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APPENDICES

APPENDIX A
EXPERIMENTAL DATA

Table A.1 Particle size analysis of quartz by Mastersizer X Ver. 2.15

No.	Mean dimeter of quartz (μm)	
	150 mesh	300 mesh
1	31.9	27.14
2	32.37	27.12
3	32.82	29.24
4	34.91	28.91
5	32.93	29.06
Avg.	32.97 $\pm$2.00	28.29 $\pm$1.20

Table A.2 Surface area of quartz by BET measurement

Sample : Quartz particle

Gas type : Nitrogen

Out gas : Minimum 17 hours at 140 ^{o}C

No.	Weight of particle (g)	Surface Area (m^2/g)
1	0.1119	4.535
2	0.1133	5.593
3	0.1303	3.563
4	0.1426	3.464
5	0.1199	5.115
6	0.1228	2.972
Avg.	1.235 $\pm$ 0.02	4.207 $\pm$ 1.400

Table A.3 The surface tension for finding the CMC of DTAB

Measurement : Tensiometer

Condition : DTAB purity 98 %

: pH 6.2 ± 0.05

: Temperature 26 °C

No.	Conc. of DTAB (μmol/l)	Surface tension (mN/m)			
		1	2	3	Avg.
1	100	68	67.1	66.2	67.1
2	500	64.2	66.2	66.2	65.5333
3	1000	59.2	59	59.9	59.3667
4	2500	58.3	59.7	59.3	59.1
5	5000	51.4	51	51.2	51.2
6	7500	46.6	47.6	48.1	47.4333
7	10000	44	42.2	43.3	43.1667
8	25000	38.3	38.8	38.3	38.4667
9	50000	38.3	38.6	38.7	38.5333
10	75000	38.2	38.4	38.3	38.3
11	100000	38.3	38.2	38.4	38.3

Table A.4 The adsorption isotherm for finding time to equilibrium

No.	Time (Min)	Adsorption density (μmol/m2)	
		at 1.0 μmol/l	at 100 μmol/l
1	5	0.001756	0.0832
2	10	0.00182	0.0819
3	20	0.001791	0.0829
4	60	0.001769	0.0835

Table A.5 The adsorption density for finding the adsorption isotherm

Measurement : HPLC

No.	Initial Conc. (100 ml solution) (μmol/l)	Weight of quartz (g)	pH	Temp (°C)	Amount of DTAB (initial) (μmol/l)	Final Conc. (μmol/l)	Amount of DTAB (final) (μmol/l)	Adsorption density ($\mu mol/m^2$)
1	0.1	5.0001	6.22	26.5	0.01	0.0902	0.00902	0.00043
2	0.25	5.0001	6.2	26.5	0.025	0.167	0.0167	0.000795
3	0.5	5.0004	6.23	26	0.05	0.22	0.022	0.00105
4	0.75	5.0003	6.17	26	0.075	0.136	0.0136	0.000646
5	1	5	6.18	27	0.1	0.376	0.0376	0.00179
6	2.5	5.0005	6.25	26.5	0.25	0.194	0.0194	0.000922
7	5	5.0001	6.19	26.8	0.5	0.24	0.024	0.00106
8	7.5	5.0002	6.17	25.9	0.75	0.21	0.021	0.001
9	10	5.0002	6.23	25.6	1	0.728	0.0728	0.00347
10	25	5.0004	6.17	25	2.5	4.80	0.48	0.0228
11	50	5	6.24	26.1	5	13.94	1.390	0.661
12	75	5.0001	6.22	27	7.5	16.9	1.69	0.0805
13	100	5.0004	6.18	26.2	10	17.4	1.74	0.0829
14	250	5.0002	6.15	26.8	25	43.4	4.34	0.212
15	500	5	6.15	26.7	50	65.6	6.56	0.313
16	750	5.0001	6.18	27	75	70.9	7.09	0.338
17	1000	5	6.15	27	100	107	10.7	0.508
18	2500	5.0005	6.21	27	250	165	16.5	0.787
19	5000	4.9997	6.17	26.6	500	411	41.1	1.96
20	7500	5.0002	6.22	25.4	750	1160	116	5.53
21	10000	4.9999	6.15	27	1000	1190	119	5.67
22	25000	5	6.17	25.6	2500	2300	230	10.9
23	50000	5.0001	6.16	26.7	5000	2230	223	10.6
24	75000	5	6.17	27	7500	2640	264	12.6
25	100000	5	6.15	26.1	10000	2640	264	12.6

Table A.6 The electrophoretic mobility data by the Zeta Meter Ver.3.0

Condition : pH 6.2 ± 0.05 at 26 ± 1.0 °C

Conc.* (μmol/l)	Weight (g)	Zeta potential (mV)										
		1	2	3	4	5	6	7	8	9	10	Avg.
0.1	5.0002	-88.8	-87.5	-84	-85.4	-86.3	-84	-86	-86.3	-81.5	-84.7	-85.5
0.25	5.0001	-86.7	-85.1	-85	-80.4	-86.3	-83	-81	-83.6	-83.7	-86.3	-84.1
0.5	5.0005	-84.7	-87.5	-84	-85.4	-83.7	-82	-83	-82.2	-84.7	-81.5	-83.9
0.75	5.0009	-88.3	-90.1	-82	-80.8	-83.7	-84	-84	-80.4	-80.8	-82.2	-83.6
1	5.0003	-81.5	-80.8	-84	-84.1	-90.1	-82	-82	-80.8	-80.4	-86.3	-83.2
2.5	5.0002	-85.8	-87.9	-83	-81.5	-82.2	-81	-82	-83.7	-84.1	-83.3	-83.5
5	5.0001	-76.2	-81.1	-90	-85.4	-80.8	-81	-86	-80.4	-83.7	-81.5	-82.6
7.5	5.0001	-80.8	-80.4	-82	-82.2	-78	-78	-77	-75.3	-78	-76.6	-78.8
10	5.0001	-73.8	-79	-77	-82.2	-81.5	-78	-78	-72.4	-75.3	-78	-77.5
25	5.0002	-72.9	-72.1	-72	-68.5	-65.7	-78	-72	-72.1	-71.8	-74.7	-72
50	5	-65.3	-64.5	-69	-66.2	-66	-62	-67	-67.4	-65.3	-60.9	-65.4
75	5	-62.3	-52.6	-61	-54.9	-56.6	-56	-55	-56.5	-54.7	-55.7	-56.5
100	5	-48.5	-53.1	-46	-51.3	-49.1	-48	-48	-49.3	-46.4	-46	-48.6
250	5	-40.1	-41.1	-38	-40.3	-39.9	-40	-41	-40	-40.1	-40.3	-40.1
500	5.0003	-36.3	-33.3	-33	-34.4	-30.6	-28	-33	-30.7	-32.5	-29	-32.1
750	5.0002	-20.2	-21.9	-20	-21.5	-25.6	-21	-22	-21.9	-19.5	-23.4	-21.7
1000	5	-8.5	-8.5	-8.5	-8.5	-8.5	-8.5	-8.5	-8.5	-8.5	-8.5	-8.5
2500	5.0005	9.531	15.53	16.1	14.5	9.11	7.45	11.5	13.64	11.6	10.6	11.96
5000	5.0005	33.16	32.71	32	38	41	33.7	33.7	37.49	33.9	34.5	35.02
7500	5.0004	50.7	52.36	52.7	53.9	53.3	47	51.1	54.71	53.2	54.6	52.36
10000	5.0004	62.71	63.28	65.5	69.8	72.1	71.6	72.5	71.94	67.6	69.8	68.68
25000	5.0002	75.39	74.48	77.2	79.9	78.3	76.3	77.2	77.85	72.8	78.3	76.77
50000	4.9997	78.84	72.09	79.5	77.6	77.4	76.2	76.1	79.6	78	76.3	77.16
75000	5.0005	74.12	72.85	78.6	75.6	75.1	79.8	79.4	76.92	77.9	79.9	77.02
100000	5.0004	72.85	7.13	85.7	75.1	79.1	81	71.8	81.83	73.9	71.3	69.97

* 100 ml of surfactant solution.

Table A.7 Flotation results

condition : Time 90 s, pH 6.2 ± 0.05 at temperature 26 ± 1.0 °C

Conc.	5.7 mL/s		6.5 mL/s		8.4 mL/s		% Floated		
(μmol/L)	Quartz int. (g)	Quartz floated (g)	Quartz int. (g)	Quartz floated (g)	Quartz int. (g)	Quartz floated (g)	5.7 mL/s	6.5 mL/s	8.4 mL/s
0.1	4.9996	0.1604	5.0003	0.4871	5.0005	1.3884	3.2083	9.74142	27.7652
0.25	5.0005	0.1771	5	0.7081	5.0001	1.6935	3.5416	14.162	33.8693
0.5	5.0005	0.1716	5.0005	0.8087	4.9998	1.9128	3.4317	16.1724	38.2575
0.75	4.9997	0.1788	5	1.3004	5	2.066	3.5762	26.008	41.32
1	5.0005	0.186	5.0003	1.9128	5.0005	2.3377	3.7196	38.2537	46.7493
2.5	5.0005	0.2273	4.9998	2.6405	5.0001	2.4935	4.5455	52.8121	49.869
5	5.0005	0.4201	5.0003	2.6653	5.0005	2.9388	8.4012	53.3028	58.7701
7.5	5	0.4539	5.0005	2.913	4.9997	3.3389	9.078	58.2542	66.782
10	5.0002	1.2903	5	3.366	5.0005	3.5891	25.805	67.32	71.7748
25	5.0001	2.3883	5.0003	3.5066	4.9998	3.7323	47.765	70.1278	74.649
50	4.9999	2.781	5.0005	3.5891	4.9995	3.9015	55.621	71.7748	78.0378
75	5.0005	2.9305	5.0003	3.8165	5.0002	3.8745	58.604	76.3254	77.4869
100	4.9998	3.061	4.9995	3.8641	5.0005	4.0343	61.222	77.2897	80.6779
250	5.0001	2.9472	5.0005	4.0092	5.0005	3.9948	58.943	80.176	79.888
500	4.9995	3.3221	5.0005	4.0542	4.9996	4.1343	66.449	81.0759	82.6926
750	5.0005	3.2921	4.9995	4.0928	5.0005	4.0133	65.835	81.8642	80.258
1000	5.0005	3.3349	5.0003	4.1365	5.0004	4.0634	66.691	82.725	81.2615
2500	4.9996	3.3029	5.0005	4.0092	5.0003	3.9776	66.063	80.176	79.5472
5000	5	3.2351	4.9995	3.9928	5.0001	4.2248	64.702	79.864	84.4952
7500	5.0003	2.6229	5.0005	3.6859	5	3.7713	52.455	73.7106	75.426
10000	4.9996	1.2356	5.0005	3.0324	5.0005	3.1398	24.714	60.6419	62.7897
25000	5.0005	0.1327	4.9997	0.2522	4.9995	0.362	2.6537	5.0443	7.24072
50000	4.9998	0.1156	5.0005	0.2408	5.0005	0.2434	2.3121	4.81552	4.86751
75000	5.0001	0.0496	5.0003	0.2671	5.0005	0.2885	0.992	5.34168	5.76942
100000	5.0004	0.0786	5.0002	0.2461	5.0005	0.3169	1.5719	4.9218	6.33737

Table A.8 The aggregation size measurement result by LSM 410

Condition : pH 6.2 ± 0.05 at 26 ± 1.0 °C

No.	Initial Conc. (μmol/l)	weight (g)	Aggregate size (μm)	
			Dia. max.	Dia. avg.
1	0.1	1.0001	96	28.32
2	0.5	1.0001	108.22	28.44
3	1	1	146.24	36.02
4	5	1.0001	161.6	40.43
5	10	1.0001	312	43.46
6	50	1	388.3	46.48
7	100	0.9999	470.4	47.01
8	500	0.9999	696.64	63.24
9	1000	1	661.6	64.46
10	5000	1.0001	743	119.64
11	10000	1.0001	405.6	66.29
12	50000	1.0001	106.56	31.85
13	100000	1.0001	99.99	28.84

Hence : each concentration surfactant solution is 20 ml.

Tabel A.9 Amount of quartz particle per aggregate from Figure 4.7-4.12

(1)	(2)		(3)		(4)		(5)		(6)		(7)	
	(8)	(9)	(8)	(9)	(8)	(9)	(8)	(9)	(8)	(8)	(8)	(9)
1	700	700	398	398	121	121	32	32	150	150	650	650
2	19	76	120	480	48	192	4	16	5	20	80	320
3	3	27	26	234	13	117	2	18	24	216	4	36
4	0	0	4	64	4	64	0	0	0	0	0	0
5	0	0	2	50	3	75	0	0	15	375	0	0
6	0	0	0	0	3	108	6	216	0	0	0	0
7	0	0	0	0	2	98	1	49	0	0	0	0
8	0	0	0	0	2	128	0	0	0	0	0	0
9	0	0	0	0	2	162	0	0	15	1215	0	0
10	0	0	0	0	2	200	1	100	0	0	0	0
11	0	0	0	0	2	242	0	0	0	0	0	0
12	0	0	0	0	0	0	0	0	0	0	0	0
13	0	0	0	0	0	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	10	1960	0	0
15	0	0	0	0	1	225	0	0	0	0	0	0
16	0	0	0	0	0	0	0	0	0	0	0	0
17	0	0	0	0	1	289	0	0	0	0	0	0
18	0	0	0	0	0	0	1	324	0	0	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0
20	0	0	0	0	0	0	0	0	0	0	0	0
21	0	0	0	0	0	0	1	441	0	0	0	0
22	0	0	0	0	0	0	0	0	0	0	0	0
23	0	0	0	0	0	0	0	0	0	0	0	0
24	0	0	0	0	0	0	1	576	0	0	0	0
25	0	0	0	0	0	0	0	0	0	0	0	0
26	0	0	0	0	0	0	1	676	0	0	0	0
Total	722	803	550	792	204	2021	51	2448	210	3936	734	1006

(1) = size of quartz particle aggregates which 1 particle = 28.3 μm diameter

(2) = at without surfactant, (3) =at concentration 1.0 μmol/l

(4) =at concentration 100 μmol/l (5) =at concentration 5,000 μmol/l

(6) =at concentration 10,000 μmol/l (7) =at concentration 100,000 μmol/l

(8) = amount of size appear , (9) = (1) x (1)

Table A.10 Commutative aggregate size distribution percentage of quartz particle aggregated

Particle size (amount of Particle)	Percentage accumulate of quatrz particle aggregates					
	Initial Conc.= 0 µ mol/l	Initial Conc.= 1.0 µmol/l	Initial Conc.= 100 µmol/l	Initial Conc.= 5,000 µ mol/l	Initial Conc.= 10,000 µ mol/l	Initial Conc.= 100,000 µ mol/l
1	87.1731	32.4633	5.987	1.307	3.810	64.612
2	96.6376	71.6156	15.487	1.961	4.319	96.421
3	100	90.7015	21.276	2.696	9.806	100
4	100	95.9217	24.443	2.696	9.806	100
5	100	100	28.154	2.696	19.334	100
6	100	100	33.498	11.520	19.334	100
7	100	100	44.681	13.521	19.334	100
8	100	100	52.697	13.521	19.334	100
9	100	100	62.592	13.521	50.203	100
10	100	100	74.567	17.606	50.203	100
11	100	100	74.567	17.606	50.203	100
12	100	100	74.567	17.606	50.203	100
13	100	100	74.567	17.606	50.203	100
14	100	100	85.700	17.606	100	100
15	100	100	85.700	17.606	100	100
16	100	100	100	17.606	100	100
17	100	100	100	17.606	100	100
18	100	100	100	30.841	100	100
19	100	100	100	30.841	100	100
20	100	100	100	30.841	100	100
21	100	100	100	48.856	100	100
22	100	100	100	48.856	100	100
23	100	100	100	48.856	100	100
24	100	100	100	72.386	100	100
25	100	100	100	72.386	100	100
26	100	100	100	100	100	100

APPENDIX B
FIGURE OF QUARTZ PARTICLES AGGREGATED

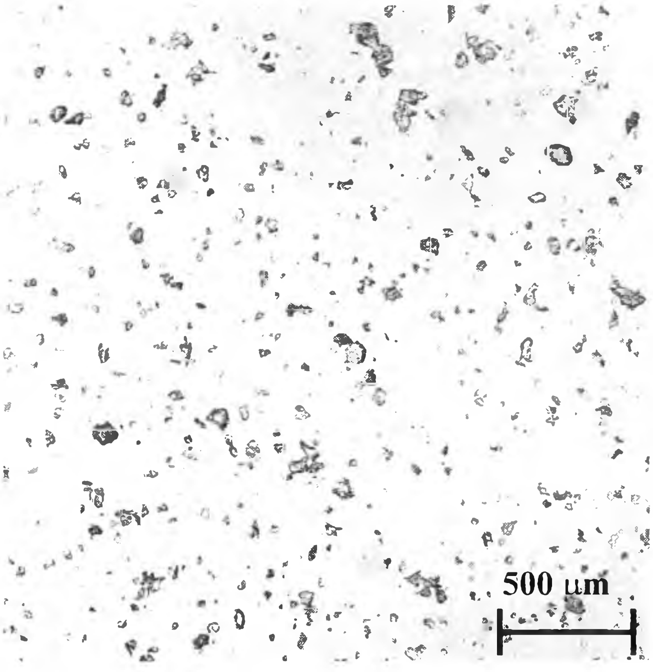

Figure B.1 Aggregates of quartz particles as without surfactant (area 1).

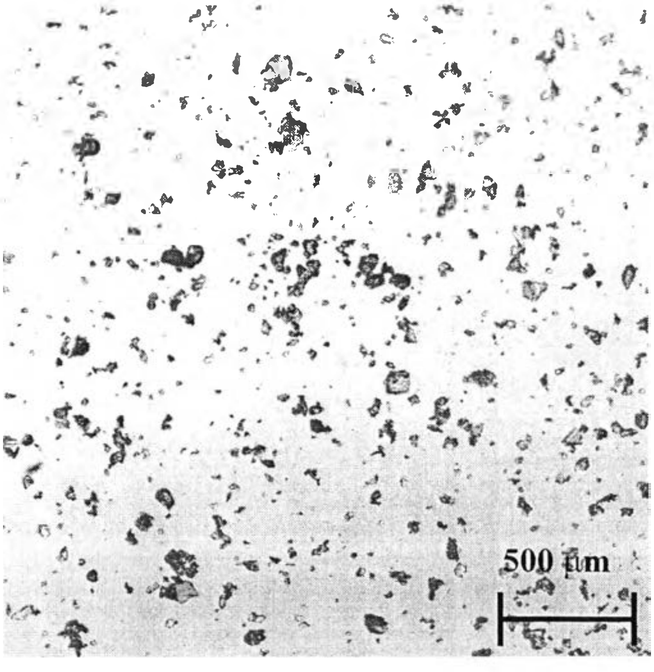

Figure B.1 Aggregates of quartz particles as without surfactant (area 2).

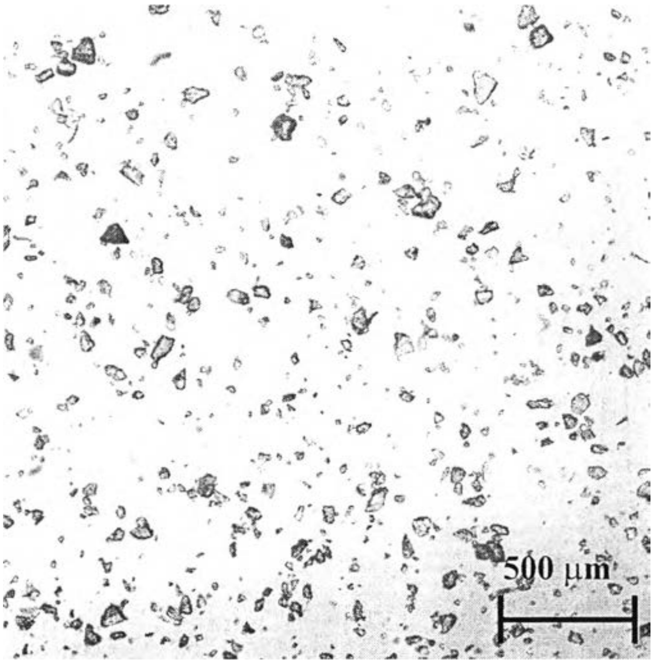

Figure B.3 Aggregates of quartz particles at DTAB concentration of 0.1 μmol/l initial concentration (area 1).

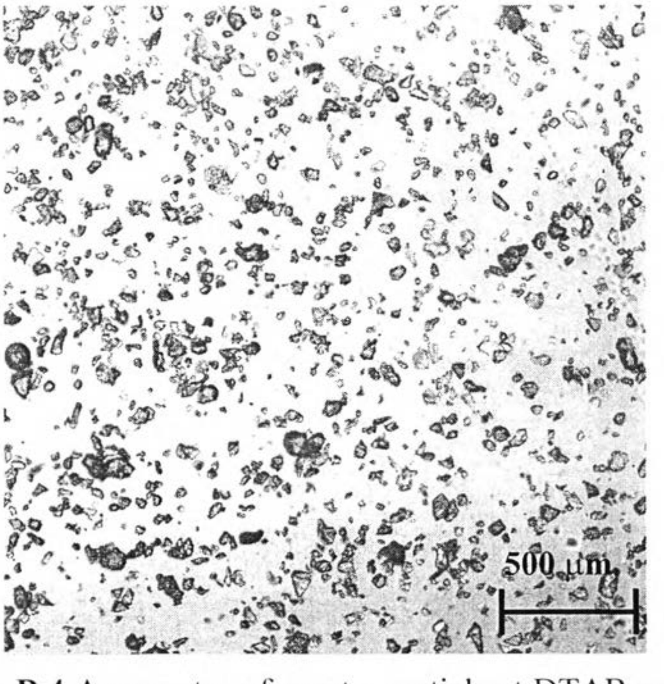

Figure B.4 Aggregates of quartz particle at DTAB concentration of 0.1 μmol/l initial concentration (area 2).

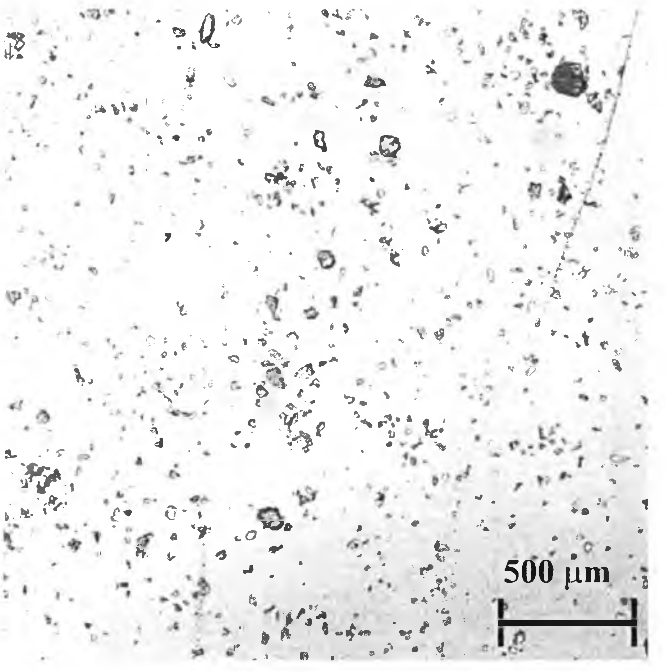

Figure B.5 Aggregates of quartz particles at DTAB concentration of 0.5 μmol/l initial concentration (area 1).

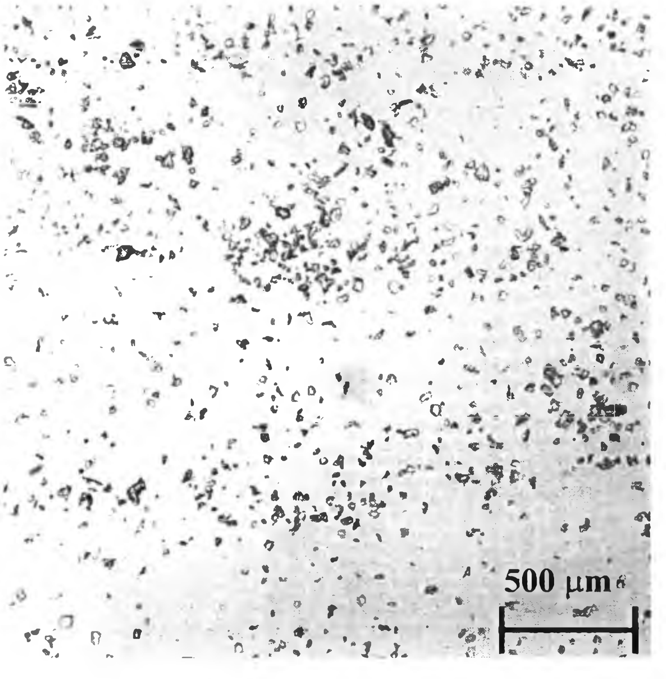

Figure B.6 Aggregates of quartz particles at DTAB concentration of 0.5 μmol/l initial concentration (area 2).

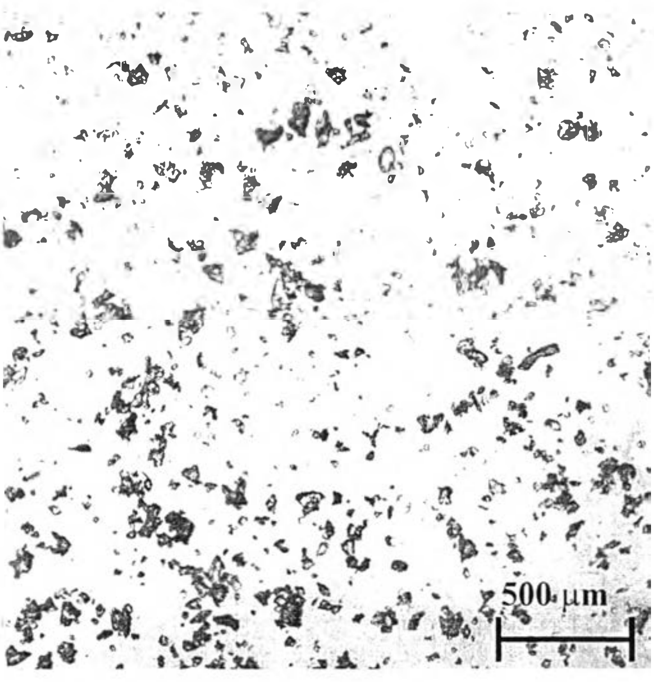

Figure B.7 Aggregates of quartz particles at DTAB concentration of 1.0 μmol/l initial concentration (area 1).

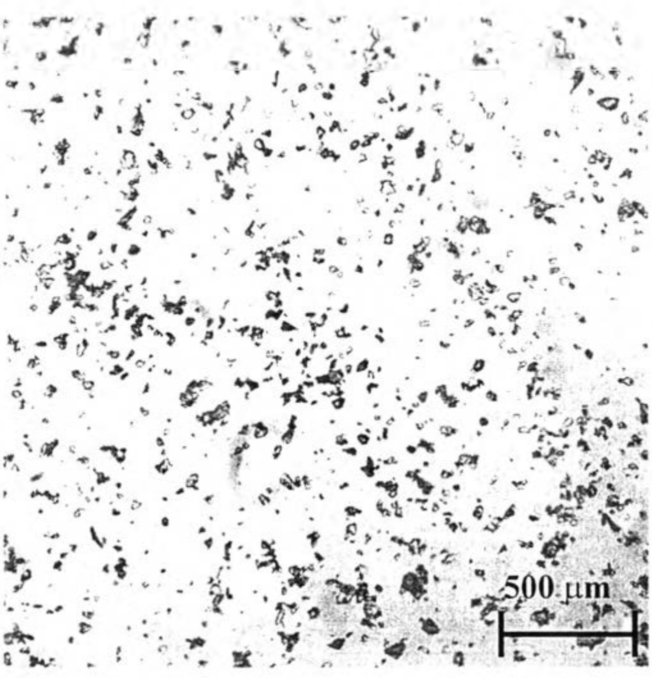

Figure B.8 Aggregates of quartz particles at DTAB concentration of 1.0 μmol/l initial concentration (area 2).

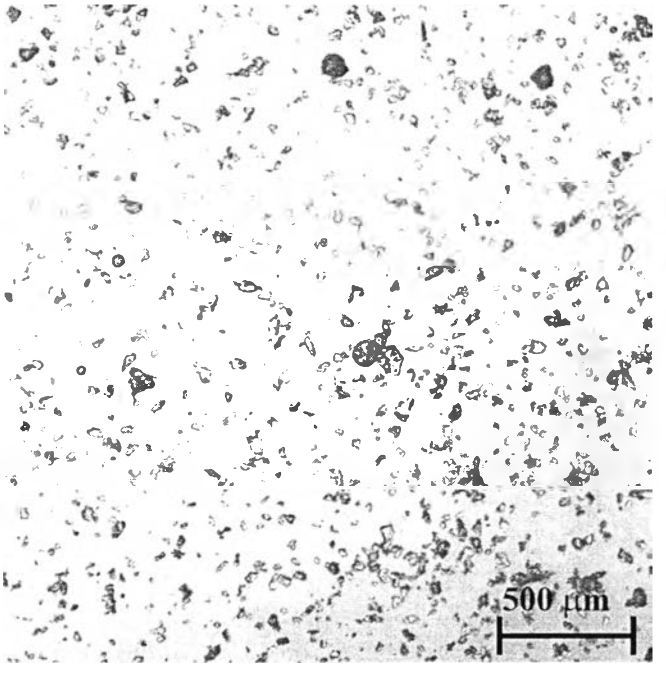

Figure B.9 Aggregates of quartz particles at DTAB concentration of 5.0 μmol/l initial concentration (area 1).

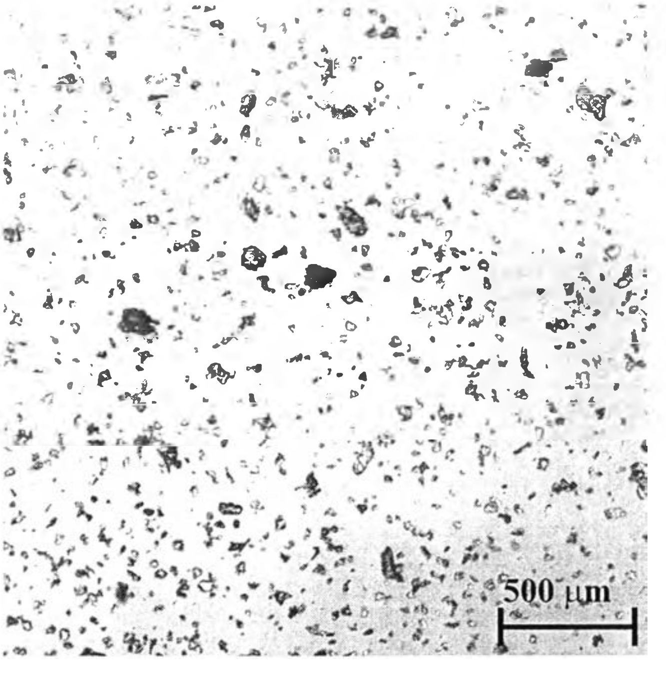

Figure B.10 Aggregates of quartz particles at DTAB concentration of 5.0 μmol/l initial concentration (area 2).

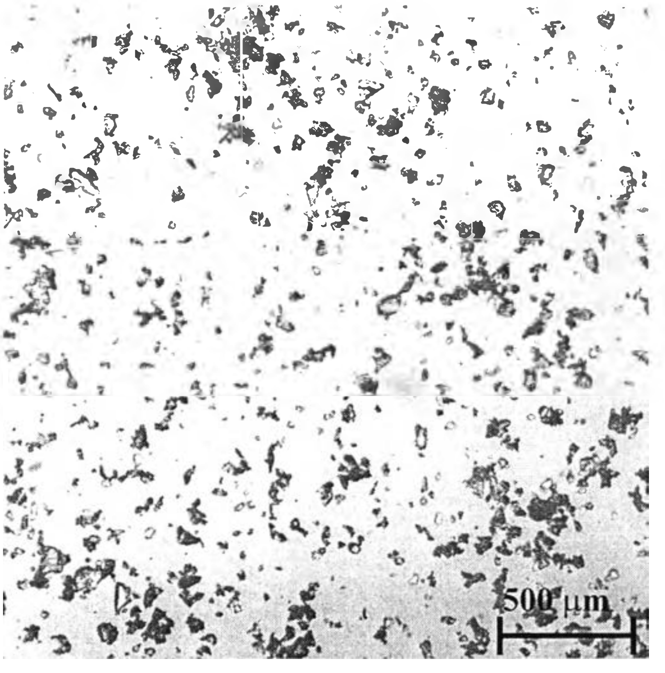

Figure B.11 Aggregates of quartz particles at DTAB concentration of 10 µmol/l initial concentration (area 1).

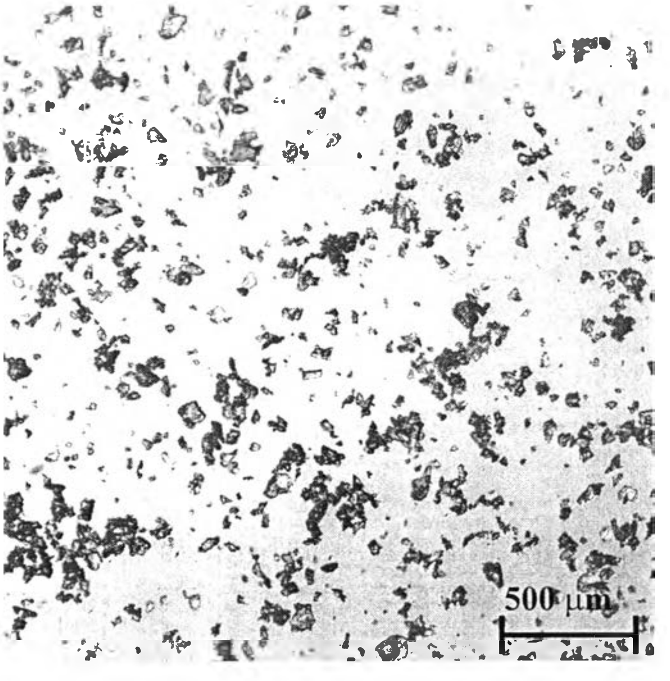

Figure B.12 Aggregates of quartz particles at DTAB concentration of 10 µmol/l initial concentration (area 2).

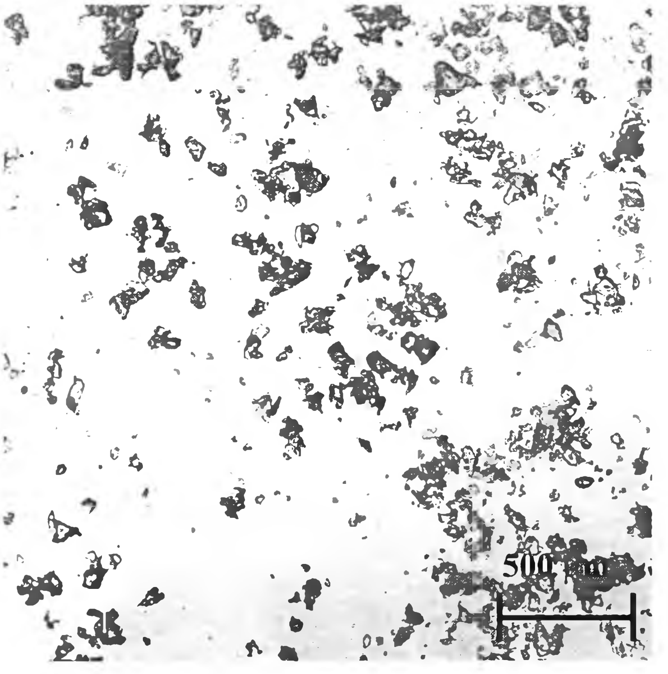

Figure B.13 Aggregates of quartz particles at DTAB concentration of 50 μmol/l initial concentration (area 1).

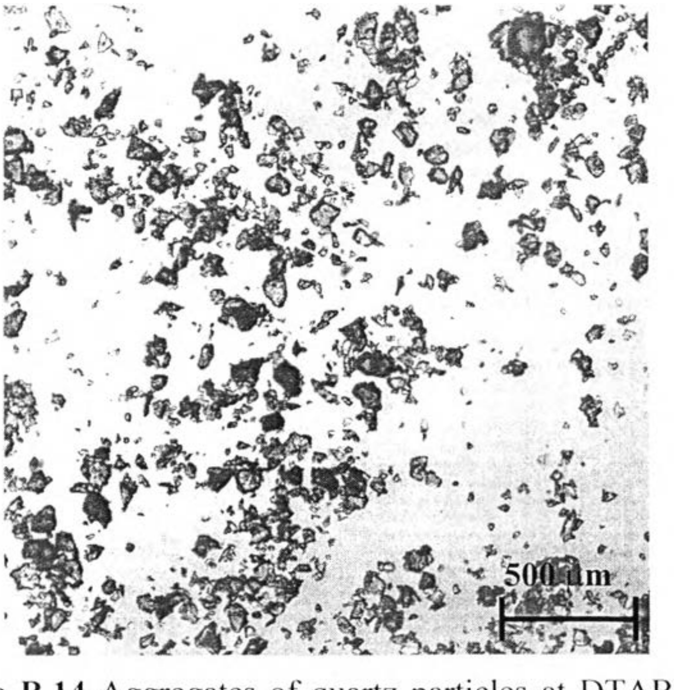

Figure B.14 Aggregates of quartz particles at DTAB concentration of 50 μmol/l initial concentration (area 2).

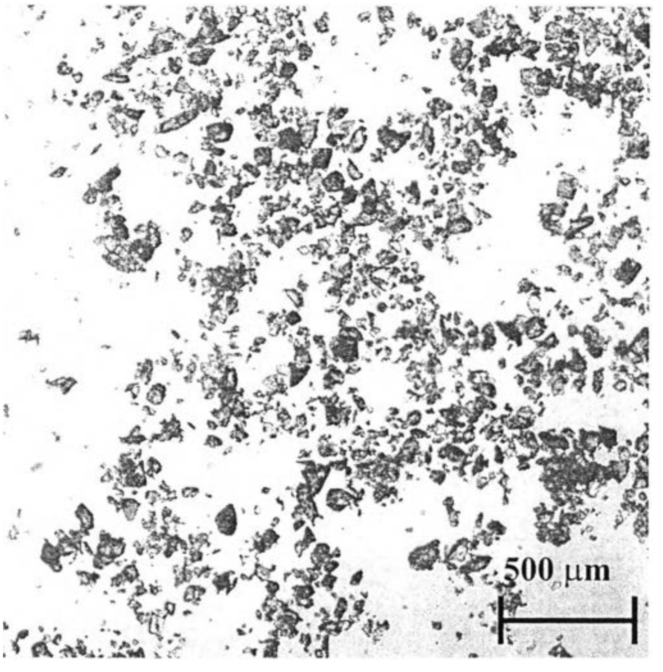

Figure B.15 Aggregates of quartz particles at DTAB concentration of 100 μmol/l initial concentration (area 1).

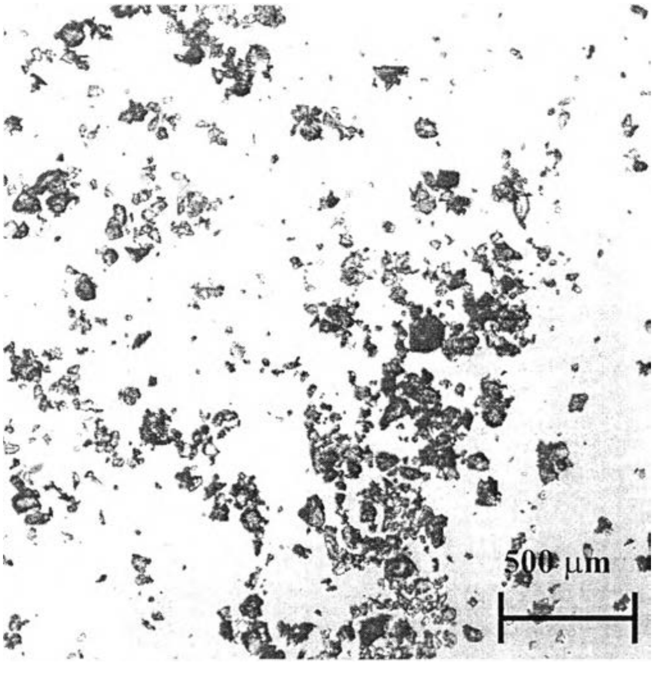

Figure B.16 Aggregates of quartz particles at DTAB concentration of 100 μmol/l initial concentration (area 2).

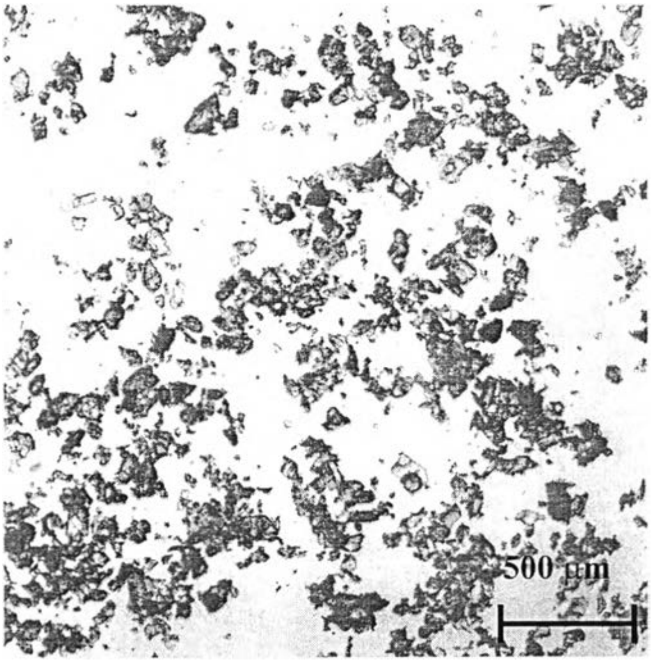

Figure B.17 Aggregates of quartz particles at DTAB concentration of 500 μmol/l initial concentration (area 1).

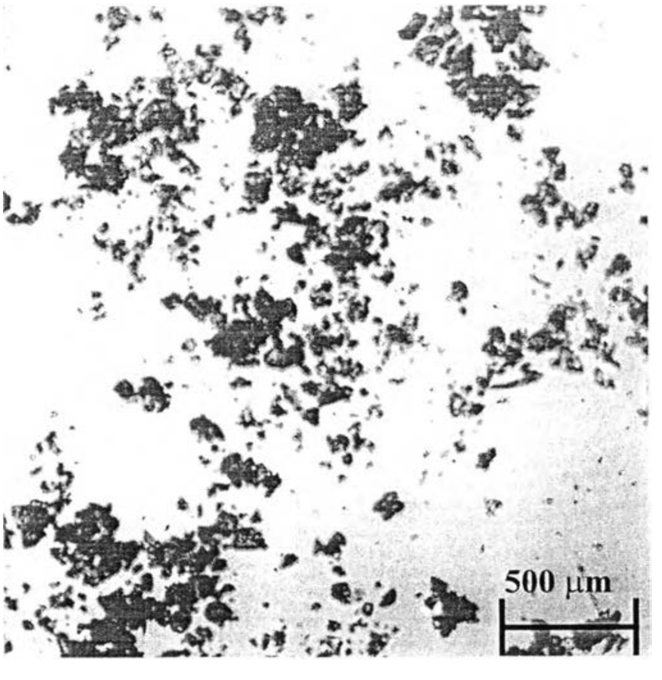

Figure B.18 Aggregates of quartz particles at DTAB concentration of 500 μmol/l initial concentration (area 2).

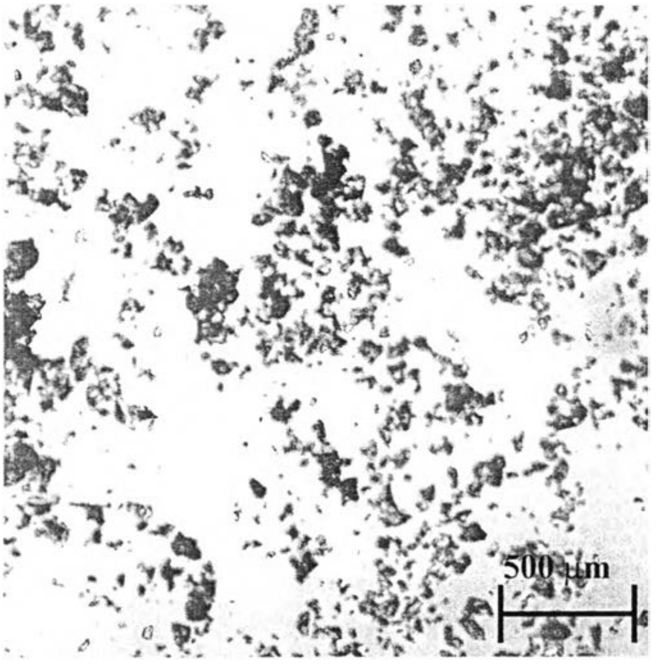

Figure B.19 Aggregates of quartz particles at DTAB concentration of 1,000 µmol/l initial concentration (area 1).

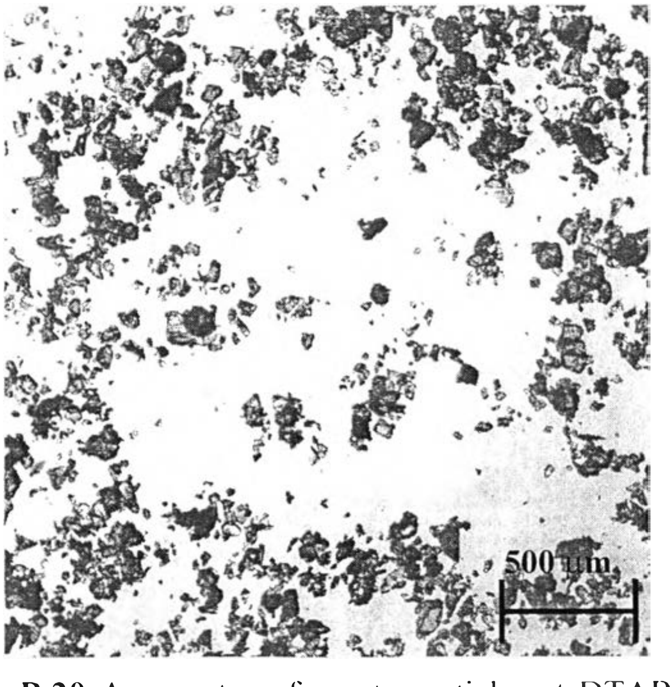

Figure B.20 Aggregates of quartz particles at DTAB concentration of 1,000 µmol/l initial concentration (area 2).

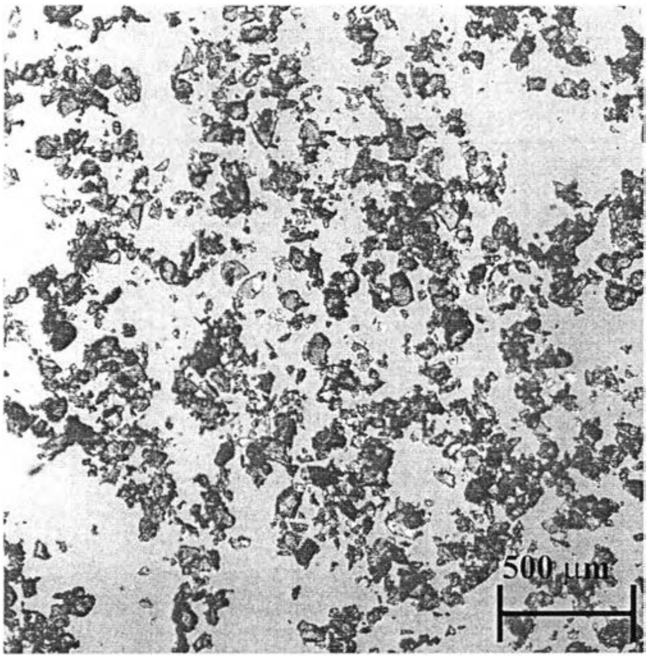

Figure B.21 Aggregates of quartz particles at DTAB concentration of 5,000 µmol/l initial concentration (area 1).

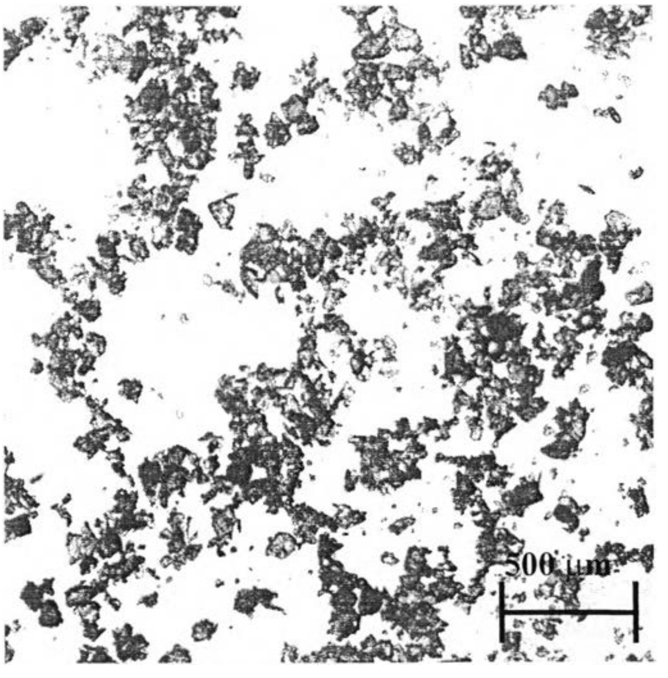

Figure B.22 Aggregates of quartz particles at DTAB concentration of 5,000 µmol/l initial concentration (area 2).

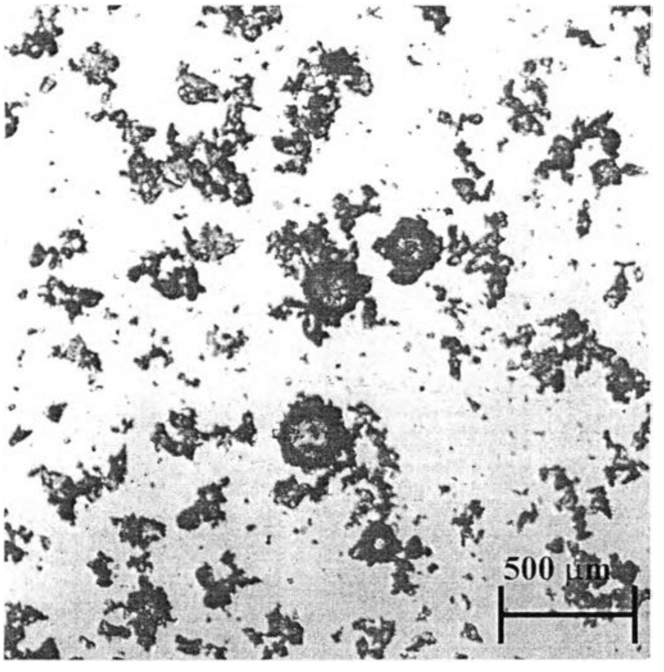

Figure B.23 Aggregates of quartz particles at DTAB concentration of 10,000 μmol/l initial concentration (area 1).

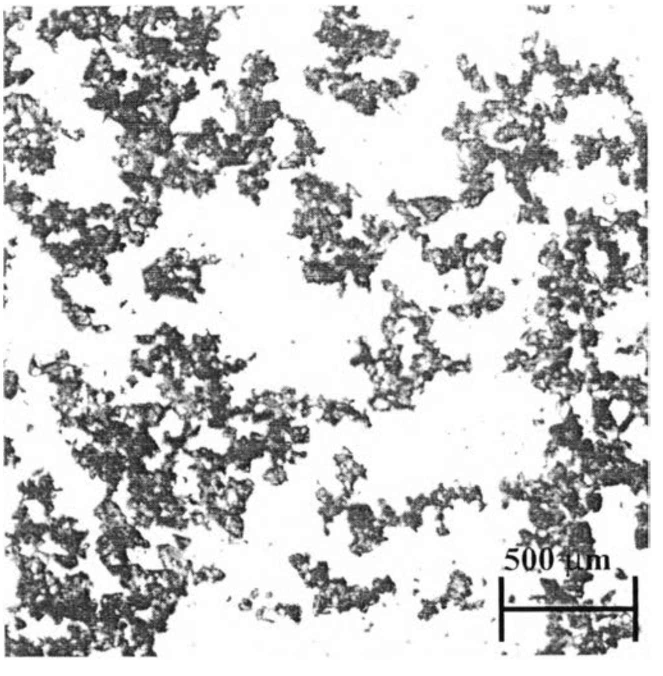

Figure B.24 Aggregates of quartz particles at DTAB concentration of 10,000 μmol/l initial concentration (area 2).

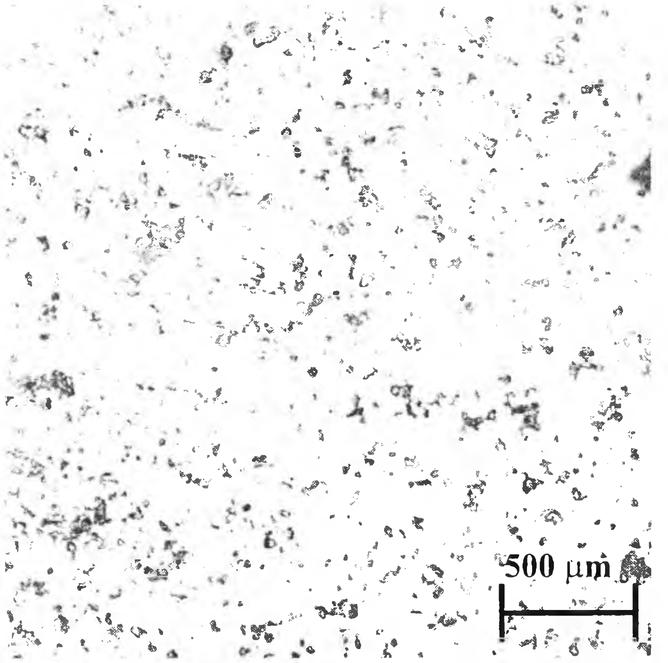

Figure B.25 Aggregates of quartz particles at DTAB concentration of 50,000 μmol/l initial concentration (area 1).

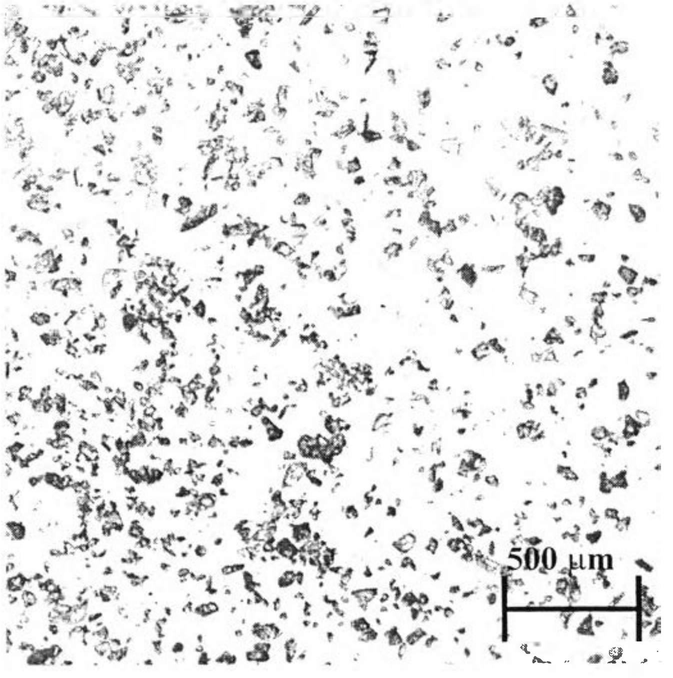

Figure B.26 Aggregates of quartz particles at DTAB concentration of 50,000 μmol/l initial concentration (area 2).

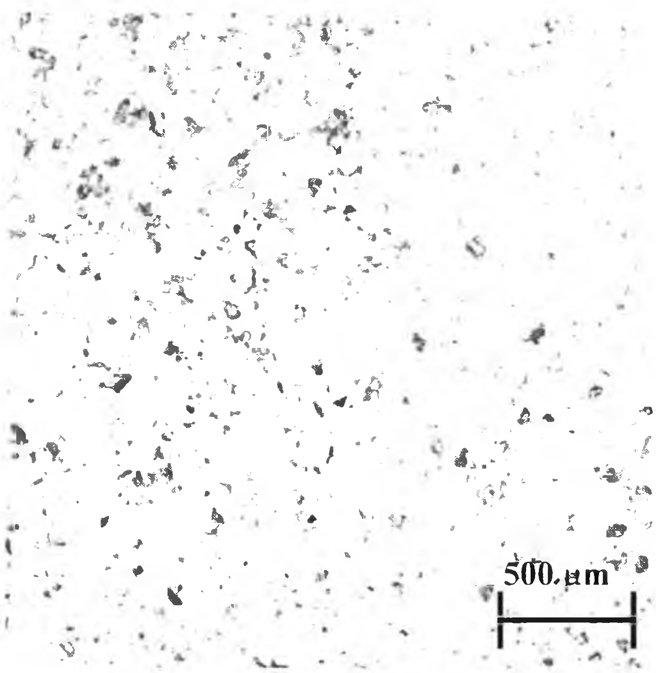

Figure B.27 Aggregates of quartz particles at DTAB concentration 100,000 µmol/l initial concentration (area 1).

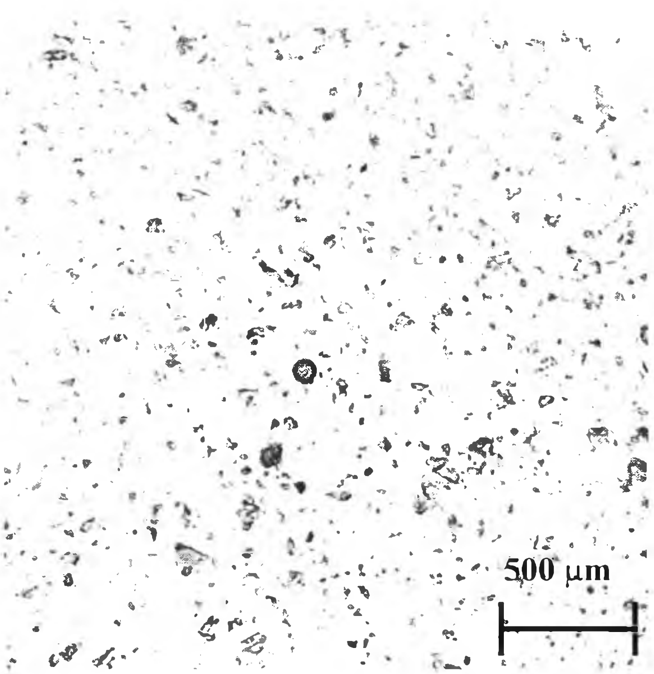

Figure B.28 Aggregates of quartz particles at DTAB concentration of 100,000 µmol/l initial concentration (area 2).

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