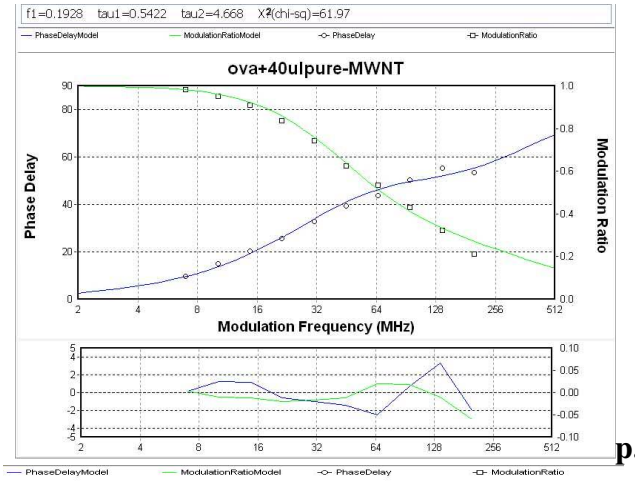
l.


f1=0.1234 tau1=0.05045 tau2=4.061 X² (chi-sq)=24.09
PhaseDelayModel
ModulationRatioModel
PhaseDelay
ModulationRatio
Hexokinase500mg+40ulTyr
Chart area
Phase Delay
Modulation Ratio
Modulation Frequency (MHz)

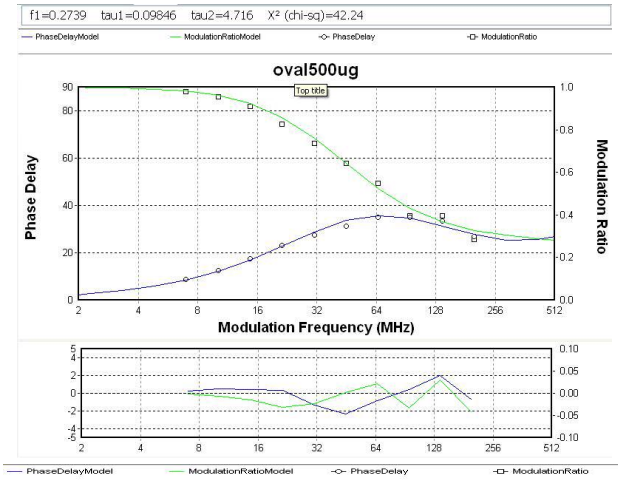
m.


f1=0.2163 tau1=0.1543 tau2=3.759 X²(chi-sq)=37.41
PhaseDelayModel
ModulationRatioModel
PhaseDelay
ModulationRatio
he+40ulpure-MWNT
Phase Delay
Modulation Ratio
Modulation Frequency (MHz)

n.


f1=0.1928 tau1=0.5422 tau2=4.668 X²(chi-sq)=61.97
PhaseDelayModel
ModulationRatioModel
PhaseDelay
ModulationRatio
ova+40ulpure-MWNT
Phase Delay
Modulation Ratio
Modulation Frequency (MHz)

o.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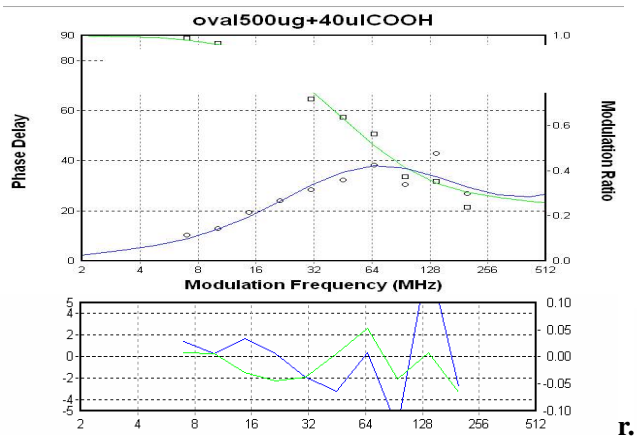
ModulationRatioModel
PhaseDelay
ModulationRatio
oval500ug
Top title
Phase Delay
Modulation Ratio
Modulation Frequency (MHz)

p.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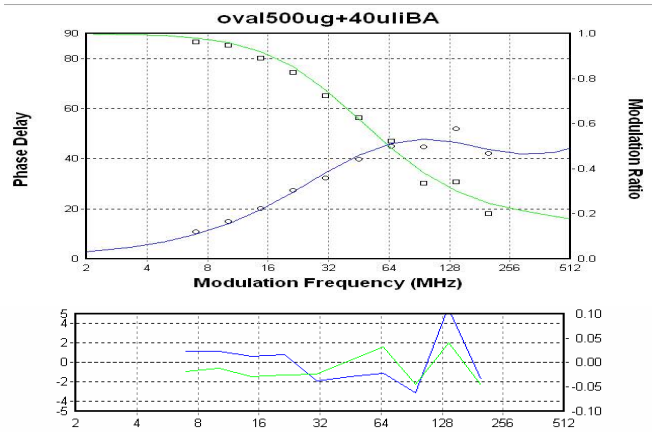
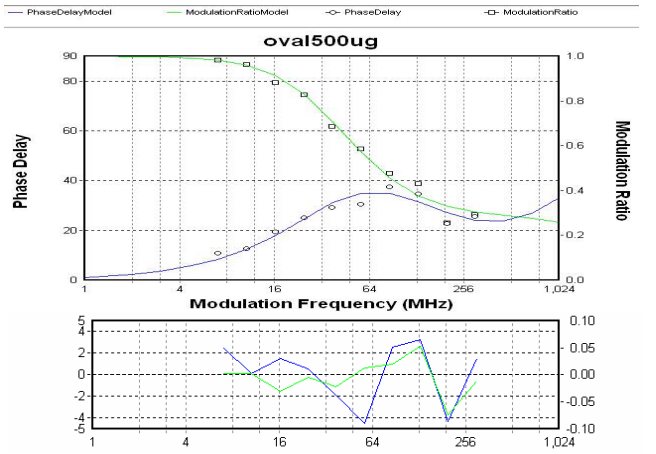
ModulationRatioModel
PhaseDelay
ModulationRatio
oval500ug+40ulCOOH
Phase Delay
Modulation Ratio
Modulation Frequency (MHz)

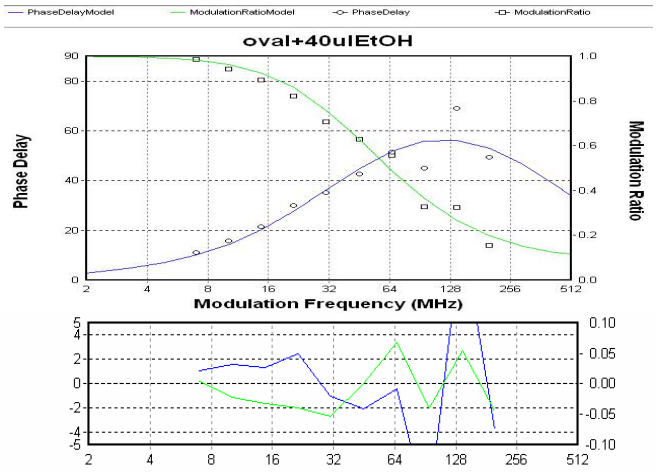
q.


PhaseDelayModel
ModulationRatioModel
PhaseDelay
ModulationRatio
oval500ug+40uliBA
Phase Delay
Modulation Ratio
Modulation Frequency (MHz)

r.

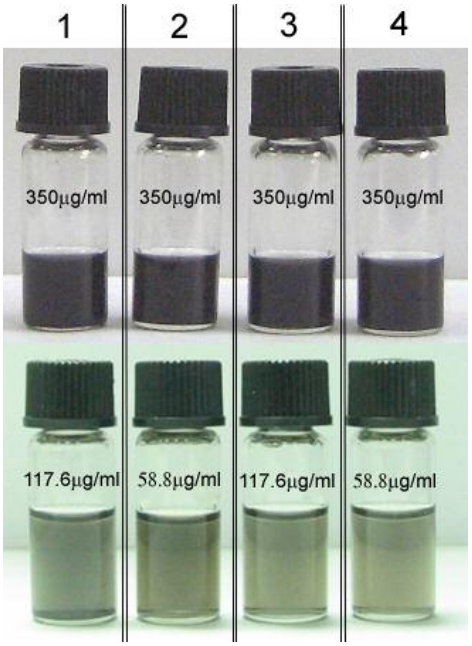


s.



t.

SI Fig 4.



SI_Table 1: Properties of selected proteins.

Name of Protein	Organism	Molecular Weight: kDa	pI	Number of Tryptophan
Albumin	Bovine Serum	66	4.7	3
Hemoglobin	Bovine Erythrocytes	16.5	6.8	6
Carbonic Anhydrase	Bovine Erythrocytes	30	6.3	14
Hexokinase	Yeast	100	5.25 or 4.93	4
Ovalbumin	Egg white	45	4.6	12

SI_Table 2. Protein secondary structure percentage calculation before and after f-MWNT treatment and ethonal as control. pure-MWNT: **1**; MWNT-COOH: **2**; MWNT-TRY: **3**; MWNT-iBA: **4**. (a) 10nm f-MWNT

	CA	CA+40ulMWNT-COOH	CA+80ulMWNT-COOH	CA+160ulMWNT-COOH
Helix:	12.70%	10.70%	13.60%	14.00%
Beta:	39.00%	46.30%	38.80%	36.80%
Turn:	19.90%	15.10%	19.80%	19.90%
Random:	28.40%	27.90%	27.80%	29.20%
Total:	100.00%	100.00%	100.00%	100.00%
	CA	CA+40ulMWNT-TYR	CA+80ulMWNT-TYR	CA+160ulMWNT-TYR
Helix:	12.70%	11.40%	13.50%	12.80%
Beta:	39.00%	45.50%	58.20%	37.90%
Turn:	19.90%	17.10%	6.30%	19.70%
Random:	28.40%	25.90%	22.00%	29.60%
Total:	100.00%	100.00%	100.00%	100.00%
	CA	CA+40ulMWNT-iBA	CA+80ulMWNT-iBA	CA+160ulMWNT-iBA
Helix:	12.70%	13.10%	12.80%	16.60%
Beta:	39.00%	40.90%	40.60%	43.40%
Turn:	19.90%	19.70%	18.40%	16.80%
Random:	28.40%	26.20%	28.30%	23.30%
Total:	100.00%	100.00%	100.00%	100.00%
	CA	CA+40ulpure-MWNT	CA+80ulpure-MWNT	CA+160ulpure-MWNT
Helix:	12.70%	11.60%	11.60%	13.20%
Beta:	39.00%	42.10%	42.00%	44.10%
Turn:	19.90%	18.50%	18.00%	16.50%
Random:	28.40%	27.80%	28.40%	26.30%
Total:	100.00%	100.00%	100.00%	100.00%
	CA	CA+40ulEtOH	CA+80ulEtOH	CA+160ulEtOH
Helix:	12.70%	10.50%	11.80%	11.80%
Beta:	39.00%	44.20%	42.30%	42.60%
Turn:	19.90%	16.90%	17.30%	17.00%
Random:	28.40%	28.30%	28.50%	28.70%
Total:	100.00%	100.00%	100.00%	100.00%
	Hb	Hb+40ulMWNT-COOH	Hb+80ulMWNT-COOH	Hb+160ulMWNT-COOH
Helix:	42.30%	54.10%	37.90%	43.10%
Beta:	23.80%	0.00%	4.10%	10.90%
Turn:	6.50%	14.00%	24.20%	16.20%
Random:	27.40%	31.90%	33.80%	29.80%
Total:	100.00%	100.00%	100.00%	100.00%

	Hb	Hb+40ulMWNT-TYR	Hb+80ulMWNT-TYR	Hb+160ulMWNT-TYR
Helix:	42.30%	38.80%	44.80%	45.30%
Beta:	23.80%	12.90%	22.30%	21.90%
Turn:	6.50%	16.90%	6.50%	6.90%
Random:	27.40%	31.40%	26.40%	25.80%

Total:	100.00%	100.00%	100.00%	100.00%
	Hb	Hb+40ulMWNT-iBA	Hb+80ulMWNT-iBA	Hb+160ulMWNT-iBA
Helix:	42.30%	52.70%	43.30%	40.80%
Beta:	23.80%	29.00%	16.20%	11.30%
Turn:	6.50%	0.00%	12.30%	17.00%
Random:	27.40%	18.30%	28.20%	31.00%
Total:	100.00%	100.00%	100.00%	100.00%
	Hb	Hb+40ulpure-MWNT	Hb+80ulpure-MWNT	Hb+160ulpure-MWNT
Helix:	42.30%	47.30%	42.50%	49.40%
Beta:	23.80%	21.10%	19.40%	26.90%
Turn:	6.50%	6.90%	10.10%	1.40%
Random:	27.40%	24.80%	28.00%	22.20%
Total:	100.00%	100.00%	100.00%	100.00%
	Hb	Hb+40ulEtOH	Hb+80ulEtOH	Hb+160ulEtOH
Helix:	42.30%	47.30%	43.90%	51.60%
Beta:	23.80%	21.10%	18.50%	28.80%
Turn:	6.50%	6.90%	10.20%	0.00%
Random:	27.40%	24.80%	27.40%	19.60%
Total:	100.00%	100.00%	100.00%	100.00%
	He	He+40ulMWNT-COOH	He+80ulMWNT-COOH	He+160ulMWNT-COOH
Helix:	23.80%	33.20%	35.50%	32.70%
Beta:	12.40%	18.70%	16.40%	12.80%
Turn:	27.10%	17.10%	19.10%	20.50%
Random:	100.00%	31.00%	29.10%	33.90%
Total:		100.00%	100.00%	100.00%
	He	He+40ulMWNT-TYR	He+80ulMWNT-TYR	He+160ulMWNT-TYR
Helix:	23.80%	37.40%	33.40%	36.00%
Beta:	12.40%	18.40%	15.40%	16.70%
Turn:	27.10%	16.10%	18.80%	16.60%
Random:	100.00%	28.20%	32.50%	30.70%
Total:		100.00%	100.00%	100.00%

	He	He+40ulMWNT-iBA	He+80ulMWNT-iBA	He+160ulMWNT-iBA
Helix:	23.80%	36.00%	35.50%	33.00%
Beta:	12.40%	23.40%	18.10%	20.00%
Turn:	27.10%	13.10%	16.50%	17.20%
Random:	100.00%	27.60%	29.90%	29.80%
Total:		100.00%	100.00%	100.00%
	He	He+40ulpure-MWNT	He+80ulpure-MWNT	He+160ulpure-MWNT
Helix:	23.80%	36.10%	36.40%	35.30%
Beta:	12.40%	18.30%	21.10%	20.10%
Turn:	27.10%	16.40%	15.20%	15.70%
Random:	100.00%	29.20%	27.30%	28.90%
Total:		100.00%	100.00%	100.00%
	He	He+40ulEtOH	He+80ulEtOH	He+160ulEtOH
Helix:	23.80%	36.00%	36.50%	35.50%

10nm

Beta:	12.40%	20.90%	21.00%	19.10%
Turn:	27.10%	15.40%	14.70%	15.40%
Random:	100.00%	27.70%	27.80%	30.00%
Total:		100.00%	100.00%	100.00%

	OVA	OVA+40ulMWNT-COOH	OVA+80ulMWNT-COOH	OVA+160ulMWNT-COOH
Helix:	39.50%	40.60%	36.60%	40.00%
Beta:	21.70%	17.90%	16.90%	16.60%
Turn:	8.30%	9.80%	14.80%	10.20%
Random:	30.50%	31.70%	31.70%	33.20%
Total:	100.00%	100.00%	100.00%	100.00%

	OVA	OVA+40ulMWNT-TYR	OVA+80ulMWNT-TYR	OVA+160ulMWNT-TYR
Helix:	39.50%	47.30%	36.00%	51.20%
Beta:	21.70%	4.80%	17.40%	22.90%
Turn:	8.30%	15.30%	14.30%	3.50%
Random:	30.50%	32.60%	32.20%	22.40%
Total:	100.00%	100.00%	100.00%	100.00%

	OVA	OVA+40ulMWNT-iBA	OVA+80ulMWNT-iBA	OVA+160ulMWNT-iBA
Helix:	39.50%	40.10%	50.00%	38.10%
Beta:	21.70%	14.30%	26.40%	19.70%
Turn:	8.30%	13.70%	0.00%	11.20%
Random:	30.50%	31.90%	23.60%	30.90%
Total:	100.00%	100.00%	100.00%	100.00%

	OVA	OVA+40ulpure-MWNT	OVA+80ulpure-MWNT	OVA+160ulpure-MWNT
Helix:	39.50%	39.30%	46.00%	38.10%
Beta:	21.70%	17.40%	14.70%	18.70%
Turn:	8.30%	10.80%	13.40%	12.00%
Random:	30.50%	32.40%	25.90%	31.20%
Total:	100.00%	100.00%	100.00%	100.00%

10nm

	OVA	OVA+40ulEtOH	OVA+80ulEtOH	OVA+160ulEtOH
Helix:	39.50%	43.20%	42.60%	43.00%
Beta:	21.70%	11.70%	8.90%	14.40%
Turn:	8.30%	13.40%	15.60%	11.30%
Random:	30.50%	31.70%	32.90%	31.30%
Total:	100.00%	100.00%	100.00%	100.00%

	BSA	BSA+40ulMWNT-COOH	BSA+80ulMWNT-COOH	BSA+160ulMWNT-COOH
Helix:	31.60%	32.30%	27.30%	22.00%
Beta:	16.80%	32.20%	36.30%	37.70%
Turn:	20.30%	4.90%	8.80%	14.90%
Random:	31.30%	30.60%	27.60%	25.40%
Total:	100.00%	100.00%	100.00%	100.00%

	BSA	BSA+40ulMWNT-TYR	BSA+80ulMWNT-TYR	BSA+160ulMWNT-TYR
Helix:	31.60%	30.30%	29.20%	22.70%
Beta:	16.80%	34.20%	33.70%	37.10%
Turn:	20.30%	5.80%	8.60%	15.00%
Random:	31.30%	29.70%	28.50%	25.20%

Total:	100.00%	100.00%	100.00%	100.00%
	BSA	BSA+40ulMWNT-iBA	BSA+80ulMWNT-iBA	BSA+160ulMWNT-iBA
Helix:	31.60%	29.60%	25.50%	24.50%
Beta:	16.80%	33.60%	36.80%	35.90%
Turn:	20.30%	8.20%	10.30%	13.00%
Random:	31.30%	28.60%	27.40%	26.60%
Total:	100.00%	100.00%	100.00%	100.00%
	BSA	BSA+40ulpure-MWNT	BSA+80ulpure-MWNT	BSA+160ulpure-MWNT
Helix:	31.60%	32.30%	34.20%	32.10%
Beta:	16.80%	18.70%	16.90%	14.80%
Turn:	20.30%	18.90%	19.50%	21.90%
Random:	31.30%	30.00%	29.40%	31.30%
Total:	100.00%	100.00%	100.00%	100.00%
	BSA	BSA+40ulEtOH	BSA+80ulEtOH	BSA+160ulEtOH
Helix:	31.60%	29.10%	27.10%	25.00%
Beta:	16.80%	35.40%	35.70%	36.50%
Turn:	20.30%	7.10%	9.00%	10.90%
Random:	31.30%	28.40%	28.10%	27.60%
Total:	100.00%	100.00%	100.00%	100.00%

10nm

(b) 40nm f-MWNT

	CA	CA+40ulMWNT-COOH	CA+80ulMWNT-COOH	CA+160ulMWNT-COOH
Helix:	7.70%	12.50%	16.20%	12.40%
Beta:	44.00%	38.70%	37.80%	40.20%
Turn:	16.30%	20.10%	20.30%	19.10%
Random:	32.00%	28.70%	25.60%	28.30%
Total:	100.00%	100.00%	100.00%	100.00%
	CA	CA+40ulMWNT-TYR	CA+80ulMWNT-TYR	CA+160ulMWNT-TYR
Helix:	13.00%	11.30%	9.50%	10.30%
Beta:	46.10%	47.60%	38.80%	45.80%
Turn:	16.30%	13.50%	19.60%	12.80%
Random:	24.70%	27.60%	32.10%	31.10%
Total:	100.00%	100.00%	100.00%	100.00%
	CA	CA+40ulMWNT-iBA	CA+80ulMWNT-iBA	CA+160ulMWNT-iBA
Helix:	11.10%	10.90%	15.60%	18.20%
Beta:	45.80%	43.20%	41.60%	47.00%
Turn:	16.10%	17.80%	17.60%	16.20%
Random:	26.90%	28.10%	25.20%	18.70%
Total:	100.00%	100.00%	100.00%	100.00%
	CA	CA+40ulpure-MWNT	CA+80ulpure-MWNT	CA+160ulpure-MWNT
Helix:	12.20%	10.50%	12.20%	21.30%
Beta:	51.80%	52.70%	48.20%	42.50%
Turn:	12.30%	11.50%	14.30%	17.40%
Random:	23.80%	25.30%	25.30%	18.80%
Total:	100.00%	100.00%	100.00%	100.00%
	CA	CA+40ulEtOH	CA+80ulEtOH	CA+160ulEtOH
Helix:	10.80%	10.60%	10.70%	12.30%

40nm

Beta:	45.20%	46.90%	44.00%	48.30%
Turn:	16.60%	15.70%	17.40%	14.90%
Random:	27.40%	26.80%	27.90%	24.40%
Total:	100.00%	100.00%	100.00%	100.00%
	Hb	Hb+40ulMWNT-COOH	Hb+80ulMWNT-COOH	Hb+160ulMWNT-COOH
Helix:	41.50%	41.20%	44.50%	43.60%
Beta:	29.60%	25.20%	23.70%	13.00%
Turn:	6.90%	10.10%	9.40%	15.80%
Random:	22.10%	23.50%	22.40%	27.60%
Total:	100.00%	100.00%	100.00%	100.00%
	Hb	Hb+40ulMWNT-TYR	Hb+80ulMWNT-TYR	Hb+160ulMWNT-TYR
Helix:	42.20%	44.10%	44.40%	42.50%
Beta:	28.70%	28.10%	27.20%	27.00%
Turn:	6.70%	6.60%	7.70%	7.30%
Random:	22.40%	21.10%	20.70%	23.30%
Total:	100.00%	100.00%	100.00%	100.00%
	Hb	Hb+40ulMWNT-iBA	Hb+80ulMWNT-iBA	Hb+160ulMWNT-iBA
Helix:	42.10%	44.00%	43.60%	40.00%
Beta:	26.20%	28.00%	26.60%	20.90%
Turn:	8.30%	6.10%	7.10%	11.50%
Random:	23.40%	21.90%	22.80%	27.70%
Total:	100.00%	100.00%	100.00%	100.00%
	Hb	Hb+40ulpure-MWNT	Hb+80ulpure-MWNT	Hb+160ulpure-MWNT
Helix:	42.20%	43.60%	39.60%	40.50%
Beta:	28.80%	27.70%	26.60%	26.30%
Turn:	7.20%	6.60%	9.50%	8.40%
Random:	21.80%	22.10%	24.40%	24.70%
Total:	100.00%	100.00%	100.00%	100.00%
	Hb	Hb+40ulEtOH	Hb+80ulEtOH	Hb+160ulEtOH
Helix:	43.90%	42.80%	42.80%	39.00%
Beta:	28.50%	28.10%	26.60%	26.50%
Turn:	6.50%	7.20%	7.80%	9.70%
Random:	21.00%	21.90%	22.80%	24.90%
Total:	100.00%	100.00%	100.00%	100.00%
	He	He+40ulMWNT-COOH	He+80ulMWNT-COOH	He+160ulMWNT-COOH
Helix:	25.10%	23.60%	24.10%	28.70%
Beta:	32.10%	30.70%	28.40%	26.50%
Turn:	13.00%	14.80%	15.10%	13.80%
Random:	29.70%	30.90%	32.40%	31.00%
Total:	100%	100.00%	100.00%	100.00%
	He	He+40ulMWNT-TYR	He+80ulMWNT-TYR	He+160ulMWNT-TYR
Helix:	24.20%	25.30%	25.20%	45.00%
Beta:	35.00%	30.60%	29.90%	21.30%
Turn:	10.90%	14.20%	15.60%	1.20%
Random:	30.00%	29.90%	29.20%	32.60%

40nm

Total:	100%	100.00%	100.00%	100.00%
	He	He+40ulMWNT-iBA	He+80ulMWNT-iBA	He+160ulMWNT-iBA
Helix:	25.00%	23.90%	24.90%	27.90%
Beta:	29.90%	32.70%	30.40%	26.90%
Turn:	14.00%	12.70%	14.20%	16.60%
Random:	31.00%	30.70%	30.50%	28.60%
Total:	100%	100.00%	100.00%	100.00%
	He	He+40ulpure-MWNT	He+80ulpure-MWNT	He+160ulpure-MWNT
Helix:	25.20%	24.30%	27.90%	24.00%
Beta:	31.10%	30.30%	33.20%	29.20%
Turn:	13.60%	14.70%	11.30%	14.70%
Random:	30.10%	30.70%	27.70%	32.00%
Total:	100%	100.00%	100.00%	100.00%
	He	He+40ulEtOH	He+80ulEtOH	He+160ulEtOH
Helix:	24.30%	23.30%	24.80%	25.20%
Beta:	33.80%	32.50%	33.50%	34.00%
Turn:	12.40%	13.10%	12.60%	12.30%
Random:	29.40%	31.10%	29.10%	28.50%
Total:	100%	100.00%	100.00%	100.00%
	OVA	OVA+40ulMWNT-COOH	OVA+80ulMWNT-COOH	OVA+160ulMWNT-COOH
Helix:	31.10%	34.10%	27.80%	29.20%
Beta:	32.00%	28.60%	27.10%	22.40%
Turn:	8.40%	10.90%	13.10%	13.00%
Random:	28.50%	26.40%	32.00%	35.40%
Total:	100.00%	100.00%	100.00%	100.00%
	OVA	OVA+40ulMWNT-TYR	OVA+80ulMWNT-TYR	OVA+160ulMWNT-TYR
Helix:	32.70%	30.80%	32.80%	27.10%
Beta:	34.10%	24.60%	26.20%	27.60%
Turn:	6.30%	15.00%	11.50%	11.30%
Random:	26.80%	29.70%	29.50%	33.90%
Total:	100.00%	100.00%	100.00%	100.00%
	OVA	OVA+40ulMWNT-iBA	OVA+80ulMWNT-iBA	OVA+160ulMWNT-iBA
Helix:	30.60%	35.30%	30.90%	27.40%
Beta:	35.70%	34.10%	34.50%	29.10%
Turn:	5.60%	5.30%	7.80%	11.30%
Random:	28.10%	25.20%	26.80%	32.20%
Total:	100.00%	100.00%	100.00%	100.00%
	OVA	OVA+40ulpure-MWNT	OVA+80ulpure-MWNT	OVA+160ulpure-MWNT
Helix:	30.10%	28.40%	31.00%	36.10%
Beta:	32.10%	28.10%	27.80%	34.90%
Turn:	8.90%	11.50%	11.30%	5.40%
Random:	28.90%	32.00%	29.90%	23.60%
Total:	100.00%	100.00%	100.00%	100.00%
	OVA	OVA+40ulEtOH	OVA+80ulEtOH	OVA+160ulEtOH
Helix:	32.90%	34.90%	30.70%	32.00%

40/100

Beta:	31.20%	33.10%	31.70%	32.20%
Turn:	8.80%	6.60%	8.40%	8.10%
Random:	27.10%	25.40%	29.20%	27.60%
Total:	100.00%	100.00%	100.00%	100.00%
	BSA	BSA+40ulMWNT-COOH	BSA+80ulMWNT-COOH	BSA+160ulMWNT-COOH
Helix:	25.80%	26.70%	25.20%	24.80%
Beta:	26.90%	25.40%	24.90%	23.70%
Turn:	16.10%	17.00%	17.90%	18.90%
Random:	31.10%	31.00%	32.00%	32.50%
Total:	100.00%	100.00%	100.00%	100.00%
	BSA	BSA+40ulMWNT-TYR	BSA+80ulMWNT-TYR	BSA+160ulMWNT-TYR
Helix:	26.40%	26.30%	26.90%	26.00%
Beta:	25.70%	26.20%	26.10%	25.20%
Turn:	17.00%	16.50%	16.20%	17.10%
Random:	30.90%	31.00%	30.80%	31.70%
Total:	100.00%	100.00%	100.00%	100.00%
	BSA	BSA+40ulMWNT-iBA	BSA+80ulMWNT-iBA	BSA+160ulMWNT-iBA
Helix:	26.60%	26.60%	26.00%	25.20%
Beta:	26.20%	26.30%	25.90%	27.70%
Turn:	16.40%	16.60%	16.80%	16.30%
Random:	30.70%	30.50%	31.40%	30.80%
Total:	100.00%	100.00%	100.00%	100.00%
	BSA	BSA+40ulpure-MWNT	BSA+80ulpure-MWNT	BSA+160ulpure-MWNT
Helix:	26.20%	26.10%	26.40%	27.30%
Beta:	26.40%	26.20%	26.10%	26.10%
Turn:	16.40%	16.40%	16.80%	16.90%
Random:	31.00%	31.40%	30.80%	29.60%
Total:	100.00%	100.00%	100.00%	100.00%
	BSA	BSA+40ulEtOH	BSA+80ulEtOH	BSA+160ulEtOH
Helix:	26.90%	26.60%	26.60%	27.20%
Beta:	27.10%	25.60%	26.20%	26.60%
Turn:	15.60%	16.80%	16.50%	16.00%
Random:	30.40%	31.00%	30.60%	30.10%
Total:	100.00%	100.00%	100.00%	100.00%

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