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APPENDIX

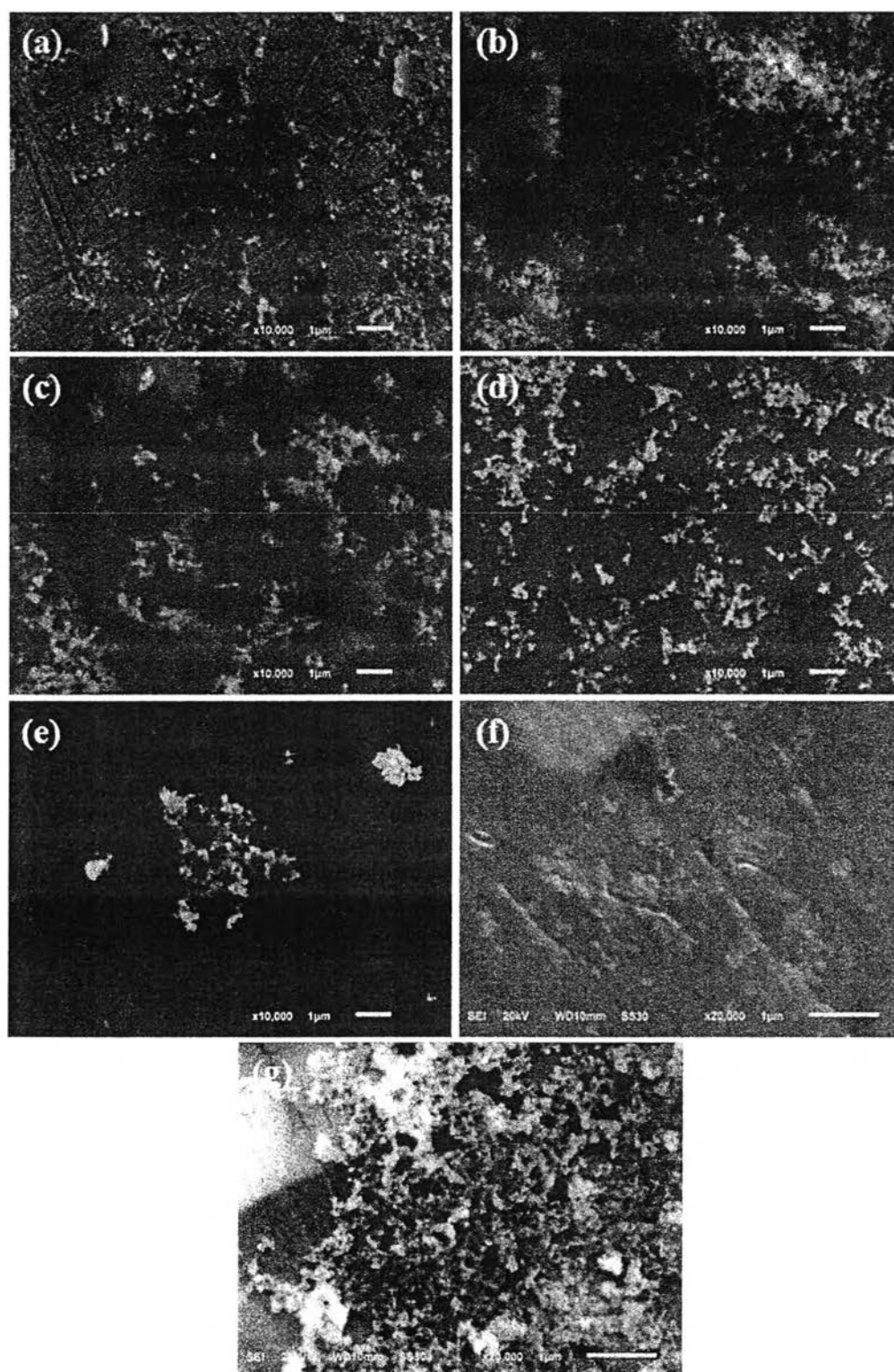


Figure A1 SEM image of GdCH CNPs (a), GdTxH CNPs (b), GdSH CNPs (c), GdSM CNPs (d), GdST CNPs (e), GdSP CNPs (f), GdSH-Cur CNPs (g)

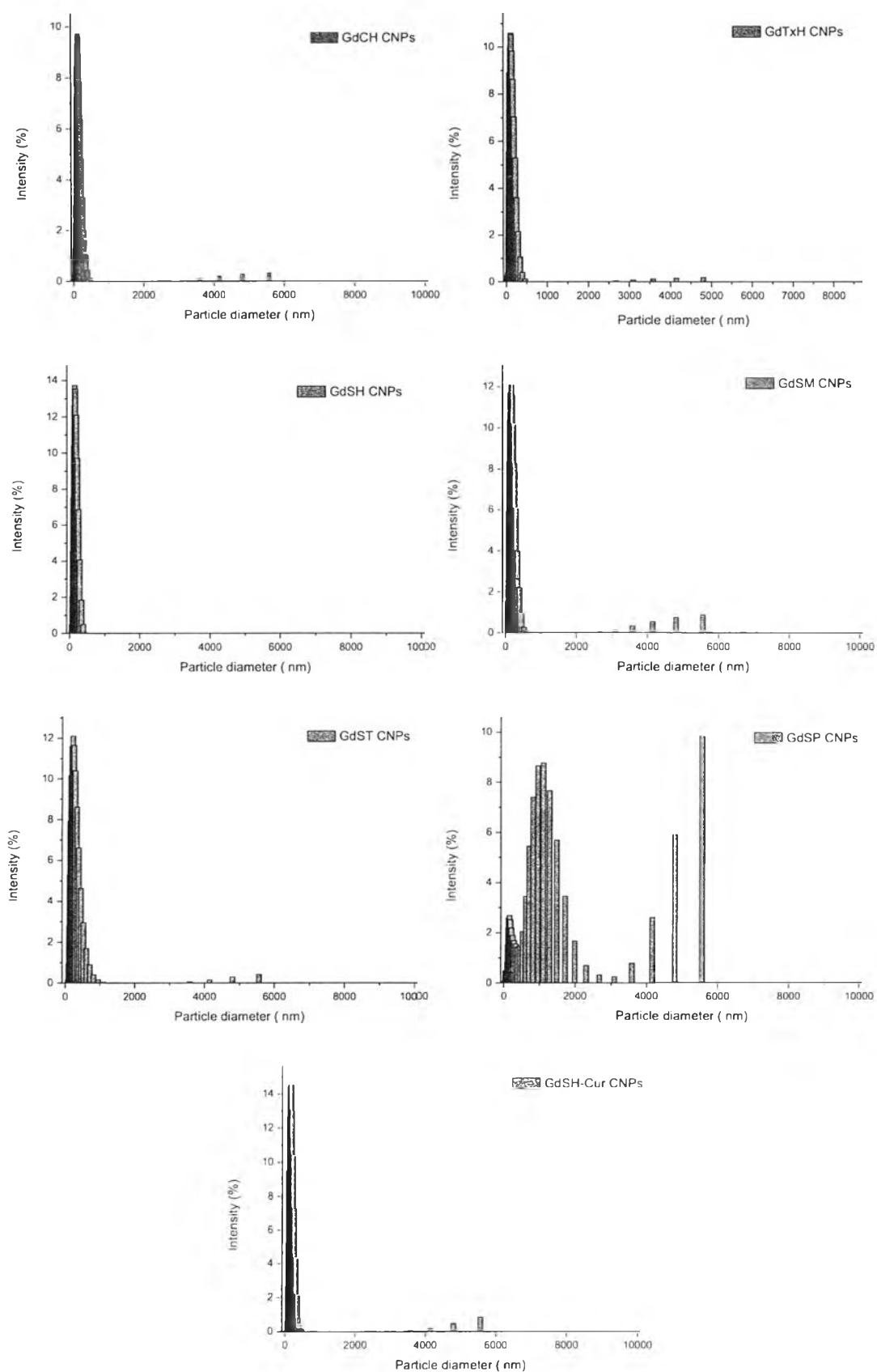


Figure A2 Particle size distributions of GdCH, GdTxH, GdSH, GdSM, GdST, GdSP and GdSH-Cur CNPs obtained from DLS technique

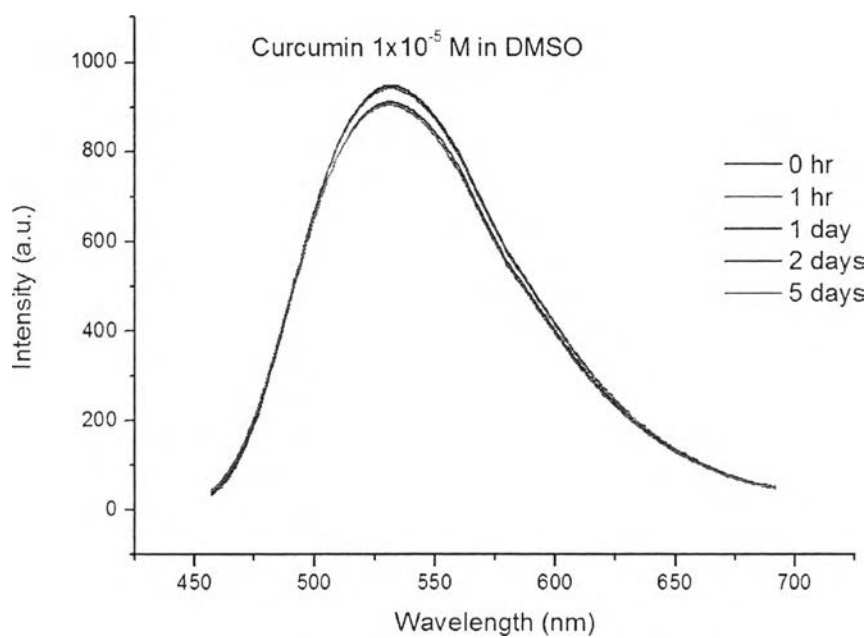


Figure A3 Fluorescence spectra of 1×10^{-5} M curcumin dissolved in DMSO for 0 to 5 days, λ_{ex} at 429 nm, slit = 10, pmt = 600.

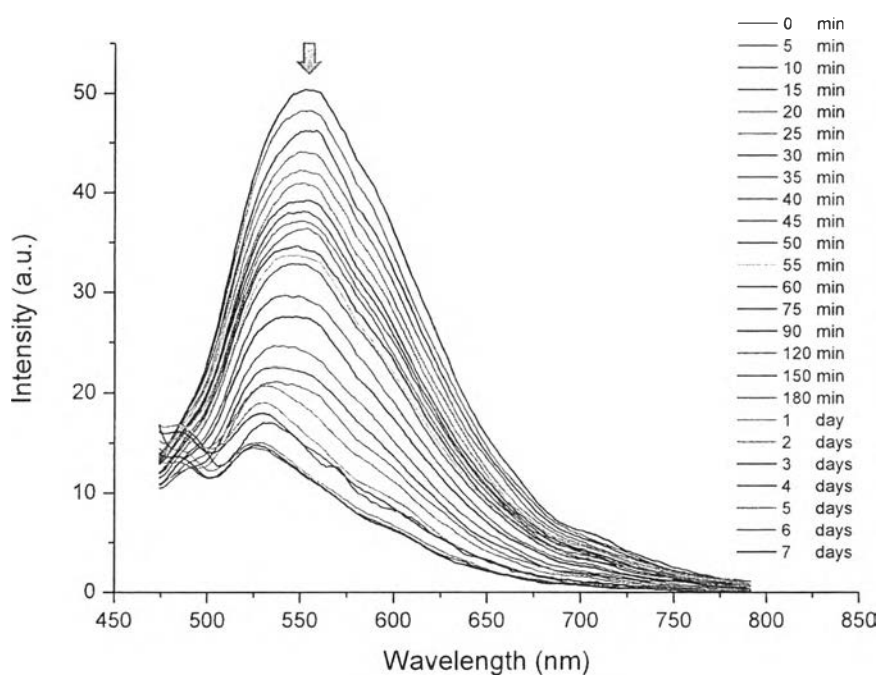


Figure A4 Fluorescence spectra of 1×10^{-5} M Cur dissolved in 10% DMSO/HEPES buffer solution for 0 to 7 days, λ_{ex} at 445 nm, slit = 10, pmt = 600.

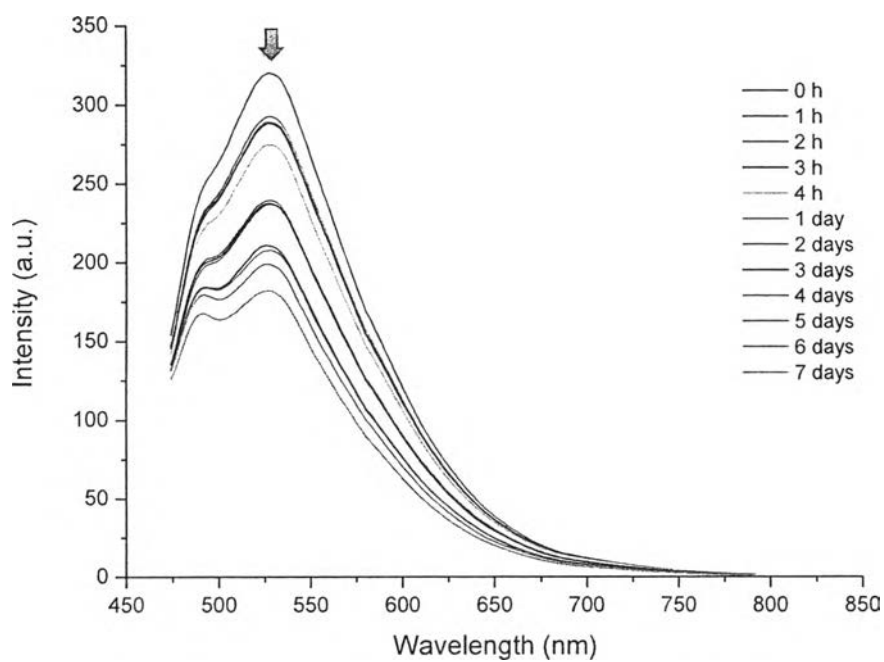


Figure A5 Fluorescence spectra of GdSH-Cur CNPs dissolved in HEPES buffer solution for 0 to 7 days, λ_{ex} at 445 nm, slit = 10, pmt = 600.

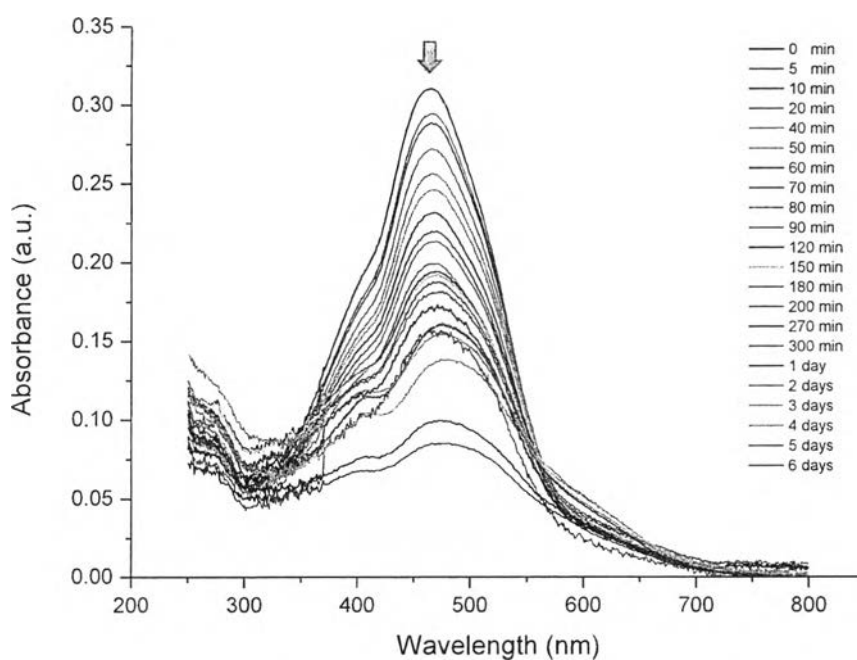


Figure A6 UV-Vis spectra of 1×10^{-5} M CurBF₂OTs dissolved in 10% DMSO/HEPES buffer solution for 0 to 6 days

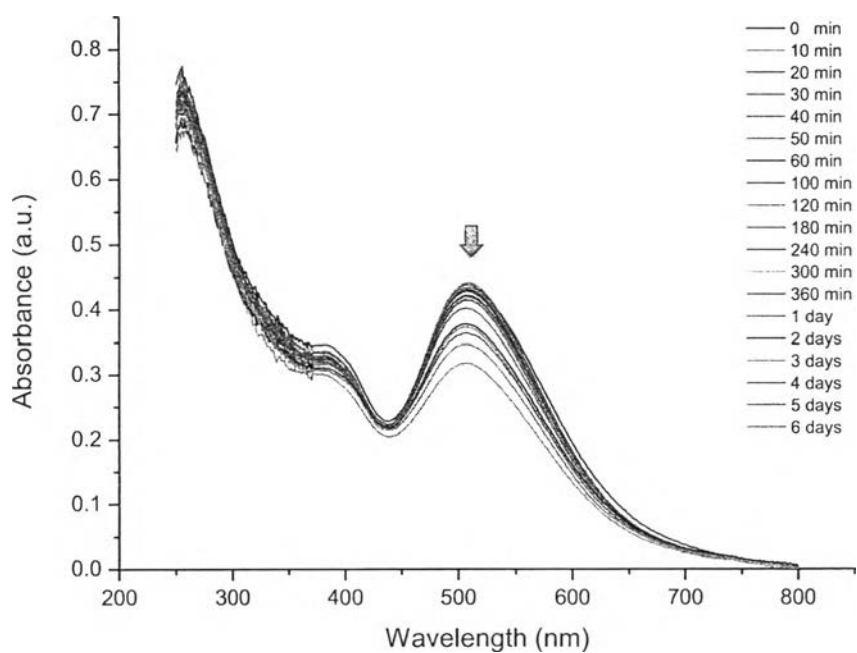


Figure A7 UV-Vis spectra of 1×10^{-5} M **CurBF₂OTs** in GdSH CNPs dissolved in HEPES buffer solution for 0 to 6 days

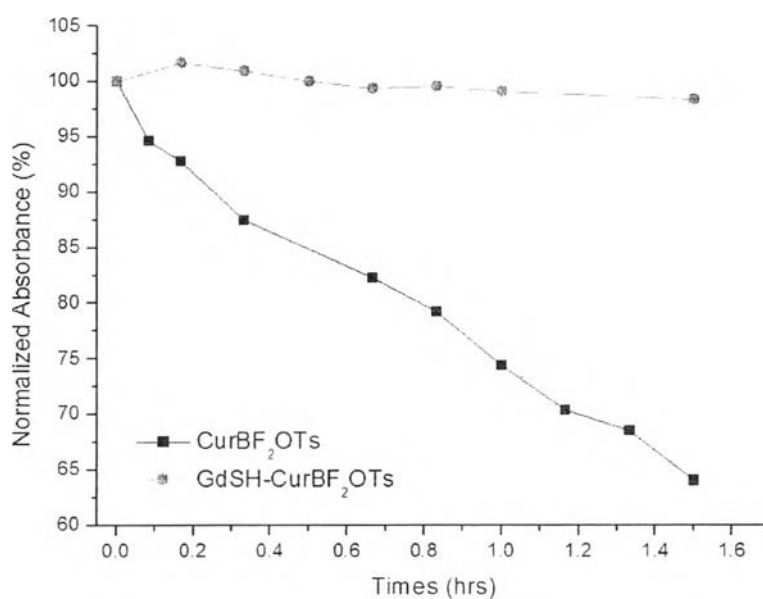


Figure A8 Normalized Absorbance of **CurBF₂OTs** 1×10^{-5} M in 10 % DMSO/HEPES and **GdSH-CurBF₂(OTs)₂** CNPs (redispersed in 100 % HEPES) for 0 to 1.5 h

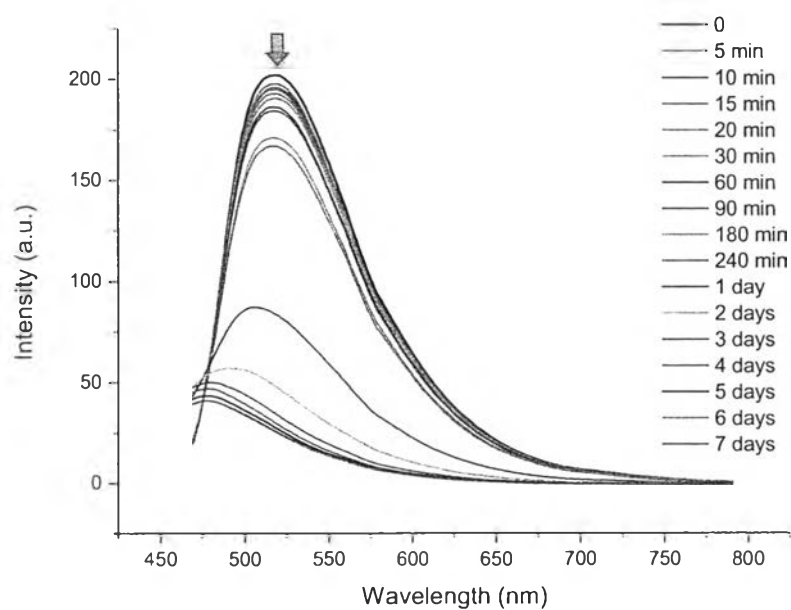


Figure A9 Fluorescence spectra of 1×10^{-5} M $\text{CurBF}_2(\text{OTs})_2$ dissolved in DMSO for 0 to 7 days, λ_{ex} at 440 nm, slit = 10, pmt = 550

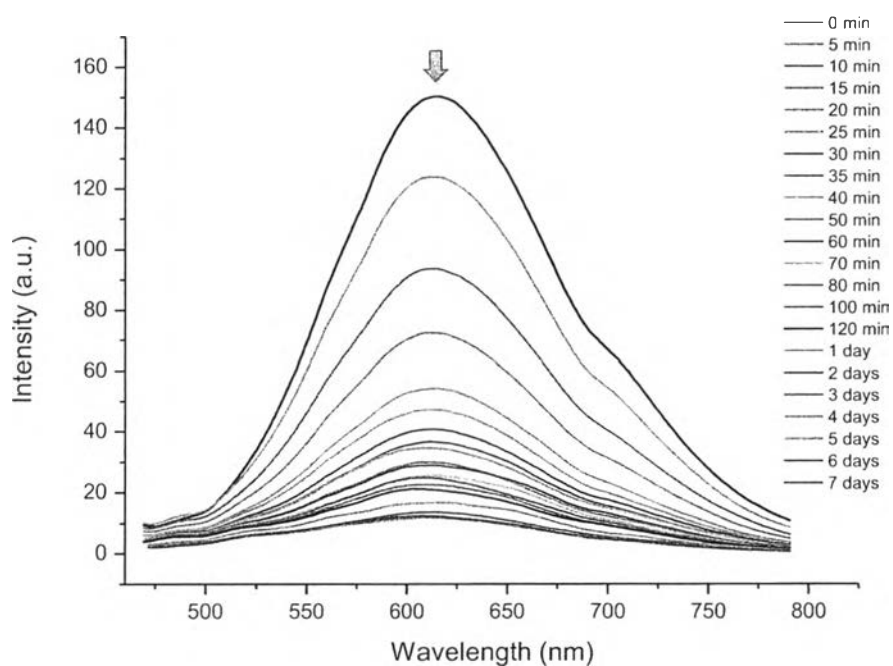


Figure A10 Fluorescence spectra of 1×10^{-5} M $\text{CurBF}_2(\text{OTs})_2$ dissolved in 10% DMSO/HEPES buffer solution for 0 to 7 days, λ_{ex} at 440 nm, slit = 10, pmt = 550

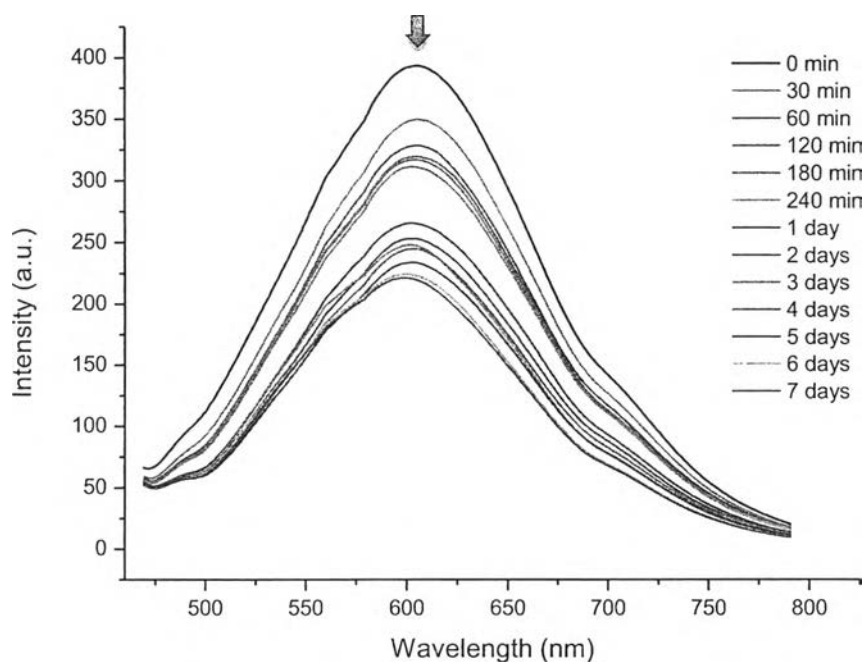


Figure A11 Fluorescence spectra of 1×10^{-5} M $\text{CurBF}_2(\text{OTs})_2$ in GdSH CNPs dissolved in HEPES buffer solution for 0 to 7 days, λ_{ex} at 440 nm, slit = 10, pmt = 550

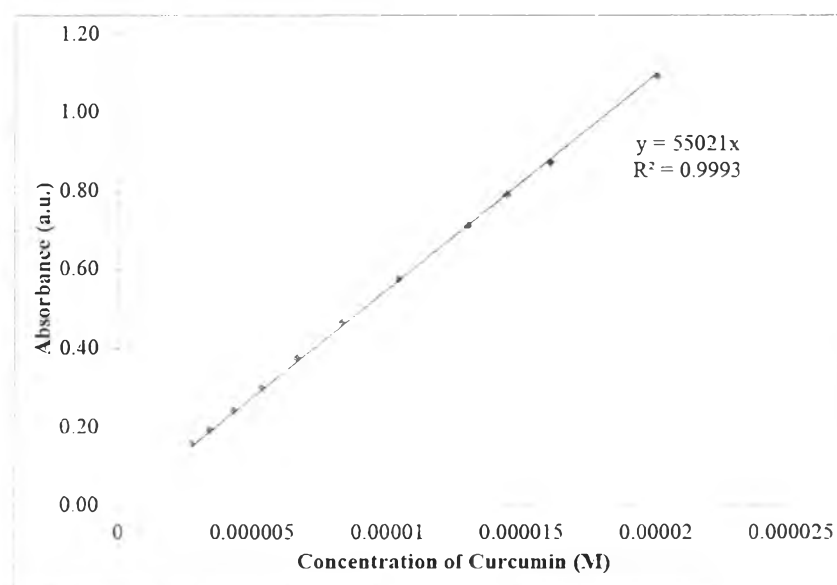


Figure A12 The linear plot between absorbance (a.u.) and concentration of **curcumin** (M) in methanol

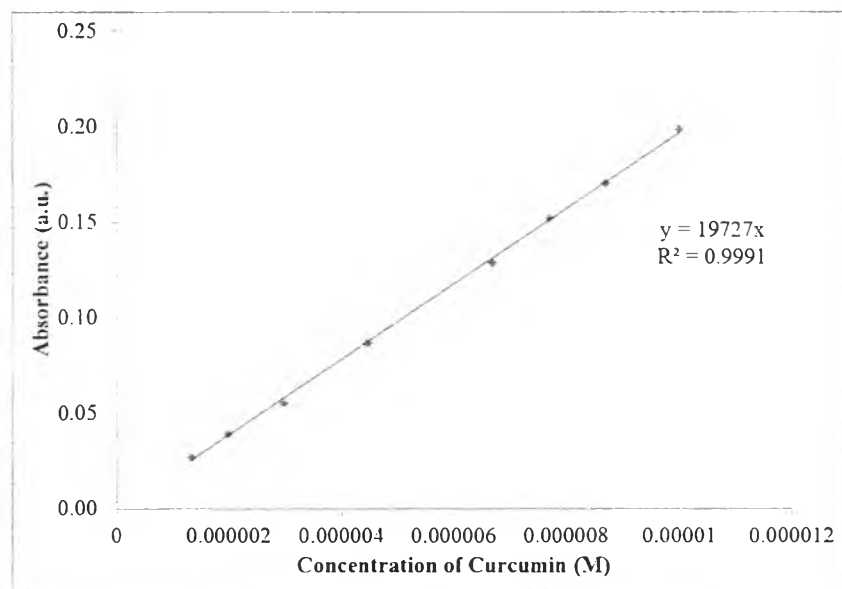


Figure A13 The linear plot between absorbance (a.u.) and concentration of **curcumin** (M) in 10% DMSO/HEPES buffer solution

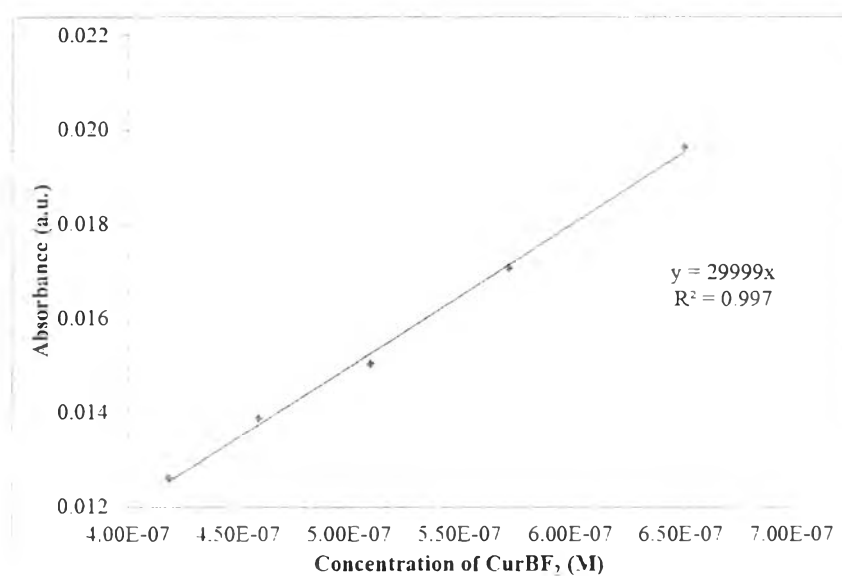


Figure A14 The linear plot between absorbance (a.u.) and concentration of **CurBF₂** (M) in 10% DMSO/HEPES buffer solution

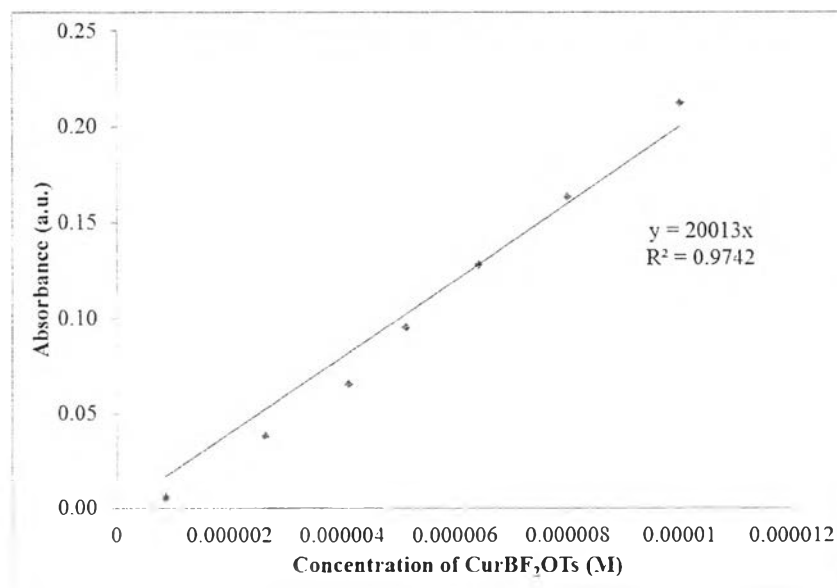


Figure A15 The linear plot between absorbance (a.u.) and concentration of CurBF₂OTs (M) in 10% DMSO/HEPES buffer solution

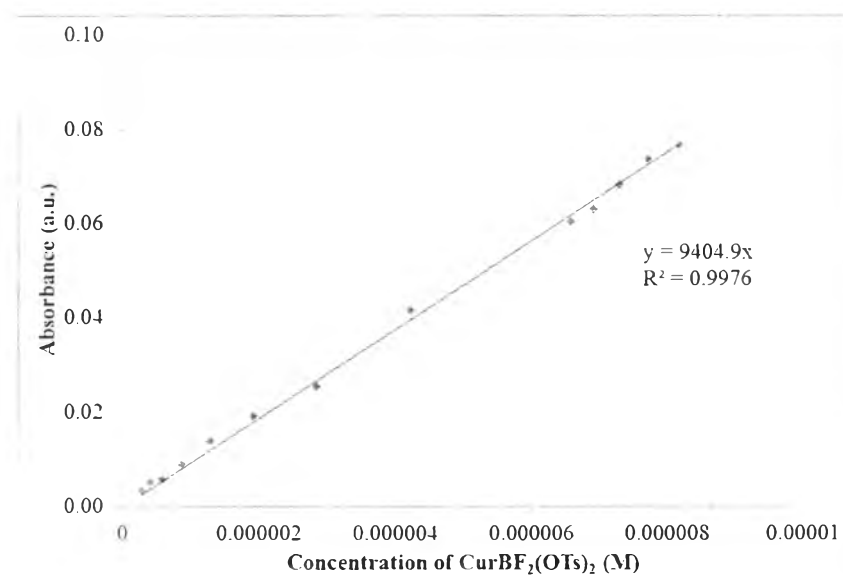


Figure A16 The linear plot between absorbance (a.u.) and concentration of CurBF₂(OTs)₂ (M) in 10% DMSO/HEPES buffer solution

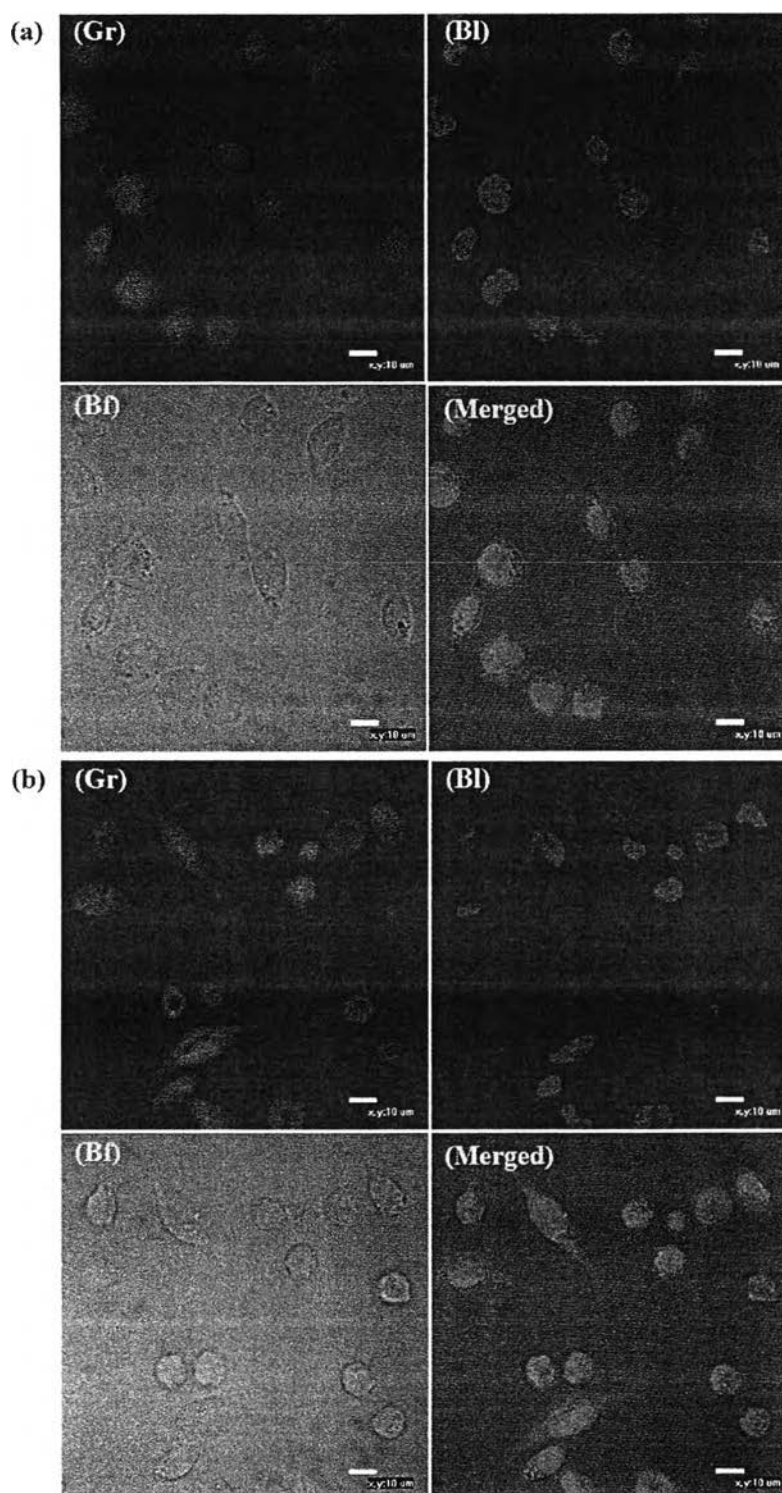


Figure A17 Confocal images of SW620 cells incubated GsSH-Cur CNPs at the concentration of 25 $\mu\text{g/ml}$ curcumin equivalence dose for 0.5 h (a) and 1 h. The CNPs were dissolved in HEPES buffer solution before mixed with the cell culture media. The curcumin channel (Green; Gr), the nuclear dye channel (Blue; Bl), the brightfield image (Bf) and the merge of three channels were showed from left to right and up to down of column.

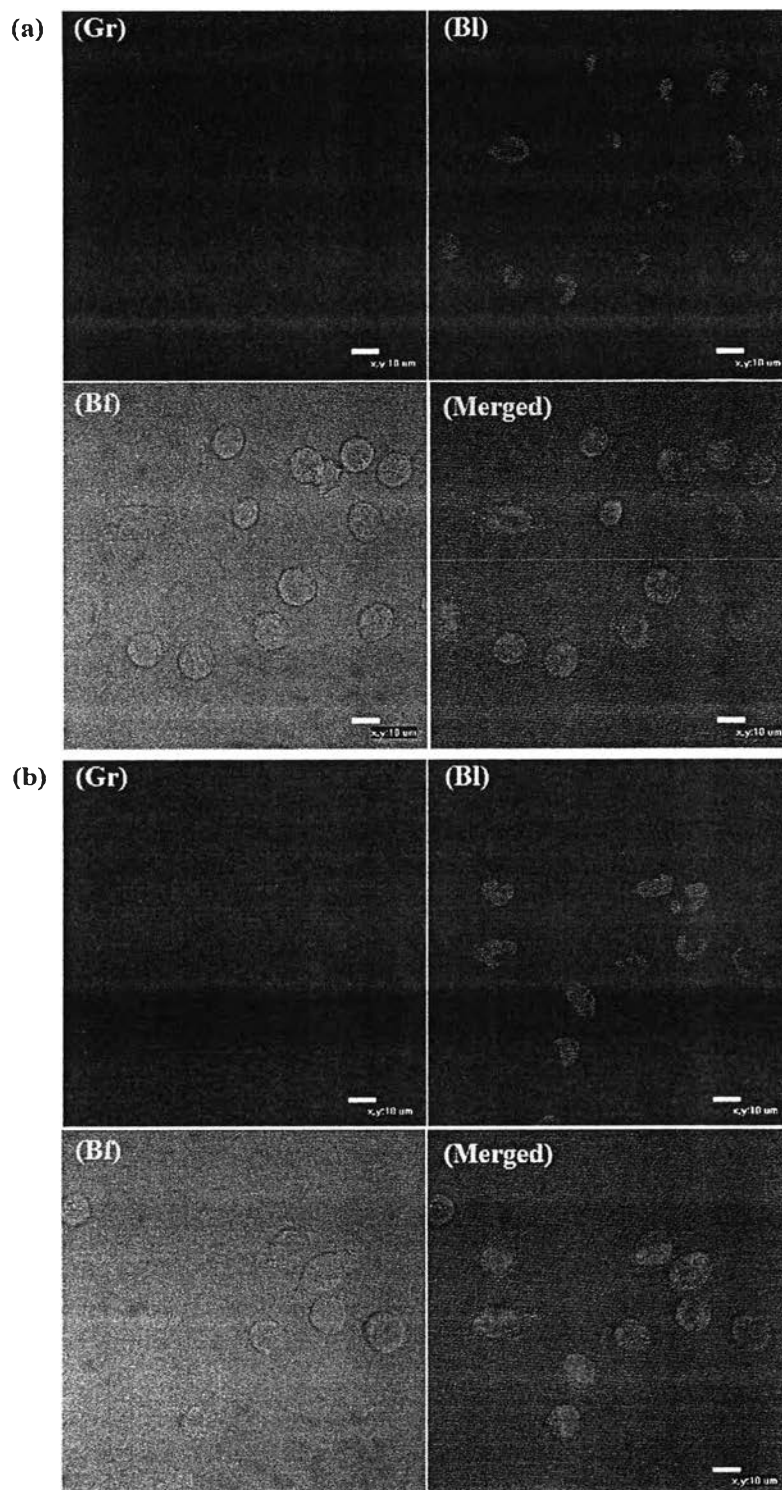


Figure A18 Confocal images of SW620 cells incubated in 25 $\mu\text{g}/\text{ml}$ **curcumin** for 0.5 h (a) and 1 h. **Curcumin** powder was dissolved in 10% DMSO/HEPES before mixed with the cell culture media. The curcumin channel (Green; Gr), the nuclear dye channel (Blue; Bl), the brightfield image (Bf) and the merge of three channels were showed from left to right and up to down of column.

Table A1 Independent Samples Test of IC₅₀ values of Cur and GdSH-Cur

Group Statistics			t-test for Equality of Means			
			95% Confidence Interval of the Difference			
Pair	N	Mean	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
GdSH-Cur to normal cells	3	17.80	2.07	0.01585	9.94	1.33
GdSH-Cur to cancer cells	3	8.03				
Cur (DMSO) to cancer cells	3	10.30	2.09	0.00560	2.20	0.18
GdSH-Cur to cancer cells	3	8.03				

Table A2 Independent Samples Test of % cell viability of Cur (in DMSO) at various concentration to normal cells compared with cancer cells

Group Statistics			t-test for Equality of Means			
			95% Confidence Interval of the Difference			
Pair	N	Mean	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
20 µg/mL Cur (DMSO) to normal cells	3	99.07	4	0.000002305	89.29	2.23
20 µg/mL Cur (DMSO) to cancer cells	3	9.78				
10 µg/mL Cur (DMSO) to normal cells	3	101.92	4	0.000002537	52.38	1.34
10 µg/mL Cur (DMSO) to cancer cells	3	49.54				
5 µg/mL Cur (DMSO) to normal cells	3	99.49	4	0.639956828	4.86	9.61
5 µg/mL Cur (DMSO) to cancer cells	3	94.63				
2.5 µg/mL Cur (DMSO) to normal cells	3	100.75	4	0.820084800	1.40	5.77
2.5 µg/mL Cur (DMSO) to cancer cells	3	99.35				

Table A3 Independent Samples Test of % cell viability of Cur in CNPs (in HEPES) at various concentration to normal cells compared with cancer cells

Group Statistics			t-test for Equality of Means			
			95% Confidence Interval of the Difference			
Pair	N	Mean	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
20 µg/mL Cur in CNPs to normal cells	3	44.03	4	0.001847466	27.23	3.72
20 µg/mL Cur in CNPs to cancer cells	3	16.80				
10 µg/mL Cur in CNPs to normal cells	3	72.04	4	0.000218886	51.07	4.01
10 µg/mL Cur in CNPs to cancer cells	3	20.96				
5 µg/mL Cur in CNPs to normal cells	3	85.78	4	0.086718218	-10.20	4.51
5 µg/mL Cur in CNPs to cancer cells	3	95.97				
2.5 µg/mL Cur in CNPs to normal cells	3	86.74	4	0.012962755	-12.91	3.02
2.5 µg/mL Cur in CNPs to cancer cells	3	99.66				

Table A4 Independent Samples Test of % cell viability of Cur (in DMSO) compared with Cur in CNPs (in HEPES) to normal cells at various concentration

Group Statistics			t-test for Equality of Means			
			95% Confidence Interval of the Difference			
Pair	N	Mean	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
20 µg/mL Cur (DMSO) to normal cells	3	99.07	4	0.000154967	55.04	3.96
20 µg/mL Cur in CNPs to normal cells	3	44.03				
10 µg/mL Cur (DMSO) to normal cells	3	101.92	4	0.001412893	29.88	3.80
10 µg/mL Cur in CNPs to normal cells	3	72.04				
5 µg/mL Cur (DMSO) to normal cells	3	99.49	4	0.022058272	13.71	3.77
5 µg/mL Cur in CNPs to normal cells	3	85.78				
2.5 µg/mL Cur (DMSO) to normal cells	3	100.75	4	0.005470757	14.00	2.56
2.5 µg/mL Cur in CNPs to normal cells	3	86.74				

Table A5 Independent Samples Test of % cell viability of Cur (in DMSO) compared with Cur in CNPs (in HEPES) to cancer cells at various concentration

Group Statistics			t-test for Equality of Means			
			95% Confidence Interval of the Difference			
Pair	N	Mean	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
20 µg/mL Cur (DMSO) to cancer cells	3	9.78	4	0.016305754	-7.02	1.76
20 µg/mL Cur in CNPs to cancer cells	3	16.80				
10 µg/mL Cur (DMSO) to cancer cells	3	49.54	4	0.000103124	28.57	1.85
10 µg/mL Cur in CNPs to cancer cells	3	20.96				
5 µg/mL Cur (DMSO) to cancer cells	3	94.63	4	0.898944484	-1.34	9.93
5 µg/mL Cur in CNPs to cancer cells	3	95.97				
2.5 µg/mL Cur (DMSO) to cancer cells	3	99.35	4	0.961228504	-0.31	5.99
2.5 µg/mL Cur in CNPs to cancer cells	3	99.66				

Table A6 Independent Samples Test of % cell viability of Cur (in HEPES) compared with Cur in CNPs (in HEPES) to cancer cells at various concentration

Group Statistics			t-test for Equality of Means			
			95% Confidence Interval of the Difference			
Pair	N	Mean	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
20 µg/mL Cur (HEPES) to cancer cells	3	78.90	4	0.000003702	62.10	1.74
20 µg/mL Cur in CNPs to cancer cells	3	16.80				
10 µg/mL Cur (HEPES) to cancer cells	3	85.34	4	0.000114551	64.37	4.29
10 µg/mL Cur in CNPs to cancer cells	3	20.96				
5 µg/mL Cur (HEPES) to cancer cells	3	89.12	4	0.294006134	-6.85	5.68
5 µg/mL Cur in CNPs to cancer cells	3	95.97				
2.5 µg/mL Cur (HEPES) to cancer cells	3	98.31	4	0.865547194	-1.34	7.44
2.5 µg/mL Cur in CNPs to cancer cells	3	99.66				

Table A7 Independent Samples Test of % cell viability of CNPs (in HEPES) at various concentration to normal cells compared with cancer cells

Group Statistics			t-test for Equality of Means			
			95% Confidence Interval of the Difference			
Pair	N	Mean	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
400 µg/mL CNPs to normal cells	3	71.93	4	0.000534924	-12.90	1.27
400 µg/mL CNPs to cancer cells	3	84.82				
200 µg/mL CNPs to normal cells	3	76.87	4	0.026758978	-5.90	1.73
200 µg/mL CNPs to cancer cells	3	82.77				
200 µg/mL CNPs to normal cells	3	79.68	4	0.004830920	-13.66	2.42
200 µg/mL CNPs to cancer cells	3	93.35				
100 µg/mL CNPs to normal cells	3	100.38	2	0.920321562	0.54	4.75
100 µg/mL CNPs to cancer cells	3	99.85				

Table A8 Independent Samples Test of IC₅₀ values of **CurBF₂** and **GdSH-CurBF₂**

Group Statistics			t-test for Equality of Means			
			95% Confidence Interval of the Difference			
Pair	N	Mean	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
CurBF ₂ (DMSO) to normal cells	3	2.0421	2	0.00146	1.2091	0.0541
CurBF ₂ (DMSO) to cancer cells	3	.8330				
GdSH-CurBF ₂ to normal cells	3	1.6456	4	0.00002	0.9923	0.0399
GdSH-CurBF ₂ to cancer cells	3	.6532				
CurBF ₂ (DMSO) to normal cells	3	2.0421	4	0.00366	0.3965	0.0651
GdSH-CurBF ₂ to normal cells	3	1.6456				
CurBF ₂ (DMSO) to cancer cells	3	.8330	4	0.00045	0.1798	0.0169
GdSH-CurBF ₂ to cancer cells	3	.6532				

Table A9 Independent Samples Test of % cell viability of **CurBF₂** (in DMSO) at various concentration to normal cells compared with cancer cells

Group Statistics			t-test for Equality of Means			
			95% Confidence Interval of the Difference			
Pair	N	Mean	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
2.5000 µg/mL CurBF ₂ (DMSO) to normal cells	3	39.75	4	0.000032230	36.93	1.78
2.5000 µg/mL CurBF ₂ (DMSO) to cancer cells	3	2.82				
1.2500 µg/mL CurBF ₂ (DMSO) to normal cells	3	66.64	4	0.000011152	59.87	2.22
1.2500 µg/mL CurBF ₂ (DMSO) to cancer cells	3	6.77				
0.6250 µg/mL CurBF ₂ (DMSO) to normal cells	3	88.01	4	0.002878648	16.43	2.53
0.6250 µg/mL CurBF ₂ (DMSO) to cancer cells	3	71.58				
0.3125 µg/mL CurBF ₂ (DMSO) to normal cells	3	98.09	4	0.023240008	14.82	4.14
0.3125 µg/mL CurBF ₂ (DMSO) to cancer cells	3	83.27				

Table A10 Independent Samples Test of % cell viability of **CurBF₂** in CNPs (in HEPES) at various concentration to normal cells compared with cancer cells

Group Statistics			t-test for Equality of Means			
			95% Confidence Interval of the Difference			
Pair	N	Mean	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
2.5000 µg/mL CurBF ₂ in CNPs to normal cells	3	32.98	4	0.000006186	28.72	0.92
2.5000 µg/mL CurBF ₂ in CNPs to cancer cells	3	4.26				
1.2500 µg/mL CurBF ₂ in CNPs to normal cells	3	52.69	4	0.000002525	49.15	1.25
1.2500 µg/mL CurBF ₂ in CNPs to cancer cells	3	3.53				
0.6250 µg/mL CurBF ₂ in CNPs to normal cells	3	73.10	4	0.000052692	34.07	1.86
0.6250 µg/mL CurBF ₂ in CNPs to cancer cells	3	39.03				
0.3125 µg/mL CurBF ₂ in CNPs to normal cells	3	85.48	4	0.228911013	-2.62	1.85
0.3125 µg/mL CurBF ₂ in CNPs to cancer cells	3	88.10				

Table A11 Independent Samples Test of % cell viability of **CurBF₂** (in DMSO) compared with **CurBF₂** in CNPs (in HEPES) to normal cells at various concentration

Group Statistics			t-test for Equality of Means			
			95% Confidence Interval of the Difference			
Pair	N	Mean	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
2.5000 µg/mL CurBF ₂ (DMSO) to normal cells	3	39.75	4	0.025658299	6.77	1.95
2.5000 µg/mL CurBF ₂ in CNPs to normal cells	3	32.98				
1.2500 µg/mL CurBF ₂ (DMSO) to normal cells	3	66.64	4	0.000312725	13.95	1.20
1.2500 µg/mL CurBF ₂ in CNPs to normal cells	3	52.69				
0.6250 µg/mL CurBF ₂ (DMSO) to normal cells	3	88.01	4	0.002577419	14.91	2.22
0.6250 µg/mL CurBF ₂ in CNPs to normal cells	3	73.10				
0.3125 µg/mL CurBF ₂ (DMSO) to normal cells	3	98.09	4	0.019576619	12.62	3.35
0.3125 µg/mL CurBF ₂ in CNPs to normal cells	3	85.48				

Table A12 Independent Samples Test of % cell viability of **CurBF₂** (in DMSO) compared with **CurBF₂** in CNPs (in HEPES) to cancer cells at various concentration

Group Statistics			t-test for Equality of Means			
			95% Confidence Interval of the Difference			
Pair	N	Mean	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference
2.5000 $\mu\text{g/mL}$ CurBF ₂ (DMSO) to cancer cells	3	2.82	4	0.035716648	-1.44	0.46
2.5000 $\mu\text{g/mL}$ CurBF ₂ in CNPs to cancer cells	3	4.26				
1.2500 $\mu\text{g/mL}$ CurBF ₂ (DMSO) to cancer cells	3	6.77	4	0.222966968	3.24	2.24
1.2500 $\mu\text{g/mL}$ CurBF ₂ in CNPs to cancer cells	3	3.53				
0.6250 $\mu\text{g/mL}$ CurBF ₂ (DMSO) to cancer cells	3	71.58	4	0.000124704	32.55	2.21
0.6250 $\mu\text{g/mL}$ CurBF ₂ in CNPs to cancer cells	3	39.03				
0.3125 $\mu\text{g/mL}$ CurBF ₂ (DMSO) to cancer cells	3	83.27	4	0.190600677	-4.82	3.06
0.3125 $\mu\text{g/mL}$ CurBF ₂ in CNPs to cancer cells	3	88.10				

VITA

General Biographical Information

Miss Chonticha Sahub was born on July, 31, 1987 in Roi Et, Thailand. She has obtained the scholarship from the Development and Promotion of Science and Technology Talent Project (DPST), under the Institute for the Promotion of Teaching Science and Technology (IPST), Ministry of Education Thailand since 2003 until present. She graduated with a high school diploma from Kaennakhon Wittayalai School (Mathematics and Science Programme), Khon Kaen in 2005. Thereafter, she got her Bachelor's degree of Science in Chemistry with a first class honor from Khon Kaen University in 2009. Afterwards, she has become a graduate student and a member of supramolecular research unit at Chulalongkorn University since 2010 until now and worked under supervision of Professor Thawatchai Tuntulani and Assistant Professor Dr. Boosayarat Tomapatanaget.

Research experiences

- 2012 Interchange for joint research entitled "Fabrication of Recognition-Actuated Cucurbituril-Nanoparticle Therapeutics" with Professor Vincent M. Rotello in Biological and Materials Applications of Nanoparticles Research Unit, Department of Chemistry, University of Massachusetts Amherst, Amherst, USA, since September 01, 2012 to February 28, 2013
- 2009 Summer research training, Young Scientist and Technologist Programme (YSTP) under supervision of Dr.Kuljira Sujirote in Materials Reliability Research Unit, National Metal and Materials Technology Center (MTEC), Thailand, since March 20 to May 22, 2009

About this research

- 2013 Chonticha Sahub, Gamolwan Tumcharern, Thawatchai Tuntulani, Sanong Ekgasit, Boosayarat Tomapatanaget, "Study of Novel Self-Assembled Coordination Nanoparticles from Surfactants and Gadolinium ion to Stabilize Curcumin in Buffered Solution", *KKU Research Journal, Impressed*, 2013
- 2012 Poster presentation at The 6th Pure and Applied Chemistry International Conference 2012 (PACCON 2012), 11-13 January 2012, The Empress convention center, Chiang Mai, Thailand

