Synthesis and Physicochemical Properties of Double-Chain Cationic Surfactants

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Supporting Information C : ^{1}H NMR Spectra and ^{13}C NMR Spectra of 12-0-12

^{1}H NMR Spectra and ^{13}C NMR Spectra of 16-0-16

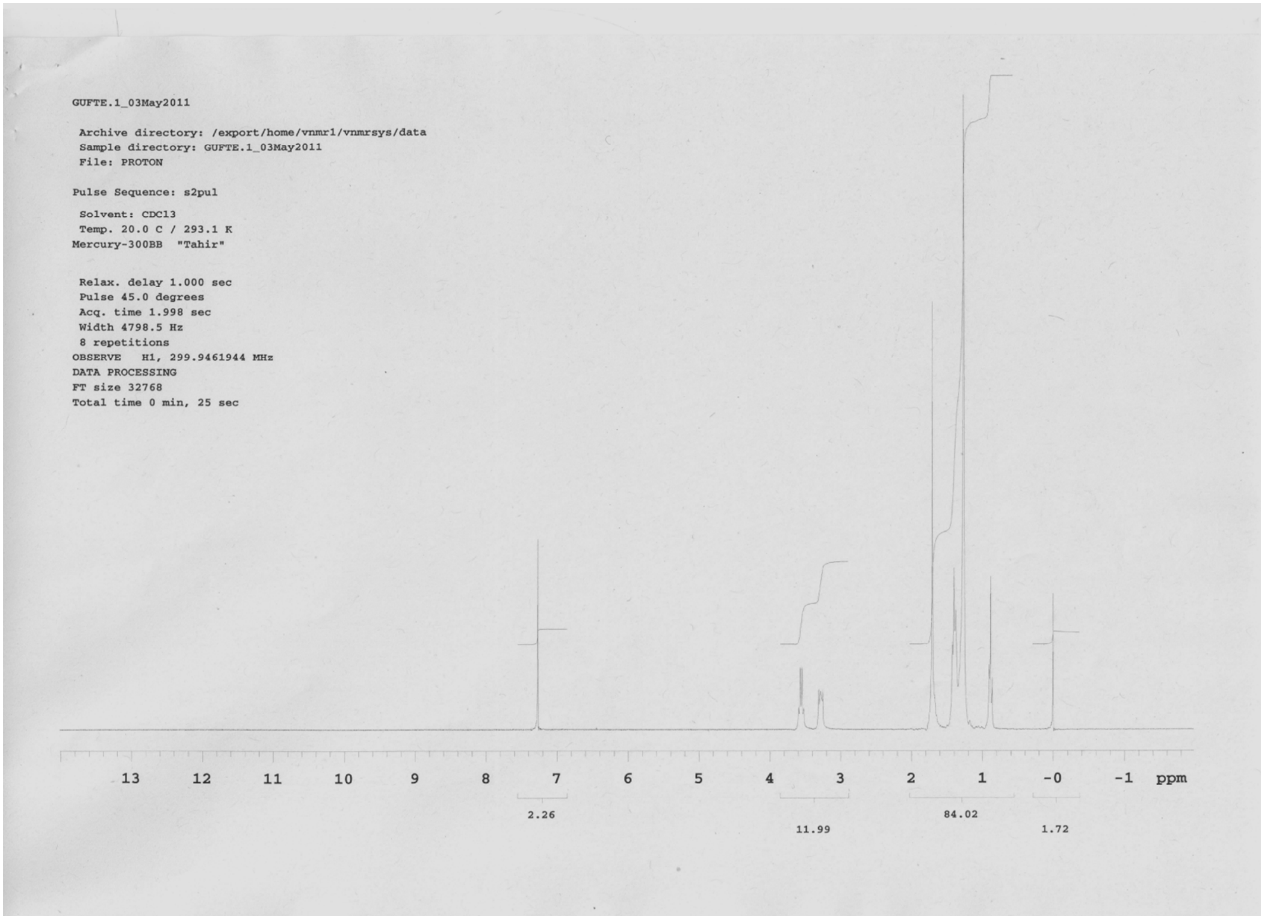
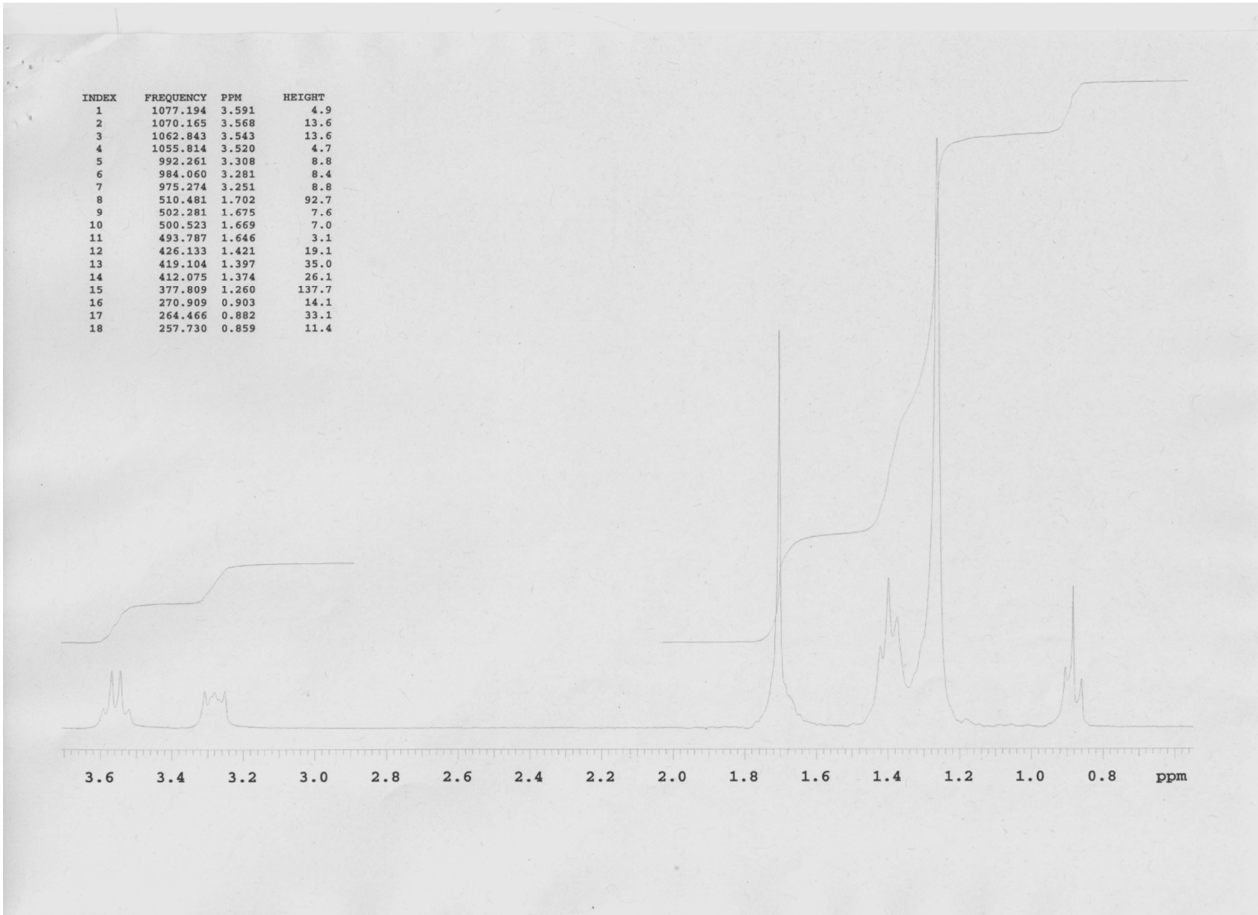
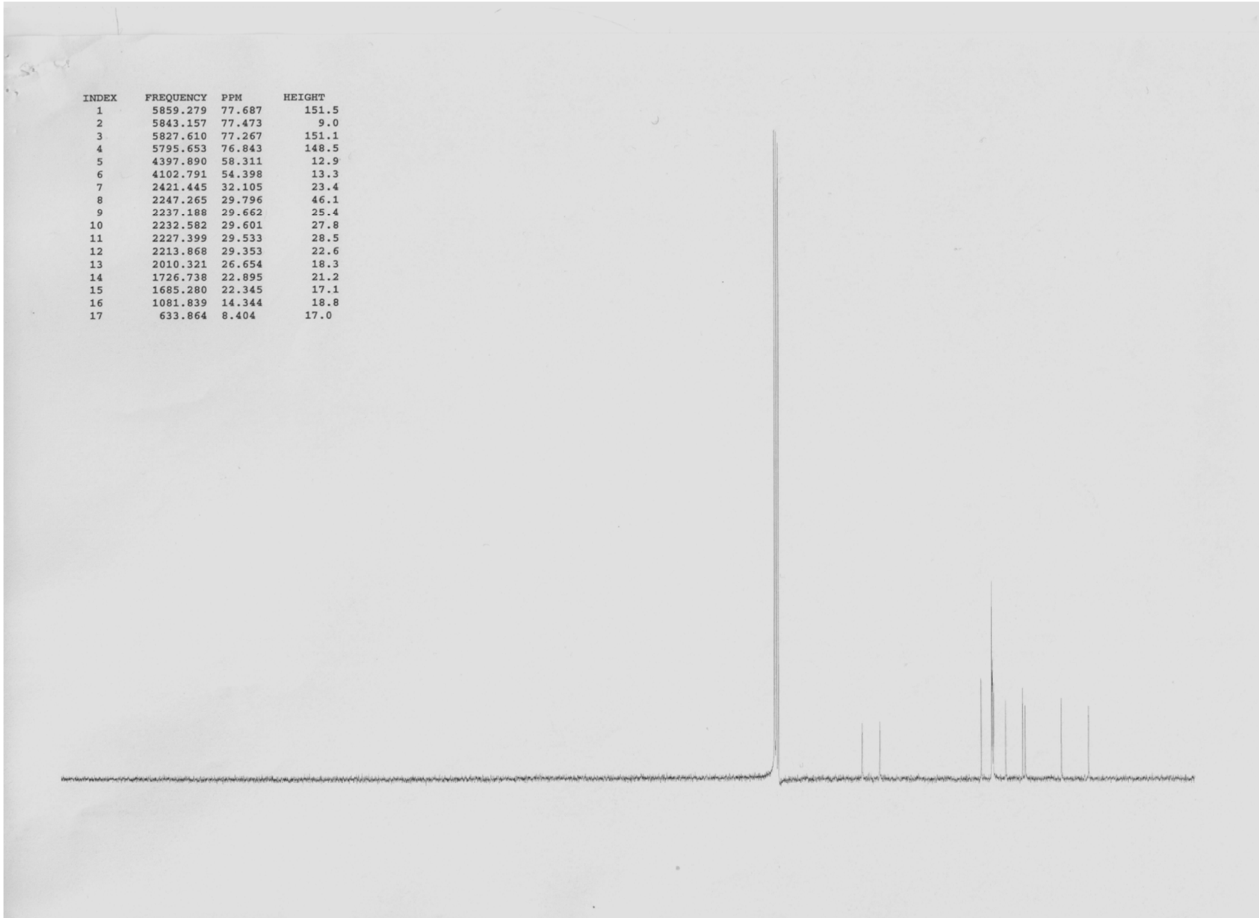


Figure S4a. ^{1}H NMR Spectra of 12-0-12



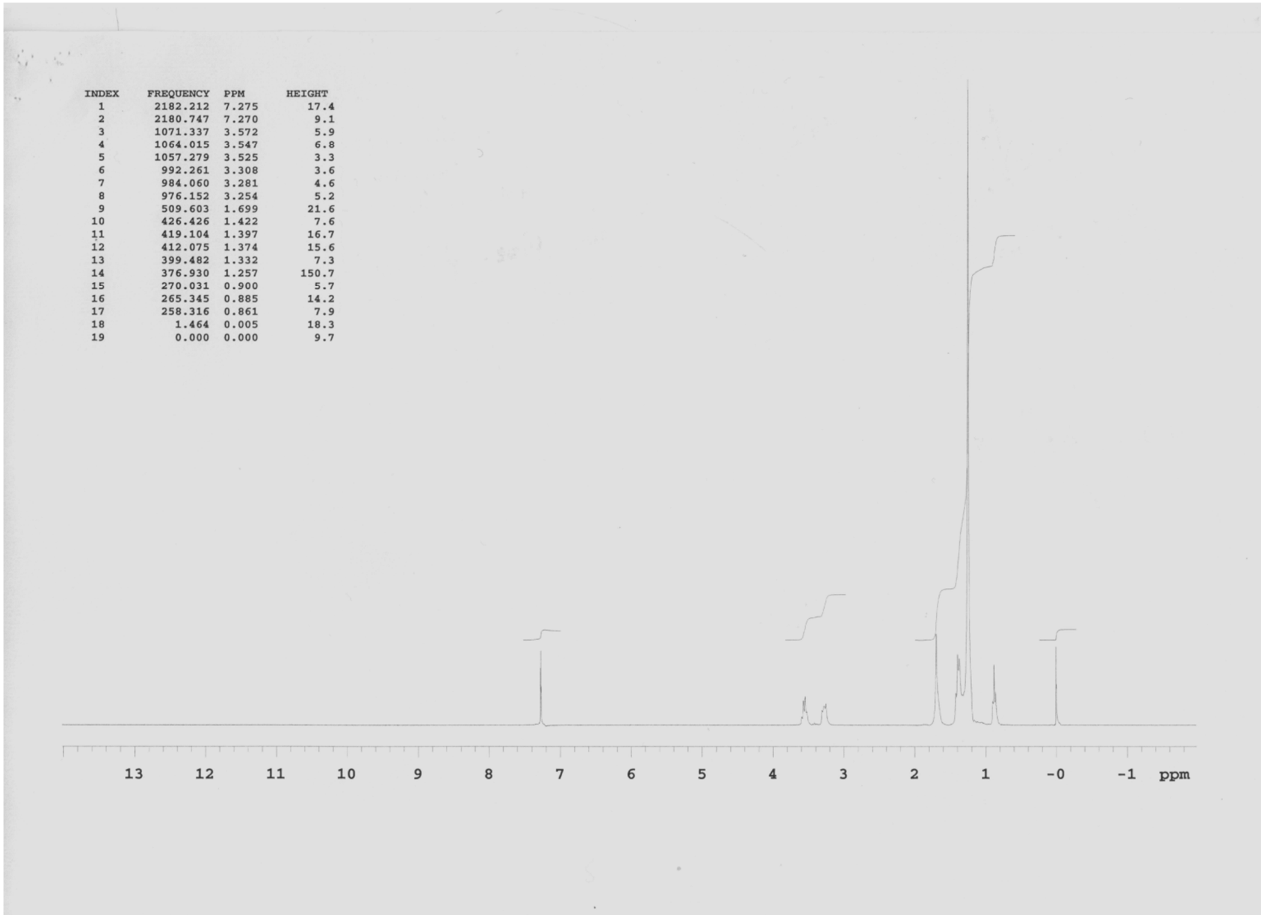
INDEX	FREQUENCY	PPM	HEIGHT
1	1077.194	3.591	4.9
2	1070.165	3.568	13.6
3	1062.843	3.543	13.6
4	1055.814	3.520	4.7
5	992.261	3.308	8.8
6	984.060	3.281	8.4
7	975.274	3.251	8.8
8	510.481	1.702	92.7
9	502.281	1.675	7.6
10	500.523	1.669	7.0
11	493.787	1.646	3.1
12	426.133	1.421	19.1
13	419.104	1.397	35.0
14	412.075	1.374	26.1
15	377.809	1.260	137.7
16	270.909	0.903	14.1
17	264.466	0.882	33.1
18	257.730	0.859	11.4

Figure S4b. ^{1}H NMR Spectra of 12-0-12



INDEX	FREQUENCY	PPM	HEIGHT
1	5859.279	77.687	151.5
2	5843.157	77.473	9.0
3	5827.610	77.267	151.1
4	5795.653	76.843	148.5
5	4397.890	58.311	12.9
6	4102.791	54.398	13.3
7	2421.445	32.105	23.4
8	2247.265	29.796	46.1
9	2237.188	29.662	25.4
10	2232.582	29.601	27.8
11	2227.399	29.533	28.5
12	2213.868	29.353	22.6
13	2010.321	26.654	18.3
14	1726.738	22.895	21.2
15	1685.280	22.345	17.1
16	1081.839	14.344	18.8
17	633.864	8.404	17.0

Figure S4c. ^{13}C NMR Spectra of 12-0-12



INDEX	FREQUENCY	PPM	HEIGHT
1	2182.212	7.275	17.4
2	2180.747	7.270	9.1
3	1071.337	3.572	5.9
4	1064.015	3.547	6.8
5	1057.279	3.525	3.3
6	992.261	3.308	3.6
7	984.060	3.281	4.6
8	976.152	3.254	5.2
9	509.603	1.699	21.6
10	426.426	1.422	7.6
11	419.104	1.397	16.7
12	412.075	1.374	15.6
13	399.482	1.332	7.3
14	376.930	1.257	150.7
15	270.031	0.900	5.7
16	265.345	0.885	14.2
17	258.316	0.861	7.9
18	1.464	0.005	18.3
19	0.000	0.000	9.7

Figure S5a. ^{1}H NMR Spectra of 16-0-16

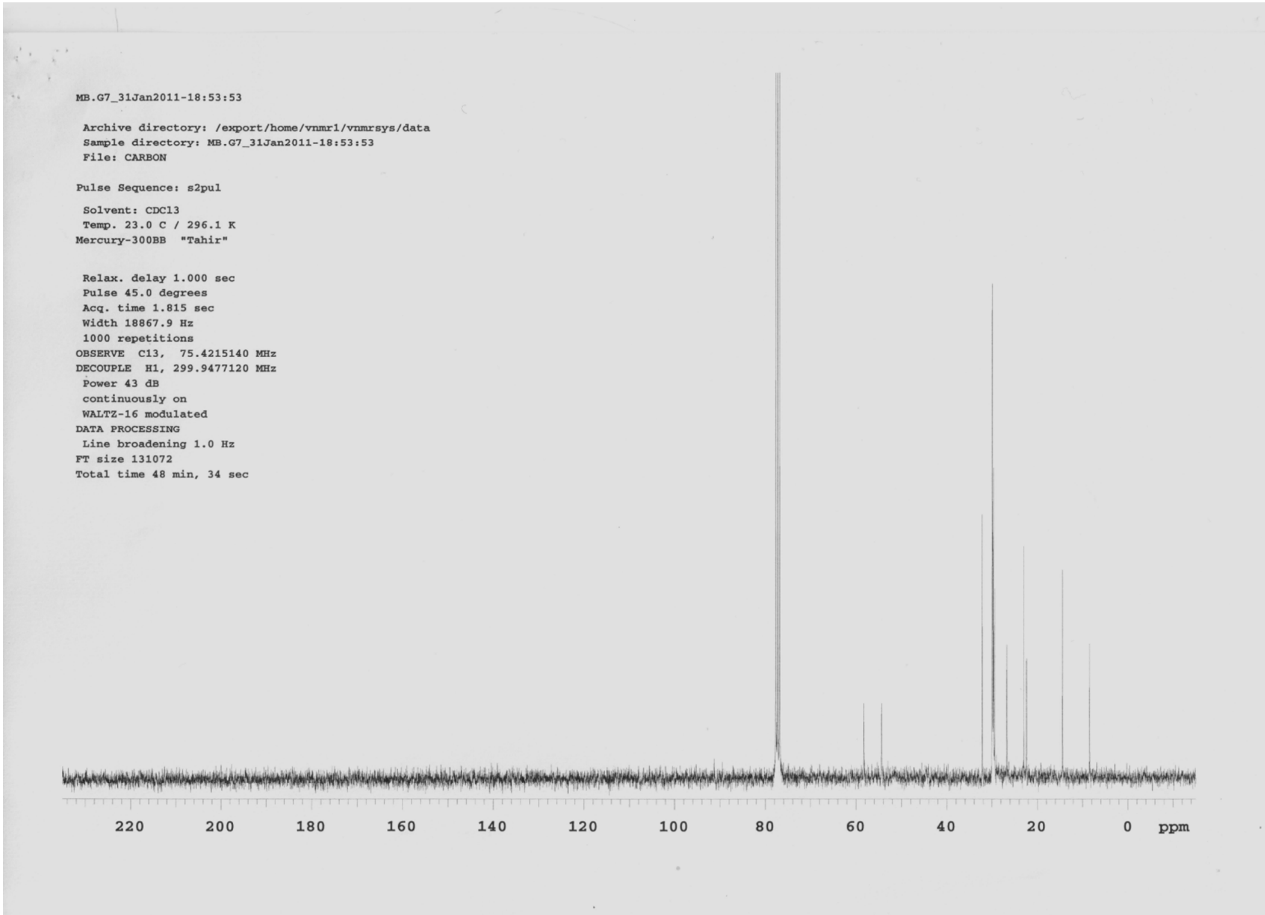


Figure S5b. ^{13}C NMR Spectra of 16-0-16

The purities of double-chain cationic surfactants m-0-m (m=10,12 and 16) are estimated to be ≥99.5 mol % from their ^{1}H NMR spectra. Because, there are no integral relating to any foreign proton.

On the other hand, the purity of the gemini surfactant 12-2-12 are estimated to be 97 mol % from ^{1}H NMR spectra. The one impurity is the starting material N,N,N',N'-tetramethylethylenediamine and the peaks come from its hydrogen are observed in 2.3-2.5 ppm. The purity of the gemini surfactant 12-2-12 was determined by the integral ratio of this proton to total integral of all hydrogen atoms. The purity of the gemini surfactant 16-2-16 are estimated to be 98,5 mol % from ^{1}H NMR spectra. The one impurity is the same of 12-2-12 (N,N,N',N'-tetramethylethylenediamine) and the peaks come from its hydrogen are observed in 2.3-2.5 ppm. The purity of the gemini surfactant 16-2-16 was determined by the integral ratio of this proton to total integral of all hydrogen atoms.