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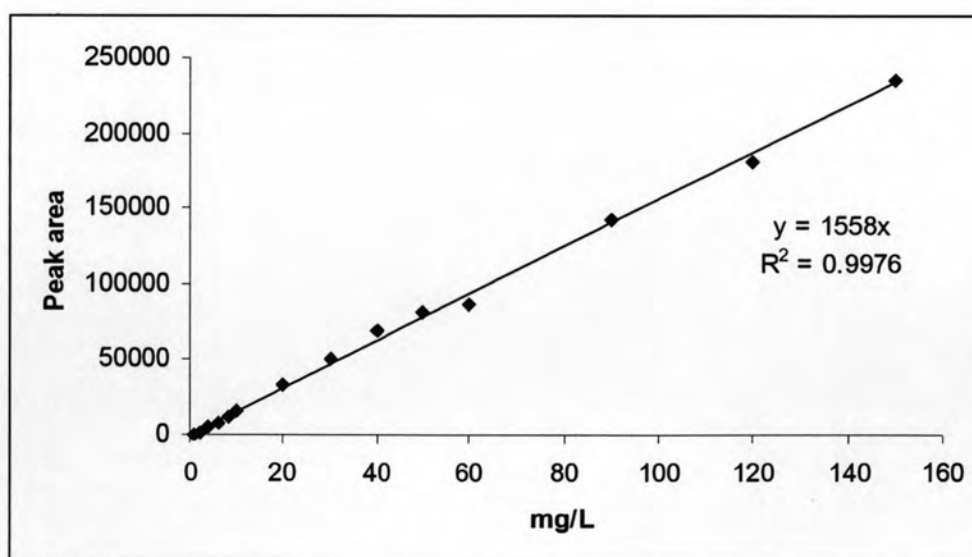
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## **APPENDICES**

**Appendix A Calibration curve of TPA standard of this research****Table A-1** Concentration of TPA and HPLC peak area at 15.6 min

TPA (mg/l)	Peak area
1	33
2	1579
4	5399
6	8119
8	11516
10	16342
20	32781
30	50600
40	69391
50	80759
60	87028
90	142263
120	181231
150	235911

**Figure A-1** Calibration curve of TPA standard for calculation the concentration of phorbol esters by HPLC determination

### Appendix B Phorbol esters extraction method for determination by HPLC data

**Table B-1** Find Shaking rate

Extraction Method	Contact Time (min)	Total Peak Area	PEs (mg/g)		SD	%CV
Shaking at 100 rpm	5	94023	0.60	0.63	0.10	16.46
		116640	0.75			
		85155	0.55			
	10	155307	1.00	0.77	0.20	26.67
		108717	0.70			
		94364	0.61			
	15	97677	0.63	0.63	0.01	1.37
		98023	0.63			
		100169	0.64			
	20	104659	0.67	0.81	0.18	22.58
		116470	0.75			
		159051	1.02			
Shaking at 200 rpm	5	141948	0.91	0.89	0.14	15.62
		114941	0.74			
		157606	1.01			
	10	122207	0.78	0.77	0.02	2.05
		117629	0.76			
		121498	0.78			
	15	151804	0.97	0.85	0.12	13.96
		115537	0.74			
		128202	0.82			
	20	163168	1.05	0.92	0.12	12.64
		137170	0.88			
		128423	0.82			



**Table B-1 Con't**

Extraction Method	Contact Time (min)	Total Peak Area	PEs (mg/g)		SD	%CV
Shaking at 300 rpm	5	227846	1.46	1.50	0.04	2.57
		239751	1.54			
		232652	1.49			
	10	249719	1.60	1.60	0.03	2.16
		244793	1.57			
		255571	1.64			
	15	267660	1.72	1.71	0.09	5.28
		279110	1.79			
		251149	1.61			
	20	296263	1.90	1.78	0.11	5.93
		265059	1.70			
		271498	1.74			
Sonicating at 35 kHz	5	153058	0.98	1.20	0.25	20.97
		230469	1.48			
		179411	1.15			
	10	149095	0.96	1.04	0.10	9.50
		159534	1.02			
		179519	1.15			
	15	299369	1.92	1.38	0.48	34.81
		183963	1.18			
		159745	1.03			
	20	223213	1.43	1.61	0.39	24.09
		321020	2.06			
		210182	1.35			

**Table B-2** Compare shaking&sonicating

Extraction Method	Contact Time (min)	Total Peak Area	PEs (mg/g)		SD	%CV
Shaking at 300 rpm	20	296263	1.90	1.78	0.11	5.93
		265059	1.70			
		271498	1.74			
	40	309054	1.98	1.99	0.01	0.67
		307503	1.97			
		311633	2.00			
	60	337900	2.17	2.11	0.05	2.39
		324679	2.08			
		323909	2.08			
	80	337523	2.17	2.20	0.04	1.63
		348718	2.24			
		342677	2.20			
	100	355997	2.28	2.26	0.04	1.60
		346134	2.22			
		355772	2.28			
	120	353469	2.27	2.35	0.09	3.75
		380796	2.44			
		364941	2.34			

**Table B-2 Con't**

Extraction Method	Contact Time (min)	Total Peak Area	PEs (mg/g)		SD	%CV
Sonicating at 35 kHz	20	223213	1.43	1.61	0.39	24.09
		321020	2.06			
		210182	1.35			
	40	298084	1.91	1.81	0.14	7.50
		289513	1.86			
		257946	1.66			
	60	329993	2.12	2.07	0.11	5.27
		333881	2.14			
		302731	1.94			
	80	295068	1.89	1.87	0.03	1.77
		292991	1.88			
		285267	1.83			
	100	302485	1.94	2.01	0.18	8.93
		290784	1.87			
		343868	2.21			
	120	333760	2.14	2.18	0.04	1.68
		343924	2.21			
		343376	2.20			

**Table B-3**

Extraction Method	Contact Time (hr)	Total Peak Area	PEs (mg/g)		SD	%CV
Shaking at 300 rpm	1	337900	2.17	2.11	0.05	2.39
		324679	2.08			
		323909	2.08			
	2	353469	2.27	2.35	0.09	3.75
		380796	2.44			
		364941	2.34			
	4	463806	2.98	2.77	0.21	7.41
		431794	2.77			
		399778	2.57			
	6	408365	2.62	2.71	0.12	4.43
		416199	2.67			
		444014	2.85			
Sonicating 10 min + Shaking at 300 rpm	2	387034	2.48	2.52	0.03	1.12
		395086	2.54			
		394104	2.53			
	4	421907	2.71	2.72	0.05	1.89
		417386	2.68			
		432941	2.78			
	6	440646	2.83	2.83	0.03	1.04
		445484	2.86			
		436305	2.80			
Shaking at 300 rpm for 2hr × 3	6	78168	2.51	2.96	0.39	13.27
		98067	3.15			
		100462	3.22			

**Appendix C Physical and Chemical Properties of *Jatropha curcas* Seeds, Meals and Oil Data**

**Table C-1 Physical properties of seeds data**

No.	Seed (g)	Kernel (g)	Shell (g)
1	0.7134	0.2627	0.4507
2	0.6589	0.2937	0.3652
3	0.7193	0.3846	0.3347
4	0.7218	0.3907	0.3311
5	0.8509	0.4034	0.4475
6	0.4765	0.4046	0.0719
7	0.7718	0.4188	0.3530
8	0.8737	0.4198	0.4539
9	0.6834	0.4228	0.2606
10	0.6820	0.4231	0.2589
11	0.7351	0.4302	0.3049
12	0.7101	0.4475	0.2626
13	0.6686	0.4484	0.2202
14	0.8336	0.4489	0.3847
15	0.8016	0.4572	0.3444
16	0.6769	0.4603	0.2166
17	0.8049	0.4607	0.3442
18	0.6908	0.4620	0.2288
19	0.6889	0.4694	0.2195
20	0.8065	0.4771	0.3294
21	0.6510	0.4819	0.1691
22	0.6273	0.4939	0.1334
23	0.7455	0.4998	0.2457
24	0.6318	0.5000	0.1318
25	0.6854	0.5154	0.1700
26	0.7802	0.5265	0.2537

**Table C-1 Con't**

No.	Seed (g)	Kernel (g)	Shell (g)
27	0.7487	0.5532	0.1955
28	0.8687	0.5549	0.3138
29	0.5035	0.5686	-0.0651
30	0.7110	0.5708	0.1402
<b>Average</b>	<b>0.7174</b>	<b>0.4550</b>	<b>0.2624</b>
<b>SD</b>	<b>0.0922</b>	<b>0.0706</b>	<b>0.1165</b>
<b>%CV</b>	<b>12.85</b>	<b>15.51</b>	<b>44.40</b>
<b>%Kernel</b>	<b>63.43</b>		
<b>%Shell</b>	<b>36.57</b>		

**Table C-2 Oil content in kernels and meals data**

No.	Oil content (%wt.)		
	Kernels	Pressed meals	Surfactant-meals
1	57.90	13.78	27.89
2	58.38	13.06	32.23
3	58.15	13.44	28.68
<b>Average</b>	<b>58.14</b>	<b>13.42</b>	<b>29.60</b>
<b>SD</b>	<b>0.24</b>	<b>0.36</b>	<b>2.31</b>
<b>%CV</b>	<b>0.42</b>	<b>2.67</b>	<b>7.81</b>

**Table C-3 Phorbol esters content in oil data**

No.	Phorbol esters (mg/g of oil)		
	Pressed oil	Soxhlet-hexane oil	Surfactant-oil
1	1.17	6.20	1.88
2	1.05	6.50	2.09
3	1.11	6.34	2.08
<b>Average</b>	<b>1.11</b>	<b>6.35</b>	<b>2.01</b>
<b>SD</b>	<b>0.06</b>	<b>0.15</b>	<b>0.12</b>
<b>%CV</b>	<b>5.79</b>	<b>2.33</b>	<b>5.89</b>

**Table C-4** Phorbol esters content in kernels and meals data

No.	Phorbol esters (mg/g)				
	Kernels	Shells	Pressed meals	Soxhlet-heaxane meals	Surfactant-meals
1	2.48	0.034	1.47	0.013	1.12
2	2.48	0.039	1.44	0.015	1.08
3	2.50	0.035	1.45	0.014	1.17
<b>Average</b>	<b>2.49</b>	<b>0.04</b>	<b>1.45</b>	<b>0.01</b>	<b>1.12</b>
<b>SD</b>	<b>0.01</b>	<b>0.00</b>	<b>0.02</b>	<b>0.00</b>	<b>0.04</b>
<b>%CV</b>	<b>0.48</b>	<b>7.61</b>	<b>1.24</b>	<b>7.01</b>	<b>3.62</b>

## Appendix D Phorbol Esters Removal from Meals using Surfactant Solution

### Data

**Table D-1** %Phorbol esters removal from meals by Tween 20

[Surfactant] mM	Extracted weight (g)	Total peak area	[PEs] (mg/g)	% Removal		SD	%CV
10	1.3180	66581	0.65	53.3	36.7	14.4	39.2
	1.3980	108478	1.00	28.3			
	1.6338	126565	0.99	28.5			
20	1.4145	78517	0.71	48.7	47.1	2.1	4.4
	1.4724	88114	0.77	44.7			
	1.4641	82779	0.73	47.8			
30	1.4707	82028	0.72	48.5	50.4	2.2	4.4
	1.4841	80643	0.70	49.8			
	1.4957	76453	0.66	52.8			
40	2.0370	80990	0.51	63.3	61.4	4.6	7.6
	1.7618	83709	0.61	56.1			
	1.5353	58458	0.49	64.8			



**Table D-2** %Phorbol esters removal from meals by Tween 40

[Surfactant] mM	Extracted weight (g)	Total peak area	[PEs] (mg/g)	% Removal		SD	%CV
10	1.4881	84340	0.73	47.7	46.0	1.5	3.2
	1.4929	88989	0.77	45.0			
	1.5135	89711	0.76	45.3			
20	1.4749	62162	0.54	61.1	58.9	2.3	3.9
	1.4377	67731	0.60	56.5			
	1.4941	65924	0.57	59.3			
30	1.4199	54239	0.49	64.7	65.3	0.6	0.9
	1.4517	54727	0.48	65.2			
	1.4821	54779	0.47	65.9			
40	1.6340	55824	0.44	68.4	70.9	2.2	3.1
	1.6179	49910	0.40	71.5			
	2.0507	60702	0.38	72.7			

**Table D-3** %Phorbol esters removal from meals by Tween 60

[Surfactant] mM	Extracted weight (g)	Total peak area	[PEs] (mg/g)	% Removal		SD	%CV
10	1.4902	100271	0.86	37.9	34.5	6.5	18.8
	1.4917	117903	1.01	27.0			
	1.5262	101481	0.85	38.6			
20	1.5194	67040	0.57	59.3	59.0	0.3	0.4
	1.0506	46849	0.57	58.8			
	1.3840	61764	0.57	58.8			
30	1.4926	54888	0.47	66.0	64.5	4.3	6.6
	1.5704	54754	0.45	67.8			
	1.5452	67400	0.56	59.7			
40	1.5361	42816	0.36	74.3	72.1	1.9	2.6
	2.1388	66070	0.40	71.5			
	1.5166	48116	0.41	70.7			

**Table D-4** %Phorbol esters removal from meals by Tween 80

[Surfactant] mM	Extracted weight (g)	Total peak area	[PEs] (mg/g)	% Removal		SD	%CV
10	1.3783	53097	0.49	64.4	47.9	19.1	39.8
	1.6209	84001	0.67	52.1			
	1.5214	120197	1.01	27.0			
20	1.4780	74988	0.65	53.1	52.3	0.9	1.6
	1.5481	80068	0.66	52.2			
	1.4664	77125	0.68	51.4			
30	1.4222	59674	0.54	61.2	62.1	1.0	1.7
	1.1481	45670	0.51	63.3			
	1.4298	59013	0.53	61.9			
40	1.4849	49038	0.42	69.5	72.0	2.3	3.2
	2.2964	64526	0.36	74.1			
	1.1862	35340	0.38	72.5			
60	1.4662	55824	0.49	64.8	66.3	2.5	3.7
	1.4933	49910	0.43	69.1			
	1.5950	60702	0.49	64.9			
80	1.4785	42816	0.37	73.3	68.4	6.3	9.3
	1.5739	66070	0.54	61.2			
	1.5163	48116	0.41	70.7			
100	1.4882	49038	0.42	69.6	69.4	9.4	13.5
	1.4890	64526	0.56	60.0			
	1.5379	35340	0.29	78.8			

**Table D-5** %Phorbol esters removal from meals by Dehydol LS 3 TH

[Surfactant] mM	Extracted weight (g)	Total peak area	[PEs] (mg/g)	% Removal		SD	%CV
40	1.5946	111196	0.90	35.6	33.4	10.1	30.3
	1.5771	98596	0.80	42.3			
	1.5909	133691	1.08	22.4			

**Table D-6** %Phorbol esters removal from meals by Dehydol LS 7 TH

[Surfactant] mM	Extracted weight (g)	Total peak area	[PEs] (mg/g)	% Removal		SD	%CV
10	1.4293	138392	1.24	10.6	11.7	4.1	34.6
	1.5140	137365	1.16	16.2			
	1.4965	148513	1.27	8.3			
20	1.4440	102799	0.91	34.3	33.9	3.0	8.8
	1.4448	108369	0.96	30.7			
	1.4495	99438	0.88	36.6			
30	1.4176	91455	0.83	40.4	37.3	6.1	16.5
	1.4840	112183	0.97	30.2			
	1.4620	93161	0.82	41.2			
40	1.5460	65774	0.55	60.7	58.0	2.9	5.1
	1.5507	75748	0.63	54.9			
	1.5056	67771	0.58	58.4			

**Table D-7** %Phorbol esters removal from meals by Dehydol LS 9 TH

[Surfactant] mM	Extracted weight (g)	Total peak area	[PEs] (mg/g)	% Removal		SD	%CV
10	1.4506	119447	1.06	24.0	20.2	5.3	26.2
	1.4445	134302	1.19	14.1			
	1.4659	123204	1.08	22.4			
20	1.4659	92111	0.81	42.0	37.7	9.1	24.2
	1.4699	115797	1.01	27.2			
	1.4378	87261	0.78	44.0			
30	1.3637	89194	0.84	39.6	38.4	4.4	11.4
	1.4531	91204	0.81	42.0			
	1.4205	102211	0.92	33.5			
40	1.4908	55663	0.48	65.5	65.6	4.9	7.4
	1.5285	64827	0.54	60.8			
	1.4842	47353	0.41	70.5			
60	1.4882	65774	0.57	59.2	57.2	3.6	6.3
	1.4890	75748	0.65	53.0			
	1.5379	67771	0.57	59.3			
80	1.4945	55663	0.48	65.6	66.1	4.8	7.3
	1.5543	64827	0.54	61.5			
	1.5141	47353	0.40	71.1			
100	1.5541	55663	0.46	66.9	66.3	5.8	8.7
	1.5060	64827	0.55	60.2			
	1.5502	47353	0.39	71.8			

**Table D-8** %Phorbol esters removal from meals by water

Extracted weight (g)	Total peak area	[PEs] (mg/g)	% Removal		SD	%CV
1.4635	116132	1.02	22.68	22.49	0.40	1.77
1.5007	120089	1.03	22.03			
1.4662	116242	1.02	22.75			

**Table D-9** %Phorbol esters removal from meals by Mixed 40 mM Tween80 with AOT and 100 mM NaCl

[AOT] mM	Extracted weight (g)	Total peak area	[PEs] (mg/g)	% Removal		SD	%CV
0	1.4021	43728	0.40	71.20	72.32	1.70	2.35
	1.2935	36024	0.36	74.28			
	1.3591	41963	0.40	71.49			
2.5	1.5567	64151	0.53	63.89	65.40	1.32	2.01
	1.5887	61553	0.50	66.05			
	1.5692	60401	0.49	66.27			
5	1.5675	53470	0.44	70.11	70.59	0.88	1.25
	1.5109	51630	0.44	70.06			
	1.5828	51276	0.42	71.61			
7.5	1.5749	63902	0.52	64.45	67.76	3.38	4.98
	1.5714	58020	0.47	67.65			
	1.602	52663	0.42	71.19			
10	1.5733	62412	0.51	65.24	65.60	3.35	5.11
	1.5977	56320	0.45	69.11			
	1.5729	67419	0.55	62.44			
20	1.575	66181	0.54	63.18	61.91	2.11	3.41
	1.5903	66988	0.54	63.09			
	1.5737	72782	0.59	59.47			
30	1.5575	60176	0.50	66.15	63.98	5.58	8.72
	1.5718	75984	0.62	57.64			
	1.6046	58322	0.47	68.15			
40	1.5562	58824	0.49	66.88	62.73	6.71	10.70
	1.5687	80577	0.66	54.99			
	1.5345	58963	0.49	66.33			

**Table D-10** %Phorbol esters removal from meals by Mixed 40 mM Dehydol LS 9 TH with AOT and 100 mM NaCl

[AOT] mM	Extracted weight (g)	Total peak area	[PEs] (mg/g)	% Removal		SD	%CV
0	1.4369	52061	0.47	66.54	64.76	1.60	2.47
	1.4793	57156	0.50	64.32			
	1.4466	57282	0.51	63.43			
2.5	1.5808	82313	0.67	54.37	58.50	3.57	6.11
	1.587	71506	0.58	60.52			
	1.6111	72437	0.58	60.60			
5	1.608	69800	0.56	61.96	62.18	0.32	0.51
	1.5975	69214	0.56	62.04			
	1.5801	67537	0.55	62.55			
7.5	1.5462	72365	0.60	58.99	62.31	2.91	4.67
	1.5587	63302	0.52	64.41			
	1.55	64539	0.53	63.51			
10	1.5915	66418	0.54	63.43	61.96	2.62	4.22
	1.5603	73109	0.60	58.94			
	1.569	65325	0.53	63.52			
20	1.5507	71042	0.59	59.86	59.80	0.34	0.57
	1.5622	72317	0.59	59.44			
	1.5419	70195	0.58	60.11			
30	1.4942	69654	0.60	59.15	59.10	0.67	1.13
	1.5497	71212	0.59	59.73			
	1.5394	73073	0.61	58.41			
40	1.4521	66019	0.58	60.16	59.41	0.77	1.30
	1.3989	64729	0.59	59.45			
	1.514	71498	0.61	58.62			

**Table D-11** %Phorbol esters removal from meals by Mixed 40 mM Tween 80 with 5 mM AOT and NaCl

[NaCl] mM	Extracted weight (g)	Total peak area	[PEs] (mg/g)	% Removal		SD	%CV
0	1.3608	28492	0.27	79.60	79.69	0.23	0.29
	1.3963	29342	0.27	79.52			
	1.4315	29446	0.26	79.96			
25	1.4902	31754	0.27	79.24	80.08	0.76	0.95
	1.4701	29107	0.25	80.71			
	1.4945	30204	0.26	80.31			
50	1.5157	29948	0.25	80.75	80.16	1.23	1.54
	1.5285	29816	0.25	80.99			
	1.5439	33672	0.28	78.75			
100	1.5509	31729	0.26	80.07	81.23	1.04	1.29
	1.5212	28833	0.24	81.53			
	1.5489	28473	0.24	82.09			
200	1.5066	28623	0.24	81.49	81.43	0.65	0.79
	1.4893	29414	0.25	80.76			
	1.5170	27954	0.24	82.05			
300	1.4458	31407	0.28	78.83	78.24	0.65	0.83
	1.4410	32030	0.29	78.34			
	1.4619	33682	0.30	77.55			

**Table D-12** %Phorbol esters removal from meals by Mixed 40 mM Dehydol LS 9 TH with 5 mM AOT and NaCl

[NaCl] mM	Extracted weight (g)	Total peak area	[PEs] (mg/g)	% Removal		SD	%CV
0	1.4334	34915	0.31	76.27	76.98	2.11	2.75
	1.3636	34557	0.33	75.31			
	1.3603	28824	0.27	79.35			
25	1.4629	32446	0.28	78.39	77.69	1.17	1.51
	1.4401	34976	0.31	76.34			
	1.4379	31970	0.29	78.34			
50	1.4534	30243	0.27	79.73	78.43	1.33	1.70
	1.4356	31656	0.28	78.51			
	1.4474	34070	0.30	77.06			
100	1.4388	29913	0.27	79.74	78.85	0.78	0.99
	1.4390	32054	0.29	78.30			
	1.4570	32119	0.28	78.52			
200	1.4125	33507	0.30	76.89	78.46	1.40	1.79
	1.4201	29785	0.27	79.56			
	1.4385	31088	0.28	78.94			
300	1.3570	28599	0.27	79.47	78.42	0.98	1.25
	1.3945	32160	0.30	77.53			
	1.3789	30769	0.29	78.26			



**Table D-13** Effect of contact time to %phorbol esters removal from meals by Mixed 40 mM Tween 80 with 5 mM AOT and 100 mM NaCl

Contact time (min)	Extracted weight (g)	Total peak area	[PEs] (mg/g)	% Removal		SD	%CV
2	1.5372	65265	0.55	67.04	70.17	4.04	5.76
	1.5260	61460	0.52	68.74			
	1.5480	50395	0.42	74.73			
5	1.5241	57376	0.48	70.78	73.70	2.54	3.44
	1.5313	49175	0.41	75.07			
	1.5261	48637	0.41	75.26			
10	1.5024	45434	0.39	76.53	77.20	0.93	1.21
	1.5232	42653	0.36	78.26			
	1.5173	45326	0.38	76.81			
15	1.5493	41800	0.35	79.06	79.95	0.83	1.03
	1.5195	38945	0.33	80.10			
	1.5283	38027	0.32	80.69			
20	1.5155	39828	0.34	79.60	79.87	0.30	0.38
	1.5200	39523	0.33	79.82			
	1.5352	39167	0.33	80.20			
30	1.5045	39809	0.34	79.46	80.36	0.85	1.06
	1.5107	36662	0.31	81.16			
	1.5237	38383	0.32	80.45			

**Table D-14** Re-extraction phorbol esters removal by solid liquid ration equal 1 g:10 ml, 15 min in each time

Solutions	Extracted weight (g)	Total peak area	[PEs] (mg/g)	%Removal		SD	%CV
1 <sup>st</sup> Single T80	1.5088	30159	0.26	80.27	80.28	0.70	0.88
	1.5089	31227	0.27	79.58			
	1.4999	28905	0.25	80.98			
1 <sup>st</sup> Single LS9	1.4902	28261	0.24	81.28	81.52	1.23	1.51
	1.4707	25552	0.22	82.85			
	1.4665	29090	0.25	80.42			
1 <sup>st</sup> Mixed T80	1.5725	33480	0.27	78.99	79.87	0.94	1.18
	1.5579	31980	0.26	79.74			
	1.5617	30280	0.25	80.87			
1 <sup>st</sup> Mixed LS9	1.5168	30139	0.26	80.39	79.80	0.63	0.79
	1.5599	31806	0.26	79.88			
	1.5332	32423	0.27	79.13			
2 <sup>nd</sup> Single T80	2.9865	44205	0.19	85.39	86.06	0.58	0.67
	3.0146	41553	0.18	86.40			
	3.0373	41883	0.18	86.39			
2 <sup>nd</sup> Single LS9	2.9456	41878	0.18	85.97	86.06	0.08	0.10
	2.9340	41369	0.18	86.09			
	2.9733	41774	0.18	86.13			
2 <sup>nd</sup> Mixed T80	3.1372	53233	0.22	83.25	83.52	0.51	0.62
	3.1995	54470	0.22	83.20			
	3.1841	51251	0.21	84.12			
2 <sup>nd</sup> Mixed LS 9	3.1078	53131	0.22	83.13	83.74	0.53	0.63
	3.1161	50282	0.21	84.08			
	3.1286	50670	0.21	84.02			

**Note:** %Phorbol esters removal in the second time extraction by drain old solution 10 ml, then adds new solution 10 ml in same tube

**Table D-15** Effect of solid:liquid to %phorbol esters removal from meals by Mixed 40 mM Dehydol LS 9 TH with 5 mM AOT and 100 mM NaCl in 15 min

Solid:Liquid ratio (g/10 ml)	Extracted weight (g)	Total peak area	[PEs] (mg/g)	% Removal		SD	%CV
0.5	0.7336	10570	0.18	88.17	87.32	0.74	0.85
	0.7689	12243	0.20	86.93			
	0.7594	12158	0.21	86.86			
0.75	1.1747	20802	0.23	85.47	84.66	0.88	1.04
	1.1643	23087	0.25	83.73			
	1.1472	21280	0.24	84.78			
1	1.5845	34273	0.28	82.25	81.97	0.32	0.39
	1.5602	34928	0.29	81.63			
	1.5913	34814	0.28	82.04			
1.5	2.2945	71991	0.40	75.74	75.93	0.92	1.21
	2.2741	73183	0.41	75.12			
	2.2968	68534	0.38	76.93			
2	3.1794	114421	0.46	72.18	71.66	0.45	0.63
	3.1570	117152	0.48	71.31			
	3.1722	116913	0.47	71.51			

**Table D-16** Effect of solid:liquid to %phorbol esters removal from meals by Mixed 40 mM Dehydol LS 9 TH with 5 mM AOT and 100 mM NaCl in 20 min

Solid:Liquid ratio (g/10 ml)	Extracted weight (g)	Total peak area	[PEs] (mg/g)	% Removal		SD	%CV
1	1.4710	34365	0.30	81.94	81.86	1.17	1.43
	1.5087	37757	0.32	80.65			
	1.4996	32980	0.28	83.00			
1.5	1.5170	32808	0.28	83.28	82.95	0.51	0.62
	1.4907	34002	0.29	82.37			
	1.4988	32529	0.28	83.22			
2	2.2945	71991	0.40	75.74	75.93	0.92	1.21
	2.2741	73183	0.41	75.12			
	2.2968	68534	0.38	76.93			

**Table D-17** Effect of solid:liquid to %phorbol esters removal from meals by Mixed 40 mM Dehydol LS 9 TH with 5 mM AOT and 100 mM NaCl in 30 min

Solid:Liquid ratio (g/10 ml)	Extracted weight (g)	Total peak area	[PEs] (mg/g)	% Removal		SD	%CV
1	1.5170	32808	0.28	83.28	82.95	0.51	0.62
	1.4907	34002	0.29	82.37			
	1.4988	32529	0.28	83.22			
1.5	2.2945	71991	0.40	75.74	75.93	0.92	1.21
	2.2741	73183	0.41	75.12			
	2.2968	68534	0.38	76.93			
2	2.2695	67514	0.38	77.00	76.84	0.30	0.39
	2.2996	69903	0.39	76.50			
	2.2806	67746	0.38	77.03			

**Table D-18** Reuse solution in new meals by solid liquid ration equal 0.5 g:10 ml, 15 min contact time

Solutions	Extracted weight (g)	Total peak area	[PEs] (mg/g)	%Removal		SD	%CV
Single T80	0.7593	31445	0.27	83.92	83.39	1.08	1.29
	0.8025	32850	0.26	84.10			
	0.7833	35993	0.29	82.15			
Single LS9	0.7421	29819	0.26	84.39	84.04	0.33	0.39
	0.7263	30392	0.27	83.75			
	0.7441	30707	0.26	83.97			
Mixed T80	0.7932	42645	0.35	79.12	79.07	0.63	0.80
	0.7951	44180	0.36	78.42			
	0.7788	40742	0.34	79.68			
Mixed LS9	0.7336	10570	0.18	88.17	87.32	0.74	0.85
	0.7689	12243	0.20	86.93			
	0.7594	12158	0.21	86.86			
Reused Single T80	0.8138	33760	0.27	83.89	84.85	0.93	1.10
	0.8159	31687	0.25	84.92			
	0.8211	30131	0.24	85.75			
Reused Single LS9	0.8380	30597	0.23	85.82	85.86	1.10	1.28
	0.8428	33010	0.25	84.79			
	0.8353	27993	0.22	86.98			
Reused Mixed T80	0.7897	59989	0.49	70.50	74.66	3.85	5.16
	0.7883	49928	0.41	75.40			
	0.7963	44911	0.36	78.10			
Reused Mixed LS 9	0.7948	35799	0.29	82.51	84.13	2.59	3.08
	0.7768	34474	0.28	82.76			
	0.7996	26526	0.21	87.12			

**Table D-19** Up-scale the removal process from 1 g:20 ml in 40 ml-test tube to 8 g: 160 ml-Erlenmeyer flask

Solutions	Extracted weight (g)	Total peak area	[PEs] (mg/g)	%Removal		SD	%CV
Single T80	0.7526	24848	0.21	87.18	86.64	0.90	1.04
	0.8962	33215	0.24	85.61			
	0.8786	29080	0.21	87.15			
Single LS9	1.0136	29269	0.19	88.79	89.94	1.59	1.76
	0.8245	17507	0.14	91.75			
	0.8236	22703	0.18	89.29			
Mixed T80	1.0069	46041	0.29	82.24	82.47	0.27	0.33
	0.8749	38812	0.28	82.77			
	0.9591	43465	0.29	82.40			
Mixed LS9	0.8099	25626	0.20	87.71	87.61	1.06	1.21
	0.7127	20884	0.19	88.62			
	0.9054	31459	0.22	86.51			

## Appendix E Crude protein study report

Food Research and Testing Laboratory  
Faculty of Science  
Chulalongkorn University  
Bangkok 10330, Thailand



Page 1 of a total of 1 pages  
Date of Report : 23 Jan,2009

----- begin report -----

### Test Report

**Report No.** C 010/09- C 017/09

Sample name : Follow by table

**Client Name/ Address:** Interpostgraduate Program in Environmental Management  
(Graduate school), Institute II Building, 2<sup>nd</sup> Floor, Phayathai Rd., Wangmai,  
Pathumwan ,Bangkok 10330

**Sampler:** Client

**The below sample(s) submitted by client as :**

**Sample Description:** The sample was packed in plastic bag and kept at room  
temperature

Quantity : one bag/sample ,weight 15-20 g/sample

**Laboratory Code/Number :** C 010/09 – C 017/09

**Client Reference Number :** Follow by table

**Date of Sample Reception:** 12 January 2009

**Date of Commenced:** 23 January 2009

**State of Detection :** Crude Protein(Total Nitrogen)

### Test Result

No. Sample	Result(g/100g)	Test Method
Kernels	20.51	Kjeldahl's method
Pressed meals	17.94	
Hexane-meals	49.18	
Surfactant-meals	18.94	
T80-meals	14.46	
LS9-meals	15.10	
LS9-meals	15.21	
Mixed T80-meals	16.24	

\* Kjeldahl Factor = 5.30

----- end report -----

*Kuki'at Anu*

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Head of Chemistry Unit

*T. Siharai*

(Tatiya Siharai)  
Quality Manager

Scaled and signed for and on behalf of  
Food Research and Testing Laboratory  
Faculty of Science, Chulalongkorn University

*Sirint Kotepk*

(Kokpol,Sirint,Assoc.Prof.Dr.)  
Laboratory Director

This Test Report is issued by the Food and Testing Laboratory, Faculty of Science, Chulalongkorn University. The result shown in this Test Report refers only to the sample(s) tested unless otherwise stated. This Test Report can not be reproduced, except in full, without prior written permission of the Food Research and Testing Laboratory, Faculty of Science, Chulalongkorn University, Bangkok 10330 Thailand

## Appendix F Statistic data test by One-way ANOVA

F-1 Oneway of Shake at 100, 200, 300 rpm and Sonicate for 5 – 20 minutes

### Descriptives

Phorbol esters (mg/g as TPA)

Extraction method	N	Mean	SD	Std. Error	95% Confidence Interval for Mean		Min.	Max.
					Lower Bound	Upper Bound		
Shake 100 rpm, 5 min	3	.6333	.10408	.06009	.3748	.8919	.55	.75
Shake 100 rpm, 10 min	3	.7700	.20421	.11790	.2627	1.2773	.61	1.00
Shake 100 rpm, 15 min	3	.6333	.00577	.00333	.6190	.6477	.63	.64
Shake 100 rpm, 20 min	3	.8133	.18339	.10588	.3578	1.2689	.67	1.02
Shake 200 rpm, 5 min	3	.8867	.13650	.07881	.5476	1.2258	.74	1.01
Shake 200 rpm, 10 min	3	.7733	.01155	.00667	.7446	.8020	.76	.78
Shake 200 rpm, 15 min	3	.8433	.11676	.06741	.5533	1.1334	.74	.97
Shake 200 rpm, 20 min	3	.9167	.11930	.06888	.6203	1.2130	.82	1.05
Shake 300 rpm, 5 min	3	1.4967	.04041	.02333	1.3963	1.5971	1.46	1.54
Shake 300 rpm, 10 min	3	1.6033	.03512	.02028	1.5161	1.6906	1.57	1.64
Shake 300 rpm, 15 min	3	1.7067	.09074	.05239	1.4813	1.9321	1.61	1.79
Shake 300 rpm, 20 min	3	1.7800	.10583	.06110	1.5171	2.0429	1.70	1.90
Sonicate, 5 min	3	1.2033	.25423	.14678	.5718	1.8349	.98	1.48
Sonicate, 10 min	3	1.0433	.09713	.05608	.8021	1.2846	.96	1.15
Sonicate, 15 min	3	1.3767	.47648	.27510	.1930	2.5603	1.03	1.92
Sonicate, 20 min	3	1.6133	.38889	.22452	.6473	2.5794	1.35	2.06
Total	48	1.1308	.42750	.06170	1.0067	1.2550	.55	2.06

### ANOVA

Phorbol esters (mg/g as TPA)

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	7.375	15	.492	12.949	.000
Within Groups	1.215	32	.038		
Total	8.590	47			



## F-1 Con't

**Post Hoc Tests**  
**Homogeneous Subsets**

**Phorbol esters (mg/g as TPA)**

Duncan<sup>a</sup>

Extraction Method	N	Subset for alpha = .05						
		1	2	3	4	5	6	7
Shake 100 rpm, 15 min	3	.6333						
Shake 100 rpm, 5 min	3	.6333						
Shake 100 rpm, 10 min	3	.7700	.7700					
Shake 200 rpm, 10 min	3	.7733	.7733					
Shake 100 rpm, 20 min	3	.8133	.8133					
Shake 200 rpm, 15 min	3	.8433	.8433					
Shake 200 rpm, 5 min	3	.8867	.8867	.8867				
Shake 200 rpm, 20 min	3	.9167	.9167	.9167				
Sonicate, 10 min	3		1.0433	1.0433	1.0433			
Sonicate, 5 min	3			1.2033	1.2033	1.2033		
Sonicate, 15 min	3				1.3767	1.3767	1.3767	
Shake 300 rpm, 5 min	3					1.4967	1.4967	1.4967
Shake 300 rpm, 10 min	3						1.6033	1.6033
Sonicate, 20 min	3						1.6133	1.6133
Shake 300 rpm, 15 min	3						1.7067	1.7067
Shake 300 rpm, 20 min	3							1.7800
Sig.		.135	.145	.077	.055	.090	.071	.121

Means for groups in homogeneous subsets are displayed.

<sup>a</sup> Uses Harmonic Mean Sample Size = 3.000.

## F-2 Oneway of Shake at 300 rpm with and without 10 min sonicate pretreatment

## Descriptives

Phorbol esters (mg/g as TPA)

Extraction Method	N	Mean	SD	Std. Error	95% Confidence Interval for Mean		Min.	Max.
					Lower Bound	Upper Bound		
Shake 1 hr	3	2.1100	.05196	.03000	1.9809	2.2391	2.08	2.17
Shake 2 hr	3	2.3500	.08544	.04933	2.1378	2.5622	2.27	2.44
Shake 4 hr	3	2.7733	.20502	.11837	2.2640	3.2826	2.57	2.98
Shake 6 hr	3	2.7133	.12097	.06984	2.4128	3.0138	2.62	2.85
Sonicate 10 min + shake 2 hr	3	2.5167	.03215	.01856	2.4368	2.5965	2.48	2.54
Sonicate 10 min + shake 4 hr	3	2.7233	.05132	.02963	2.5959	2.8508	2.68	2.78
Sonicate 10 min + shake 6 hr	3	2.8300	.03000	.01732	2.7555	2.9045	2.80	2.86
Shake 2 hr × 3 times	3	2.9600	.39128	.22591	1.9880	3.9320	2.51	3.22
Total	24	2.6221	.30126	.06149	2.4949	2.7493	2.08	3.22

## ANOVA

Phorbol esters (mg/g as TPA)

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1.639	7	.234	8.348	.000
Within Groups	.449	16	.028		
Total	2.087	23			

## Post Hoc Tests

## Homogeneous Subsets

Phorbol esters (mg/g as TPA)

Duncan<sup>a</sup>

Extraction Method	N	Subset for alpha = .05			
		1	2	3	4
Shake 1 hr	3	2.1100			
Shake 2 hr	3	2.3500	2.3500		
Sonicate 10 min + shake 2 hr	3		2.5167	2.5167	
Shake 6 hr	3			2.7133	2.7133
Sonicate 10 min + shake 4 hr	3			2.7233	2.7233
Shake 4 hr	3			2.7733	2.7733
Sonicate 10 min + shake 6 hr	3			2.8300	2.8300
Shake 2 hr × 3 times	3				2.9600
Sig.		.098	.241	.054	.122

Means for groups in homogeneous subsets are displayed.

<sup>a</sup> Uses Harmonic Mean Sample Size = 3.000.

## F-3 Oneway of %phorbol esters removal by 40 mM nonionic surfactant solutions

## Descriptives

## %Phorbol esters removal

Surfactant solution	N	Mean	SD	Std. Error	95% Confidence Interval for Mean		Min.	Max.
					Lower Bound	Upper Bound		
Tween 20	3	61.4000	4.65081	2.68514	49.8468	72.9532	56.10	64.80
Tween 40	3	70.8667	2.21886	1.28106	65.3547	76.3786	68.40	72.70
Tween 60	3	72.1667	1.89033	1.09138	67.4708	76.8625	70.70	74.30
Tween 80	3	72.0333	2.33524	1.34825	66.2323	77.8344	69.50	74.10
Dehydol LS 3	3	33.4333	10.12538	5.84589	8.2805	58.5862	22.40	42.30
Dehydol LS 7	3	58.0000	2.92062	1.68622	50.7448	65.2552	54.90	60.70
Dehydol LS 9	3	65.6000	4.85077	2.80060	53.5500	77.6500	60.80	70.50
Total	21	61.9286	13.64603	2.97781	55.7170	68.1402	22.40	74.30

## ANOVA

## %Phorbol esters removal

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	3383.956	6	563.993	23.201	.000
Within Groups	340.327	14	24.309		
Total	3724.283	20			

## Post Hoc Tests

## Homogeneous Subsets

## %Phorbol esters removal

Duncan<sup>a</sup>

Surfactant solution	N	Subset for alpha = .05		
		1	2	3
Dehydol LS 3	3	33.4333		
Dehydol LS 7	3		58.0000	
Tween 20	3		61.4000	
Dehydol LS 9	3		65.6000	65.6000
Tween 40	3			70.8667
Tween 80	3			72.0333
Tween 60	3			72.1667
Sig.		1.000	.094	.154

Means for groups in homogeneous subsets are displayed.

<sup>a</sup> Uses Harmonic Mean Sample Size = 3.000.

**F-4 Oneway of %phorbol esters removal by 40 mM Tween80 + 100 mM NaCl + AOT**

**Descriptives**

%Phorbol esters removal

[AOT] mM	N	Mean	SD	Std. Error	95% Confidence Interval for Mean		Min.	Max.
					Lower Bound	Upper Bound		
0.0	3	72.3233	1.70072	.98191	68.0985	76.5481	71.20	74.28
2.5	3	65.4033	1.31519	.75933	62.1362	68.6705	63.89	66.27
5.0	3	70.5933	.88081	.50854	68.4053	72.7814	70.06	71.61
7.5	3	67.7633	3.37143	1.94650	59.3882	76.1384	64.45	71.19
10.0	3	65.5967	3.34927	1.93370	57.2766	73.9167	62.44	69.11
20.0	3	61.9133	2.11647	1.22194	56.6557	67.1709	59.47	63.18
30.0	3	63.9800	5.58092	3.22215	50.1162	77.8438	57.64	68.15
40.0	3	62.7333	6.71156	3.87492	46.0609	79.4058	54.99	66.88
Total	24	66.2883	4.68022	.95535	64.3121	68.2646	54.99	74.28

**ANOVA**

%Phorbol esters removal

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	286.496	7	40.928	3.013	.032
Within Groups	217.307	16	13.582		
Total	503.802	23			

**Post Hoc Tests**

**Homogeneous Subsets**

**%Phorbol esters removal**

Duncan<sup>a</sup>

[AOT] mM	N	Subset for alpha = .05		
		1	2	3
20.0	3	61.9133		
40.0	3	62.7333		
30.0	3	63.9800	63.9800	
2.5	3	65.4033	65.4033	65.4033
10.0	3	65.5967	65.5967	65.5967
7.5	3	67.7633	67.7633	67.7633
5.0	3		70.5933	70.5933
0.0	3			72.3233
Sig.		.101	.063	.053

Means for groups in homogeneous subsets are displayed.

<sup>a</sup> Uses Harmonic Mean Sample Size = 3.000.

F-5 Oneway of %phorbol esters removal by 40 mM Dehydol LS 9 + 100 mM NaCl + AOT

### Descriptives

%Phorbol esters removal

[AOT] mM	N	Mean	SD	Std. Error	95% Confidence Interval for Mean		Min.	Max.
					Lower Bound	Upper Bound		
0.0	3	64.7633	1.60170	.92474	60.7845	68.7422	63.43	66.54
2.5	3	58.4967	3.57402	2.06346	49.6183	67.3750	54.37	60.60
5.0	3	62.1833	.32005	.18478	61.3883	62.9784	61.96	62.55
7.5	3	62.3033	2.90450	1.67692	55.0881	69.5185	58.99	64.41
10.0	3	61.9633	2.61867	1.51189	55.4582	68.4685	58.94	63.52
20.0	3	59.8033	.33858	.19548	58.9623	60.6444	59.44	60.11
30.0	3	59.0967	.66161	.38198	57.4531	60.7402	58.41	59.73
40.0	3	59.4100	.77078	.44501	57.4953	61.3247	58.62	60.16
Total	24	61.0025	2.63653	.53818	59.8892	62.1158	54.37	66.54

### ANOVA

%Phorbol esters removal

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	96.117	7	13.731	3.446	.019
Within Groups	63.763	16	3.985		
Total	159.880	23			

### Post Hoc Tests

#### Homogeneous Subsets

#### %Phorbol esters removal

Duncan<sup>a</sup>

[AOT] mM	N	Subset for alpha = .05	
		1	2
2.5	3	58.4967	
30.0	3	59.0967	
40.0	3	59.4100	
20.0	3	59.8033	
10.0	3	61.9633	61.9633
5.0	3	62.1833	62.1833
7.5	3	62.3033	62.3033
0.0	3		64.7633
Sig.		.055	.132

Means for groups in homogeneous subsets are displayed.

<sup>a</sup> Uses Harmonic Mean Sample Size = 3.000.

**F-6 Oneway of %phorbol esters removal by 40 mM Tween 80 + 5 mM AOT + NaCl**

**Descriptives**

%Phorbol esters removal

[NaCl] mM	N	Mean	SD	Std. Error	95% Confidence Interval for Mean		Min.	Max.
					Lower Bound	Upper Bound		
0	3	79.6933	.23438	.13532	79.1111	80.2756	79.52	79.96
25	3	80.0867	.76002	.43880	78.1987	81.9747	79.24	80.71
50	3	80.1633	1.22985	.71005	77.1082	83.2185	78.75	80.99
100	3	81.2300	1.04288	.60211	78.6393	83.8207	80.07	82.09
200	3	81.4333	.64686	.37347	79.8264	83.0402	80.76	82.05
300	3	78.2400	.64583	.37287	76.6357	79.8443	77.55	78.83
Total	18	80.1411	1.28698	.30335	79.5011	80.7811	77.55	82.09

**ANOVA**

%Phorbol esters removal

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	20.021	5	4.004	5.906	.006
Within Groups	8.136	12	.678		
Total	28.158	17			

**Post Hoc Tests**

**Homogeneous Subsets**

**%Phorbol esters removal**

Duncan<sup>a</sup>

[NaCl] mM	N	Subset for alpha = .05		
		1	2	3
300	3	78.2400		
0	3	79.6933	79.6933	
25	3		80.0867	80.0867
50	3		80.1633	80.1633
100	3		81.2300	81.2300
200	3			81.4333
Sig.		.052	.055	.087

Means for groups in homogeneous subsets are displayed.

<sup>a</sup> Uses Harmonic Mean Sample Size = 3.000.

F-7 Oneway of %phorbol esters removal by 40 mM Dehydol LS 9 + 5 mM AOT + NaCl

### Descriptives

%Phorbol esters removal

[NaCl] mM	N	Mean	SD	Std. Error	95% Confidence Interval for Mean		Min.	Max.
					Lower Bound	Upper Bound		
0	3	76.9767	2.11067	1.21860	71.7335	82.2199	75.31	79.35
25	3	77.6900	1.16940	.67515	74.7850	80.5950	76.34	78.39
50	3	78.4333	1.33665	.77172	75.1129	81.7538	77.06	79.73
100	3	78.8533	.77571	.44786	76.9264	80.7803	78.30	79.74
200	3	78.4633	1.39737	.80677	74.9921	81.9346	76.89	79.56
300	3	78.4200	.97985	.56571	75.9859	80.8541	77.53	79.47
Total	18	78.1394	1.31167	.30916	77.4872	78.7917	75.31	79.74

### ANOVA

%Phorbol esters removal

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	7.001	5	1.400	.755	.598
Within Groups	22.247	12	1.854		
Total	29.248	17			

### Post Hoc Tests

#### Homogeneous Subsets

%Phorbol esters removal

Duncan<sup>a</sup>

[NaCl] mM	N	Subset for alpha = .05
		1
0	3	76.9767
25	3	77.6900
300	3	78.4200
50	3	78.4333
200	3	78.4633
100	3	78.8533
Sig.		.153

Means for groups in homogeneous subsets are displayed.

<sup>a</sup> Uses Harmonic Mean Sample Size = 3.000.

**F-8** Oneway of %phorbol esters removal by water, single T80, mixed T80, single LS9 and mixed LS9 solution

### Descriptives

%Phorbol esters removal

System	N	Mean	SD	Std. Error	95% Confidence Interval for Mean		Min.	Max.
					Lower Bound	Upper Bound		
Water	3	22.4867	.39703	.22923	21.5004	23.4729	22.03	22.75
Single T80	3	81.4300	3.44344	1.98807	72.8760	89.9840	77.47	83.72
Mixed T80	3	81.2300	1.04288	.60211	78.6393	83.8207	80.07	82.09
Single LS9	3	81.8733	.78258	.45182	79.9293	83.8174	80.99	82.48
Mixed LS9	3	78.8533	.77571	.44786	76.9264	80.7803	78.30	79.74
Total	15	69.1747	24.23002	6.25616	55.7565	82.5928	22.03	83.72

### ANOVA

%Phorbol esters removal

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	8190.679	4	2047.670	715.133	.000
Within Groups	28.633	10	2.863		
Total	8219.312	14			

### Post Hoc Tests

#### Homogeneous Subsets

#### %Phorbol esters removal

Duncan<sup>a</sup>

System	N	Subset for alpha = .05	
		1	2
Water	3	22.4867	
Mixed LS9	3		78.8533
Mixed T80	3		81.2300
Single T80	3		81.4300
Single LS9	3		81.8733
Sig.		1.000	.069

Means for groups in homogeneous subsets are displayed.

<sup>a</sup> Uses Harmonic Mean Sample Size = 3.000.



**F-9 Oneway of effect of contact time to %phorbol esters removal by mixed T80**

**Descriptives**

%Phorbol esters removal

Contact time (min)	N	Mean	SD	Std. Error	95% Confidence Interval for Mean		Min.	Max.
					Lower Bound	Upper Bound		
2	3	70.1700	4.03952	2.33222	60.1353	80.2047	67.04	74.73
5	3	73.7033	2.53346	1.46270	67.4099	79.9968	70.78	75.26
10	3	77.2000	.92860	.53613	74.8932	79.5068	76.53	78.26
15	3	79.9500	.82529	.47648	77.8999	82.0001	79.06	80.69
20	3	79.8733	.30353	.17525	79.1193	80.6274	79.60	80.20
30	3	80.3567	.85383	.49296	78.2356	82.4777	79.46	81.16
Total	18	76.8756	4.25144	1.00207	74.7614	78.9897	67.04	81.16

**ANOVA**

%Phorbol esters removal

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	257.069	5	51.414	12.290	.000
Within Groups	50.201	12	4.183		
Total	307.271	17			

**Post Hoc Tests**

**Homogeneous Subsets**

**%Phorbol esters removal**

<sup>a</sup> Duncan

Contact time (min)	N	Subset for alpha = .05		
		1	2	3
2	3	70.1700		
5	3	73.7033	73.7033	
10	3		77.2000	77.2000
20	3			79.8733
15	3			79.9500
30	3			80.3567
Sig.		.056	.058	.105

Means for groups in homogeneous subsets are displayed.

<sup>a</sup> Uses Harmonic Mean Sample Size = 3.000.

**F-10 Oneway of %phorbol esters removal by single surfactant solution in reuse study**

**Descriptives**

%Phorbol esters removal

System	N	Mean	SD	Std. Error	95% Confidence Interval for Mean		Min.	Max.
					Lower Bound	Upper Bound		
Single T80	3	83.3900	1.07764	.62217	80.7130	86.0670	82.15	84.10
Single LS9	3	84.0367	.32517	.18774	83.2289	84.8444	83.75	84.39
Reuse single T80	3	84.8533	.93179	.53797	82.5386	87.1680	83.89	85.75
Reuse single LS9	3	85.8633	1.09564	.63257	83.1416	88.5851	84.79	86.98
Total	12	84.5358	1.24122	.35831	83.7472	85.3245	82.15	86.98

**ANOVA**

%Phorbol esters removal

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	10.275	3	3.425	4.107	.049
Within Groups	6.671	8	.834		
Total	16.947	11			

**Post Hoc Tests**

**Homogeneous Subsets**

**%Phorbol esters removal**

<sup>a</sup> Duncan

System	N	Subset for alpha = .05	
		1	2
Single T80	3	83.3900	
Single LS9	3	84.0367	
Reuse single T80	3	84.8533	84.8533
Reuse single LS9	3		85.8633
Sig.		.096	.213

Means for groups in homogeneous subsets are displayed.

<sup>a</sup> Uses Harmonic Mean Sample Size = 3.000.

**F-11 Oneway of %phorbol esters removal by mixed surfactant solution in reuse study**

**Descriptives**

%Phorbol esters removal

System	N	Mean	SD	Std. Error	95% Confidence Interval for Mean		Min.	Max.
					Lower Bound	Upper Bound		
Mixed T80	3	79.0733	.63129	.36448	77.5051	80.6416	78.42	79.68
Mixed LS9	3	87.3200	.73695	.42548	85.4893	89.1507	86.86	88.17
Reuse mixed T80	3	74.6667	3.85270	2.22436	65.0960	84.2373	70.50	78.10
Reuse mixed LS9	3	84.1300	2.59243	1.49674	77.6900	90.5700	82.51	87.12
Total	12	81.2975	5.43253	1.56824	77.8458	84.7492	70.50	88.17

**ANOVA**

%Phorbol esters removal

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	279.625	3	93.208	16.566	.001
Within Groups	45.011	8	5.626		
Total	324.637	11			

**Post Hoc Tests**

**Homogeneous Subsets**

**%Phorbol esters removal**

<sup>a</sup> Duncan

System	N	Subset for alpha = .05	
		1	2
Reuse mixed T80	3	74.6667	
Mixed T80	3	79.0733	
Reuse mixed LS9	3		84.1300
Mixed LS9	3		87.3200
Sig.		.052	.138

Means for groups in homogeneous subsets are displayed.

<sup>a</sup> Uses Harmonic Mean Sample Size = 3.000.

## BIOGRAPHY

Miss Kanokwan Chaichodkunchai was born on November 11, 1985 in Bangkok, Thailand. She graduated Bachelor's degree of Science (Environmental Science and Technology) from Faculty of Environment and Resource Studies, Mahidol University, Thailand in 2007 with first-class honor. She pursued Master's degree studies at the International Post Graduated Programs in Environmental Management (Hazardous Waste Management), Chulalongkorn University, Thailand. She finished her Master degree of Science in Environmental Management in May 2009.

