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APPENDICES

Appendix A Distillation Result

Table A1 Percent recovery vs temperature of Lankrabue, U-Thong and Fang crude oils

% Recovery	Temperature							
	Lankrabue crude oil			U-thong crude oil			Fang crude oil	
	Average Temp (Previous work)	Average Temp (Thesis work)	Sim-Disc GC	Average Temp (Previous work)	Average Temp (Thesis work)	Sim-Disc GC	Average Temp (Thesis work)	Sim-Disc GC
0	67.00+ 12	79.97+ 12	76+12	168.17+40	126.87+5	125.1+5	89.48+5	86.7+5
5	144.00+ 10	145.33+ 10	135.5+10	227.83+30	191.43+5	187+5	118.84+5	110.1+5
10	195.83+ 20	182.90+ 15	173.5+15	260.00+40	226.70+5	223+5	145.31+9	137.1+9
15	225.33+ 30	207.43+ 20	197.6+20	287.50+35	248.57+3	246.4+3	161.85+5	157.8+5
20	263.17+ 30	243.23+ 30	228.7+30	320.17+60	260.60+2	260.4+2	198.94+5	194.5+5
25	286.17+ 30	257.27+ 30	249.3+30	337.50+40	274.87+5	271.1+5	237.84+8	229.8+8
30	316.00+ 35	266.70+ 5	263.1+5	345.83+50	291.67+5	288.9+5	260.22+9	252.4+9
35	335.00+ 40	282.43+ 10	275.3+10	354.00+50	305.33+5	302.2+5	276.76+9	268.8+9
40	354.17+ 45	302.93+ 10	292.3+10	361.83+50	317.40+3	315.4+3	293.53+9	285.3+9
45	367.33+ 50	312.23+ 10	303+10	368.83+30	331.20+5	329.8+5	306.55+7	300.2+7
50	377.83+ 50	326.67+ 10	320.3+10	376.67+30	346.03+3	344.2+3	310.59+8	302.3+8
55	386.75+ 40	345.13+ 15	338.4+15	385.83+15	363.10+5	360.5+5	321.73+5	315.8+ 10
60	396.50+ 35	369.30+ 15	355.3+15	395.50+15	381.80+5	378.3+5	351.02+20	337.5+2 0
65	-	381.03+ 15	367.9+15	-	393.80+5	390.6+5	365.37+10	355.4+ 10
70	-	-	380.5+15	-	-	409.7+5	376.9+5+9	367.9+9
75	-	-	400.9+15	-	-	425.5+5	-	389.6+5
80	-	-	419.3+15	-	-	440.6+5	-	401.6+5
85	-	-	438.8+15	-	-	457.3+5	-	429.7+5
90	-	-	463.8+15	-	-	480.8+5	-	446.1+5
95	-	-	507.4+15	-	-	522.4+5	-	466.1+5
FBP	-	-	571.2+15	-	-	585.3+5	-	521.1+5

Appendix B Calculation of the n-Paraffins Containing in Crude Oil

Mass Balance Calculation

Lankrabue crude oil used 1.0052 g dissolved in 100 ml of CS₂

That mean 1.0052 g of crude oil in 100x10³ μl

Injection only 1 μl thus it is equivalent to $(1.0052 \times 1 \times 10^6) / 100 \times 10^3 = 10.052 \mu\text{g}$ of crude oil.

From GC Chromatogram of Lankrabue crude oil sample solution

n-C12 having peak area 2205.6 unit

From the reference Standard solution contain n-C12 0.2127 wt%

1 g of standard contain n-C12 = $(0.2127 \times 1)/100 = 2.127 \times 10^{-3}$ g

In standard solution 1 g was dissolved in 25 ml of CS₂

Thus 25 ml or 25 x 10³ μl but injection only 1 μl thus it is equivalent to

$$(2.127 \times 10^{-3} \times 1)/25 \times 10^3 = 8.508 \times 10^{-8} \text{ g or } 8.508 \times 10^{-2} \mu\text{g}$$

From chromatogram of standard solution

n-C12 peak area 8179.7 units equal to 8.508 x 10⁻² μg

thus peak area 2205.6 units equal to $(8.508 \times 10^{-2} \times 2205.6)/8179.7 = 0.02294 \mu\text{g}$

Therefore 10.052 μg contain n-C12 0.02294 μg

100 μg contain n-C12 $(0.02294 \times 100)/10.052 = 0.2282 \mu\text{g}$ or
0.2282%

Precipitation after extraction oil(Ngyen) used 0.5485 g dissolved in 100 ml of CS₂

That mean 0.5485 g of crude oil in 100x10³ μl

Injection only 1 μl thus it is equivalent to $(0.5485 \times 1 \times 10^6) / 100 \times 10^3 = 5.4850 \mu\text{g}$ of crude oil.

From GC Chromatogram of Precipitation after extraction oil sample solution

n-C12 having peak area 2205.3 unit

From the reference Standard solution contain n-C12 0.2127 wt%

1 g of standard contain n-C12 = $(0.2127 \times 1)/100 = 2.127 \times 10^{-3}$ g

In standard solution 1 g was dissolved in 25 ml of CS₂

Thus 25 ml or 25 x 10³ μl but injection only 1 μl thus it is equivalent to

$$(2.127 \times 10^{-3} \times 1)/25 \times 10^3 = 8.508 \times 10^{-8} \text{ g or } 8.508 \times 10^{-2} \mu\text{g}$$

From chromatogram of standard solution

n-C12 peak area 8179.7 units equal to 8.508 x 10⁻² μg

thus peak area 2205.3 units equal to $(8.508 \times 10^{-2} \times 2205.3)/8179.7 = 0.022938 \mu\text{g}$

Therefore 5.4850 μg contain n-C12 0.022938 μg

100 μg contain n-C12 $(0.022938 \times 100)/5.4850 = 0.4182 \mu\text{g}$ or
0.4182%

Lankrabue microcrystalline (Nguyen) used 0.2574 g dissolved in 100 ml of CS₂

That mean 0.2574 g of crude oil in 100x10³ μl

Injection only 1 μl thus it is equivalent to $(0.2574 \times 1 \times 10^6) / 100 \times 10^3 = 2.5740 \mu\text{g}$ of crude oil.

From GC Chromatogram of Lankrabue microcrystalline (Ngyen) sample solution
n-C12 having peak area 7.4 unit

Lankrabue macrocrystalline (Nguyen) used 0.3348 g dissolved in 100 ml of CS₂

That mean 0.3348 g of crude oil in $100 \times 10^3 \mu\text{l}$

Injection only 1 μl thus it is equivalent to $(0.3348 \times 1 \times 10^6) / 100 \times 10^3 = 3.3480 \mu\text{g}$
of crude oil.

From GC Chromatogram of Lankrabue macrocrystalline (Ngyen) sample solution
n-C12 having peak area 2197.8 unit

From the reference Standard solution contain n-C12 0.2127 wt%

1 g of standard contain n-C12 = $(0.2127 \times 1) / 100 = 2.127 \times 10^{-3}$ g

In standard solution 1 g was dissolved in 25 ml of CS₂

Thus 25 ml or $25 \times 10^3 \mu\text{l}$ but injection only 1 μl thus it is equivalent to

$$(2.127 \times 10^{-3} \times 1) / 25 \times 10^3 = 8.508 \times 10^{-8} \text{ g or } 8.508 \times 10^{-2} \mu\text{g}$$

From chromatogram of standard solution

n-C12 peak area 8179.7 units equal to $8.508 \times 10^{-2} \mu\text{g}$

thus peak area 2197.8 units equal to $(8.508 \times 10^{-2} \times 2197.8) / 8179.7 = 0.022860 \mu\text{g}$

Therefore 3.3480 μg contain n-C12 0.022860 μg

$$100 \mu\text{g contain n-C12 } (0.022860 \times 100) / 3.3480 = 0.6828 \mu\text{g or}$$

0.6828%

Material Balance(only C12)

Mass of Lankrabue crude oil = Mass of Precipitation + Mass of Saturated

For Ngyen method

$$0.02294 = 0.022938 + 0$$

$$0.02294 = 0.022938$$

$$0.02294 = 0.02294$$

For Modified method

$$0.02294 = 0.022936 + 0$$

$$0.02294 = 0.022936$$

$$0.02294 = 0.02294$$

Mass of Precipitation = Mass of Microcrystalline + Mass of Macrocrystalline

For Ngyen method

$$0.02294 = 0.000077 + 0.022860$$

$$0.02294 = 0.022937$$

$$0.02294 = 0.02294$$

For Modified method

$$0.02294 = 0.004072 + 0.018863$$

$$0.02294 = 0.022935$$

$$0.02294 = 0.02294$$

Table B1 Hydrocarbon composition of Lankrabue crude oil

n Hydrocarbon	Weight(g)	Peak area of standard	Peak area of Experiment	Reference weight %	%wt in crude oil	wt of each fraction (µg)
C5	1.0052	5572.6	-	0.1948	0.0000	0.000000
C6	1.0052	9465.9	-	0.1782	0.0000	0.000000
C7	1.0052	8580.1	-	0.1945	0.0000	0.000000
C8	1.0052	6895.2	-	0.1982	0.0000	0.000000
C9	1.0052	9055.4	-	0.1981	0.0000	0.000000
C10	1.0052	9132.4	-	0.2183	0.0000	0.000000
C11	1.0052	9215.8	-	0.2091	0.0000	0.000000
C12	1.0052	8179.7	2205.6	0.2127	0.2282	0.022941
C13	1.0052	7974.8	5335.4	0.2126	0.5660	0.056895
C14	1.0052	8271.3	8775.3	0.2260	0.9541	0.095908
C15	1.0052	8205.2	10130.8	0.2263	1.1119	0.111763
C16	1.0052	8070.6	10036.1	0.2213	1.0951	0.110078
C17	1.0052	6934.1	9247.0	0.2322	1.2322	0.123861
C18	1.0052	7123.4	10547.7	0.2203	1.2981	0.130480
C20	1.0052	6633.0	10321.2	0.2205	1.3653	0.137243
C22	1.0052	5779.9	9133.3	0.1984	1.2475	0.125403
C24	1.0052	4607.2	8088.1	0.2297	1.6046	0.161299
C28	1.0052	3506.8	5511.9	0.2236	1.3985	0.140580
C32	1.0052	2831.0	-	0.2043	0.0000	0.000000
C36	1.0052	2632.6	-	0.2147	0.0000	0.000000
C38	1.0052	2613.2	-	0.2108	0.0000	0.000000
C44	1.0052	1995.3	-	0.2049	0.0000	0.000000

TOTAL 12.1016

Table B2 Hydrocarbon composition of U-thong crude oil

n Hydrocarbon	Weight(g)	Peak area of standard	Peak area of Experiment	Reference weight %	%wt in crude oil	wt of each fraction (µg)
C5	1.0028	5572.6	-	0.1948	0.0000	0.000000
C6	1.0028	9465.9	-	0.1782	0.0000	0.000000
C7	1.0028	8580.1	-	0.1945	0.0000	0.000000
C8	1.0028	6895.2	-	0.1982	0.0000	0.000000
C9	1.0028	9055.4	-	0.1981	0.0000	0.000000
C10	1.0028	9132.4	-	0.2183	0.0000	0.000000
C11	1.0028	9215.8	-	0.2091	0.0000	0.000000
C12	1.0028	8179.7	355.8	0.2127	0.0369	0.003701
C13	1.0028	7974.8	2506.2	0.2126	0.2665	0.026725
C14	1.0028	8271.3	5197.4	0.2260	0.5665	0.056804
C15	1.0028	8205.2	6469.9	0.2263	0.7118	0.071376
C16	1.0028	8070.6	6176.5	0.2213	0.6756	0.067745
C17	1.0028	6934.1	6287.6	0.2322	0.8399	0.084220
C18	1.0028	7123.4	5684.8	0.2203	0.7013	0.070324
C20	1.0028	6633.0	7302.9	0.2205	0.9684	0.097108
C22	1.0028	5779.9	6767.3	0.1984	0.9266	0.092917
C24	1.0028	4607.2	5815.6	0.2297	1.1565	0.115979
C28	1.0028	3506.8	4465.0	0.2236	1.1356	0.113879
C32	1.0028	2831.0	2486.4	0.2043	0.7157	0.071773
C36	1.0028	2632.6	1216.5	0.2147	0.3957	0.039684
C38	1.0028	2613.2	-	0.2108	0.0000	0.000000
C44	1.0028	1995.3	-	0.2049	0.0000	0.000000
TOTAL					9.0969	

Table B3 Hydrocarbon composition of Fang crude oil

n Hydrocarbon	Weight(g)	Peak area of standard	Peak area of Experiment	Reference weight %	%wt in crude oil	wt of each fraction (μ g)
C5	1.0034	5572.6	63.8	0.1948	0.0089	0.000892
C6	1.0034	9465.9	68.5	0.1782	0.0051	0.000516
C7	1.0034	8580.1	198.5	0.1945	0.0179	0.001800
C8	1.0034	6895.2	-	0.1982	0.0000	0.000000
C9	1.0034	9055.4	528.1	0.1981	0.0461	0.004621
C10	1.0034	9132.4	940.6	0.2183	0.0896	0.008994
C11	1.0034	9215.8	1234.0	0.2091	0.1116	0.011199
C12	1.0034	8179.7	997.1	0.2127	0.1034	0.010371
C13	1.0034	7974.8	1422.9	0.2126	0.1512	0.015173
C14	1.0034	8271.3	1818.3	0.2260	0.1981	0.019873
C15	1.0034	8205.2	2035.5	0.2263	0.2238	0.022456
C16	1.0034	8070.6	1892.0	0.2213	0.2068	0.020752
C17	1.0034	6934.1	2993.3	0.2322	0.3996	0.040094
C18	1.0034	7123.4	288.0	0.2203	0.0355	0.003563
C20	1.0034	6633.0	1871.6	0.2205	0.2480	0.024887
C22	1.0034	5779.9	1627.8	0.1984	0.2227	0.022350
C24	1.0034	4607.2	1358.8	0.2297	0.2701	0.027098
C28	1.0034	3506.8	1101.6	0.2236	0.2800	0.028096
C32	1.0034	2831.0	646.0	0.2043	0.1858	0.018648
C36	1.0034	2632.6	590.3	0.2147	0.1919	0.019257
C38	1.0034	2613.2	-	0.2108	0.0000	0.000000
C44	1.0034	1995.3	-	0.2049	0.0000	0.000000
TOTAL					2.9960	

Appendix C Wax Appearance and Disappearance Temperature

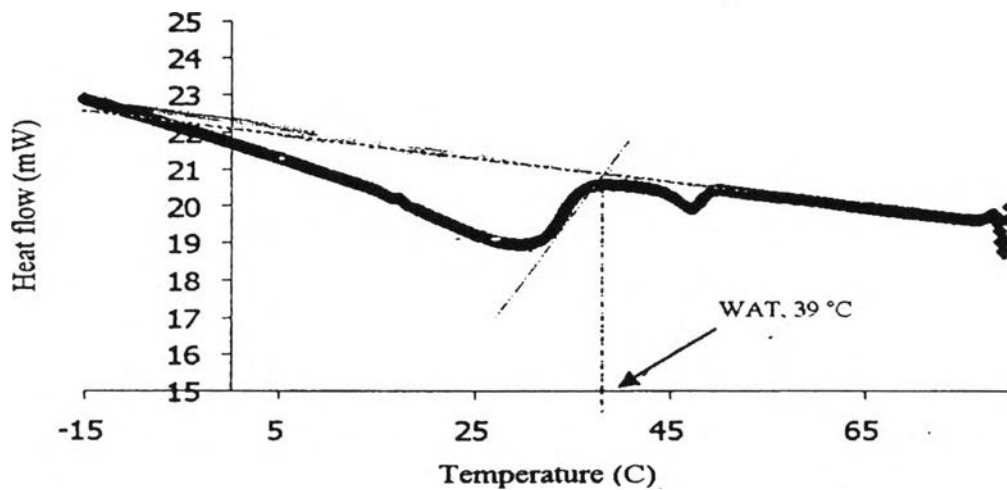


Figure C1 DSC thermogram obtained by cooling from 80 °C to -30 °C of Lankrabue crude oil.

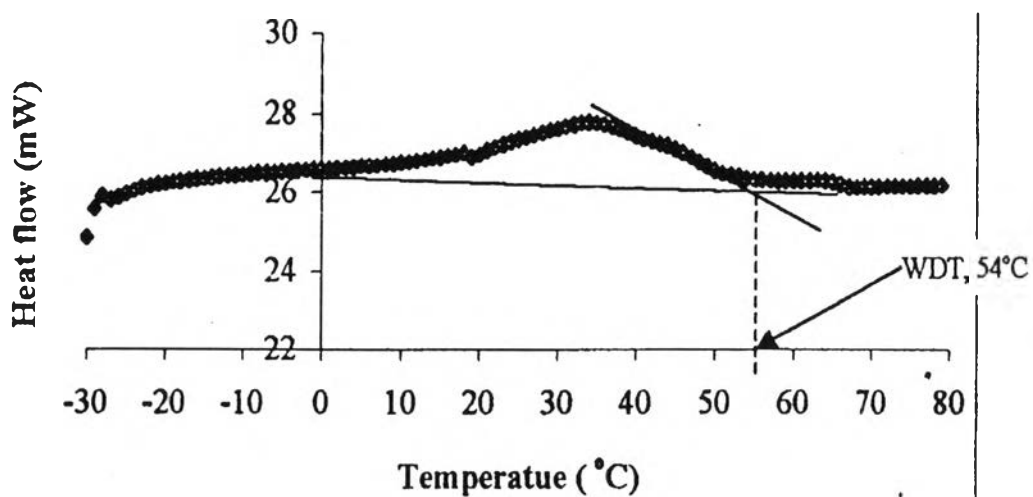


Figure C2 DSC thermogram obtained by heating from 80 °C to -30 °C of Lankrabue crude oil.

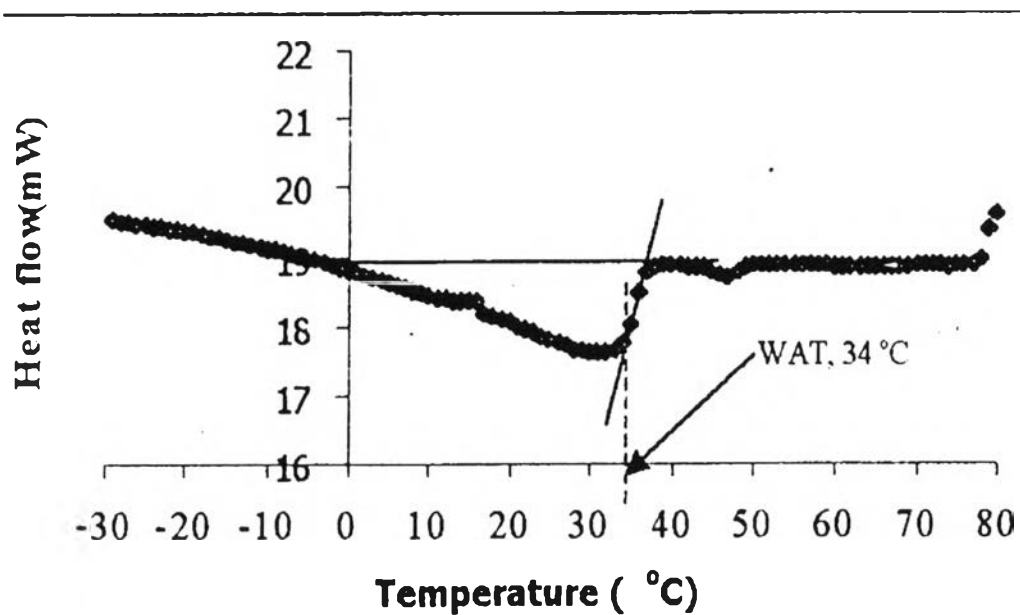


Figure C3 DSC thermogram obtained by cooling of U-Thong crude oil.

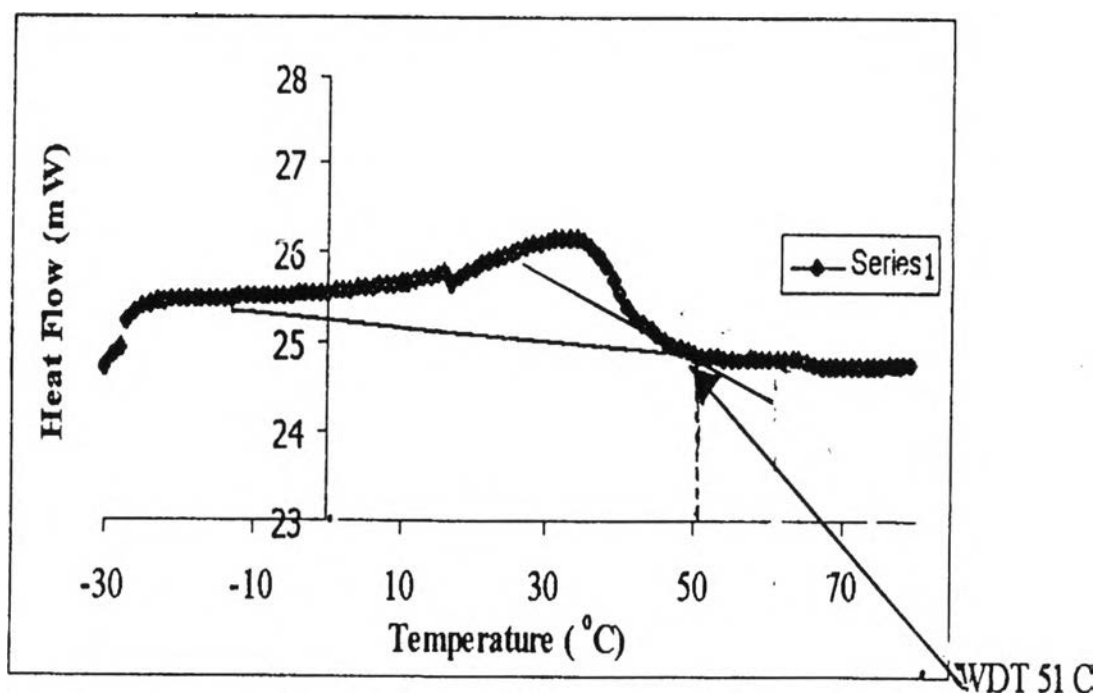


Figure C4 DSC thermogram obtained by heating of U-Thong crude oil.

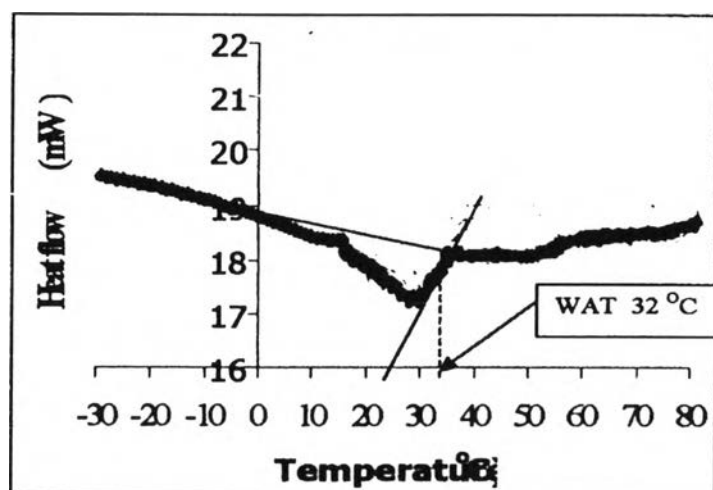


Figure 11 DSC thermogram obtained by cooling from 80 to -30 C of Phang crude oil

Figure C5 DSC thermogram obtained by cooling of Fang crude oil.

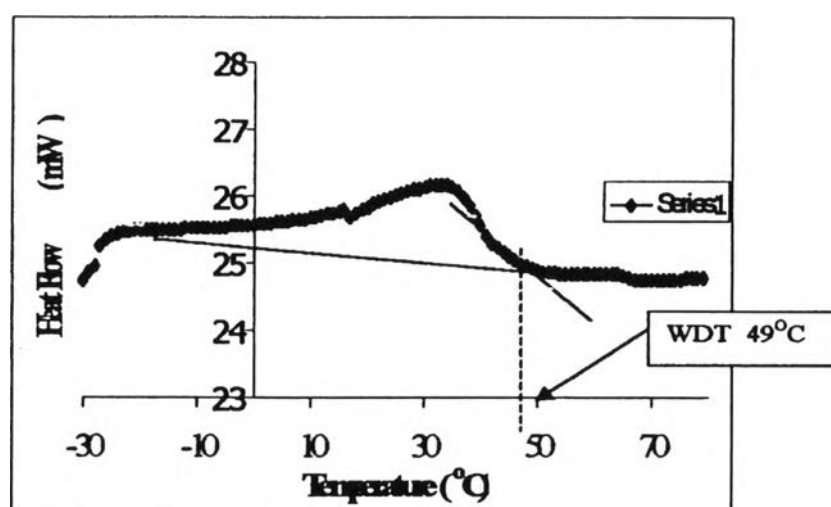


Figure 12 DSC thermogram obtained by heating from -30 to 80 C of Phang crude oil

Figure C6 DSC thermogram obtained by heating of Fang crude oil.

Appendix D ASTM Standards

D1 Pour Point Testing

The crude oil samples were transferred from the pretreatment cell to conventional pour point glass tubes at 30 °C. They were cooled at the rate of 12.0 °C /h from 30 °C and checked for pour ability every 2 °C. The pour point is the lowest temperature at which a movement of the sample can be observed when the tube is held in a horizontal position for 5 s. The pour point of oil sample is measured by heating to 80 °C and cooling from 80 °C in the cooling jacket. It is important, not to disturb the mass of oil nor to permit the thermometer to shift the oil. The pour point is examined when the temperature of oil is 9 °C above the pour point. At each test thermometer reading that is multiple of 3 °C below the starting temperature the test cell is removed from the cooling jacket. The movement of crude oil is observed in the test cell. If the crude oil shows any movement, replace the test cell immediately in the cooling jacket and repeat a test for flow at the next temperature 3 °C lower. The complete operation of removal, wiping, and replacement shall required no more than 3 s. If the crude oil shows no movement when the test cell is held in a horizontal position for 5 s. After testing, the samples were reheated to 50 °C and re-cooled at the same rate in order to examine their sensitivity to temperature cycling following in ATSM D97. The repeatability of pour point test generally is about ± 2 °C (Figure D1).

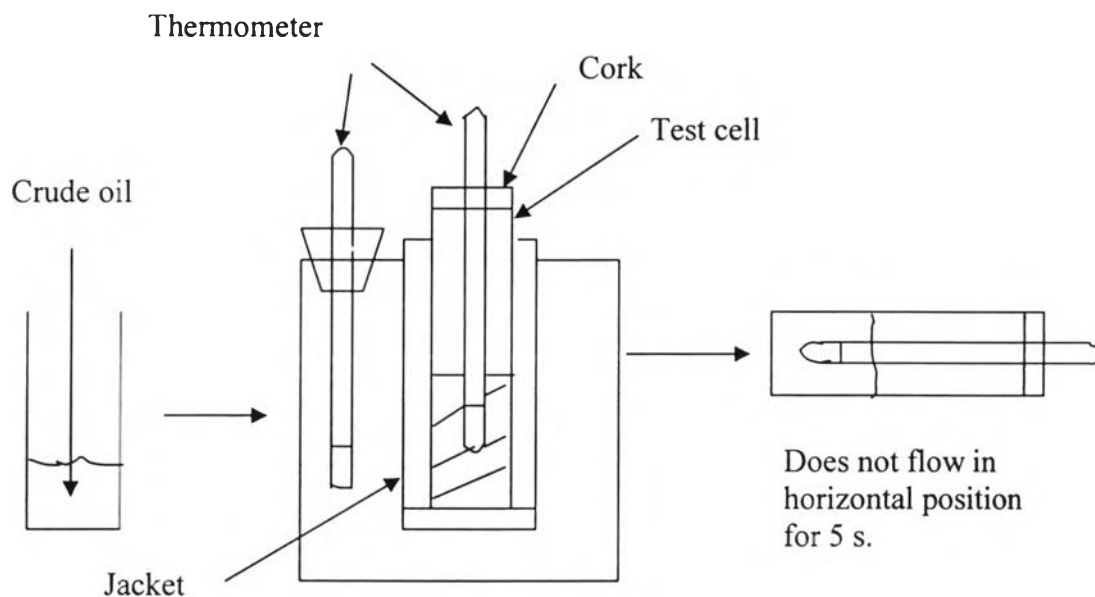


Figure D-1 Procedure of pour point testing.

D2 Determine Wax Content

About 5 g of crude oil sample was heated to 80 °C, mixed with pentane (1:40 wt/v) and left overnight to precipitate asphaltene. The 35 ml of petroleum ether was added to the filtrate and thoroughly stirred until homogenized. The 110 ml of acetone was added, stirred and cooled at -20 to 30 using dry ice and methanol coolant. The precipitate was filtered through a weighed glass fiber filter (Schleicher & Schuell GF 10), and washed with a cold mixture (3:1) of acetone and petroleum ether. The filter was placed in a tarred bottle and the wax precipitated still remaining in the filter funnel was washed into the weighed bottle with toluene. The toluene was evaporated at 100 °C to dryness and the bottle was reweighed to obtain the percentage of total wax in the original oil sample. Toluene was again evaporated to dryness. The bottle was reweighed and the wax was dissolved in about 10 cm³ of hexane. Finally, coprecipitated polar material and trapped oil were removed by elution with hexane through a short silica column. The hexane was evaporated to obtain the percentage of pure wax. The repeatability of this method is about $\pm 10\%$

relative (Figure D2).

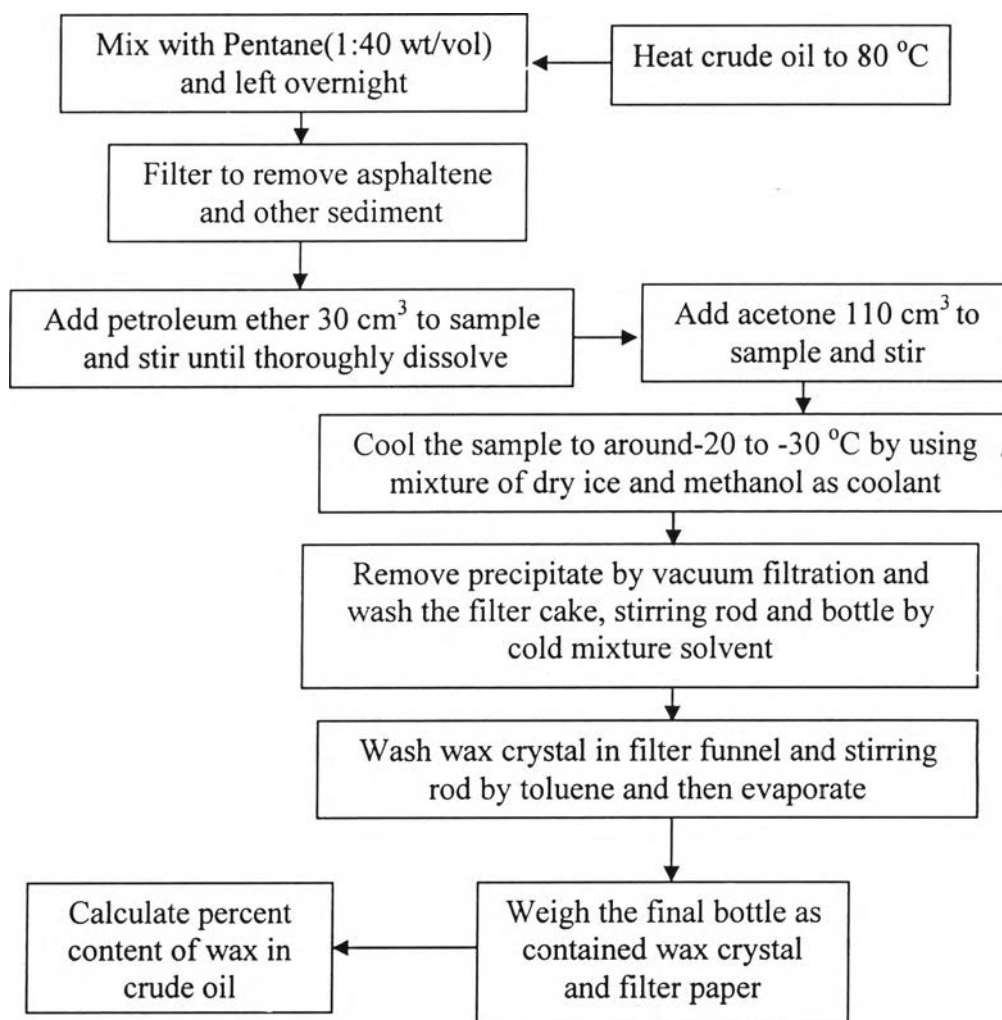


Figure D2 Wax content testing.

D3 Determination of Wax Appearance Temperature (WAT) and Wax Disappearance Temperature (WDT).

Prior to any measurement, the crude oil sample was heated to temperature of 80 °C for 60 min to ensure that all wax crystals were dissolved. A sample of 5-10 mg was then transferred into an aluminium capsule and sealed. An aluminum capsule of 40 µl capacity was used for sample measurements and references. During the cooling process, the sample was cooled at a rate of 5 °C/min from 80 °C to -30 °C using liquid nitrogen. The crystallization onset temperature or WAT was determined as the

onset of the exothermic peak corresponding to the liquid-solid transition. Under heating conditions, the sample was heated from $-30\text{ }^{\circ}\text{C}$ to $80\text{ }^{\circ}\text{C}$ at a rate of $5\text{ }^{\circ}\text{C}/\text{min}$. The dissolution temperature on heating is taken as the temperature at which the solid-liquid exotherm reaches the baseline. The procedure is shown in Figure D3.

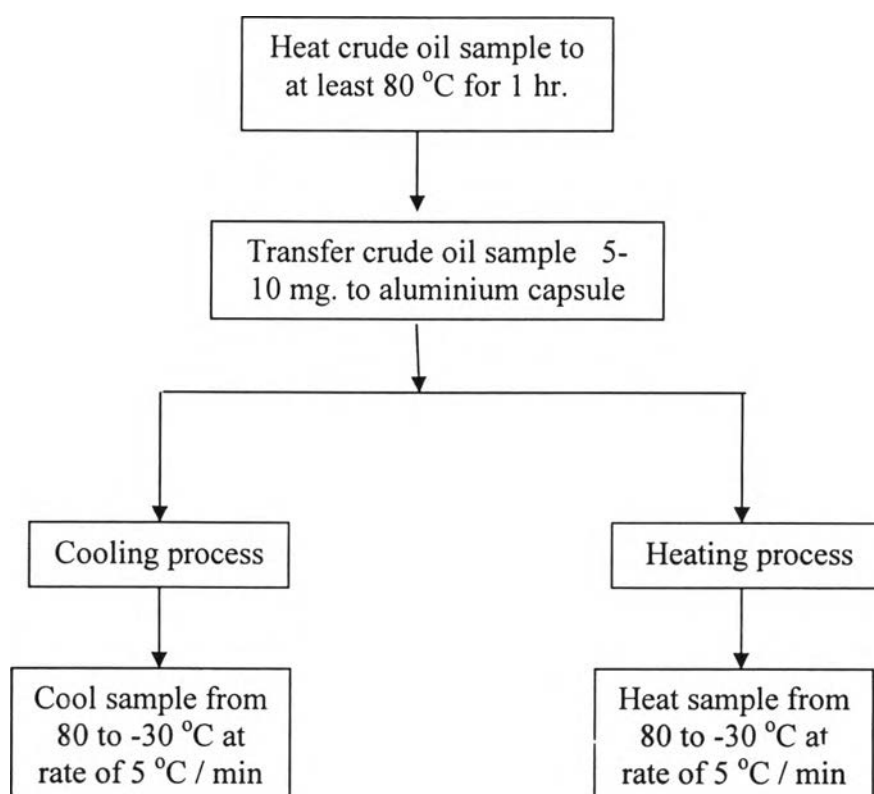


Figure D3 Method to determine WAT and WDT.

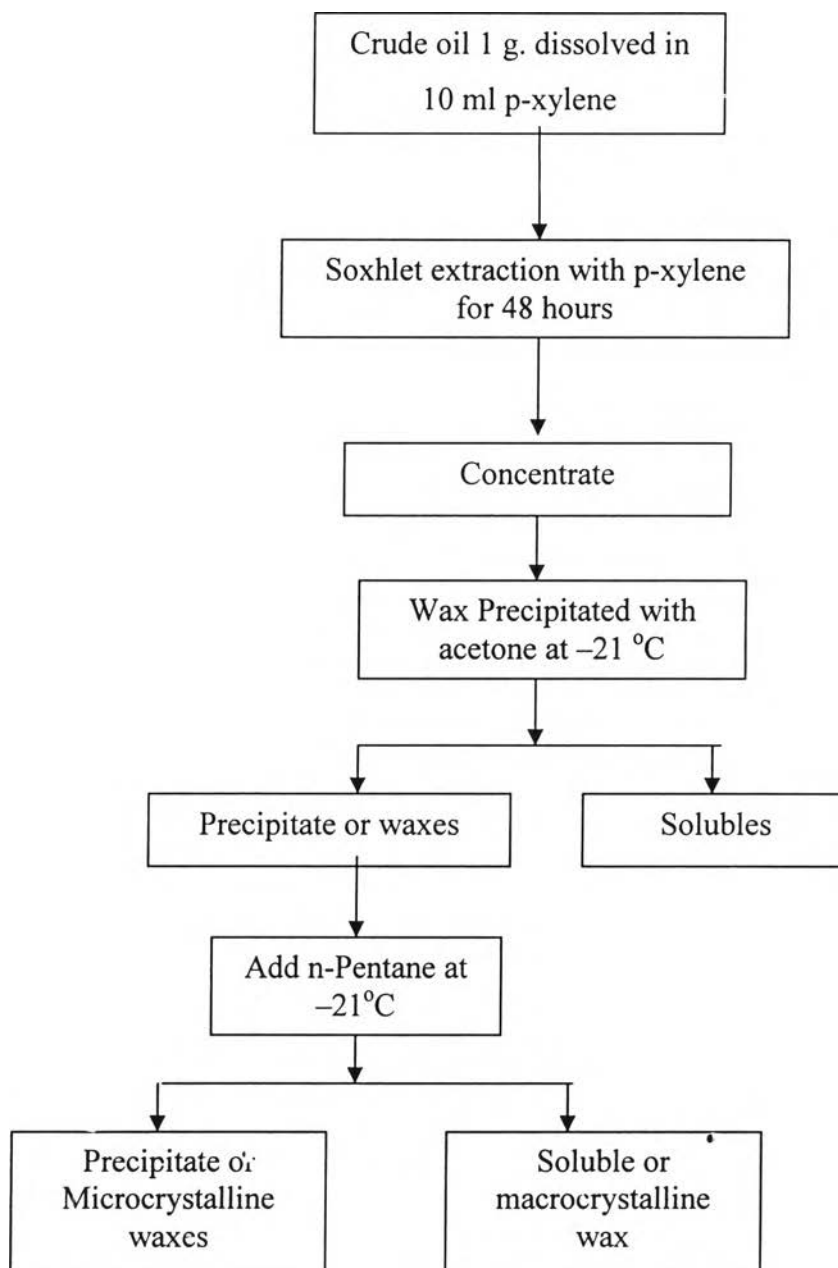
D4 Nguyen 's Method.

Figure D4 Qualitative separation scheme of asphaltenes, micro- and macrocrystalline waxes (Nguyen *et al.*, 1999).

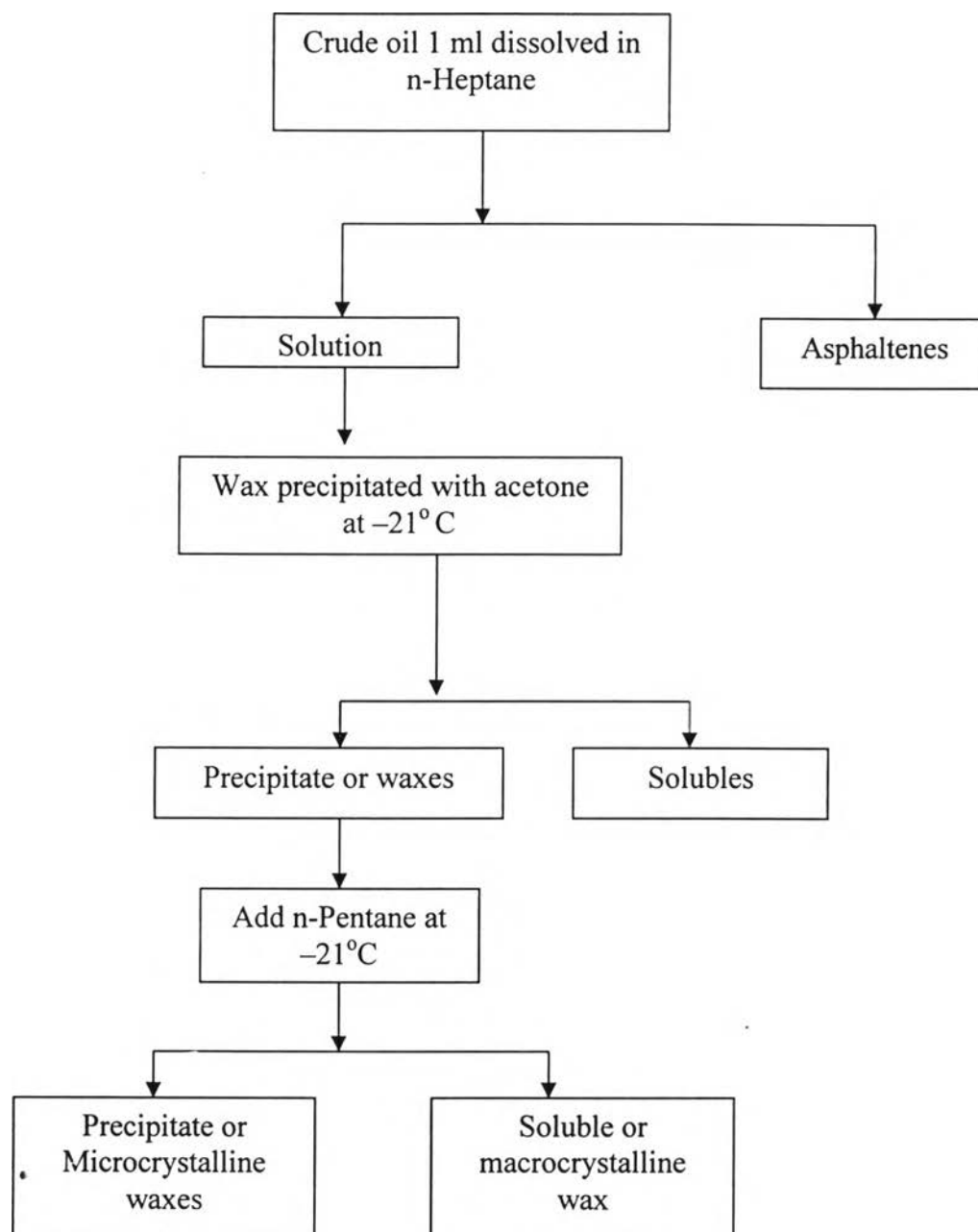
D5 Modified Nguyen's Method

Figure D5 Modified method from Nguyen *et al.*, 1999, for qualitative separation of asphaltenes, micro- and macro-crystalline waxes.

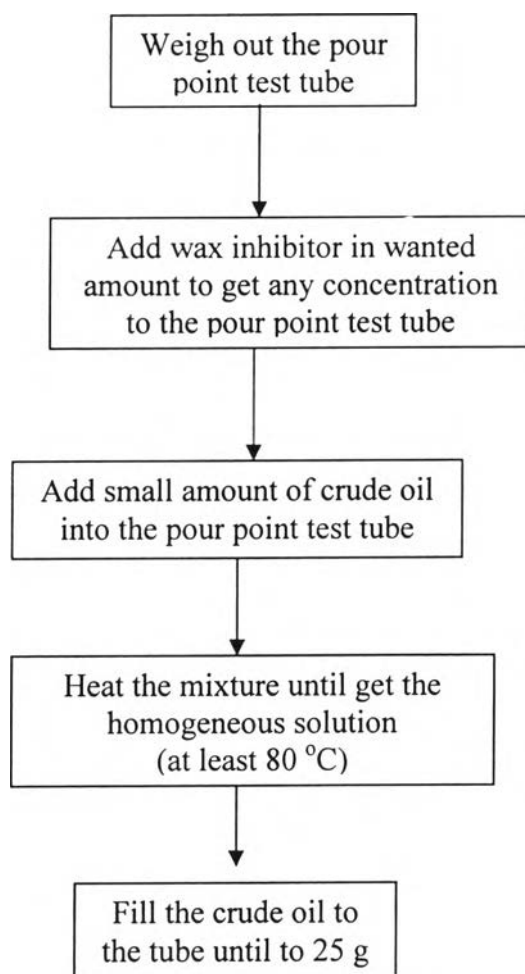
D6 Chemical Testing

Figure D6 Procedure of preparation of treated crude oil at any concentration.

Appendix E Chemical Testing

Table E1 Pour point of treated Lankrabue crude oil with EVA and PMMA

Concentration ppm (wt/wt)	18 % VA in EVA		25 % VA in EVA		33 % VA in EVA		40 % VA in EVA		VH grade PMMA		MD grade PMMA	
	Average	S.D.	Average	S.D.	Average	S.D.	Average	S.D.	Average	S.D.	Average	S.D.
0	38.1	0.0	38.1	0.0	38.1	0.0	38.1	0.0	38.1	0.0	38.1	0.0
100	36.3	0.0	34.3	0.1	33.8	0.1	37.7	0.1	27.0	0.1	33.9	0.1
200	34.9	0.1	32.1	0.1	34.5	0.1	37.0	0.1	28.3	0.2	36.0	0.1
400	35.3	0.1	31.4	0.1	32.8	0.2	36.2	0.1	28.8	0.2	33.9	0.1
600	33.9	0.1	30.2	0.1	32.1	0.1	37.1	0.1	30.4	0.2	33.9	0.2
800	36.1	0.1	26.8	0.3	35.3	0.3	38.1	0.1	31.0	0.1	37.8	0.1
1000	37.7	0.0	30.8	0.2	36.4	0.1	38.6	0.1	24.6	0.2	32.9	0.1

Note : Average of 5 measurements

Table E2 Pour point of treated U-thong crude oil with EVA and PMMA

Concentration ppm (wt/wt)	18 % VA in EVA		25 % VA in EVA		33 % VA in EVA		40 % VA in EVA		VH grade PMMA		MD grade PMMA	
	Average	S.D.	Average	S.D.	Average	S.D.	Average	S.D.	Average	S.D.	Average	S.D.
0	35.7	0.0	35.7	0.0	35.7	0.0	35.7	0.0	35.7	0.0	35.7	0.0
100	32.6	0.1	27.1	0.2	33.8	0.4	29.6	0.1	34.8	0.2	31.3	0.2
200	30.0	0.1	20.9	0.1	34.4	0.1	32.8	0.3	34.0	0.1	26.1	0.2
400	29.0	0.1	22.6	0.2	25.6	0.2	28.1	0.3	25.1	0.1	27.3	0.3
600	27.0	0.1	25.3	0.2	31.5	0.1	32.8	0.3	32.9	0.2	28.0	0.1
800	28.5	0.1	26.5	0.1	34.1	0.2	32.3	0.2	33.4	0.2	25.1	0.2
1000	28.9	0.1	32.3	0.4	32.2	0.3	33.9	0.2	37.6	0.1	35.9	0.1

Note : Average of 5 measurements

Table E3 Pour point of treated Fang crude oil with EVA and PMMA

Concentration ppm (wt/wt)	18 % VA in EVA		25 % VA in EVA		33 % VA in EVA		40 % VA in EVA		VH grade PMMA		MD grade PMMA	
	Average	S.D.	Average	S.D.	Average	S.D.	Average	S.D.	Average	S.D.	Average	S.D.
0	31.1	0.0	31.1	0.0	31.1	0.0	31.1	0.0	31.1	0.0	31.1	0.0
100	27.7	0.2	23.4	0.1	25.4	0.2	29.6	0.1	25.4	0.1	28.1	0.1
200	28.4	0.1	31.0	0.1	22.0	0.0	32.3	0.3	28.9	0.1	32.0	0.0
400	19.2	0.1	22.0	0.2	31.7	0.3	24.6	0.1	24.5	0.1	25.9	0.1
600	24.5	0.1	23.9	0.1	29.5	0.1	26.2	0.2	24.4	0.1	25.4	0.1
800	29.6	0.1	24.6	0.2	26.7	0.1	30.5	0.1	29.0	0.0	28.0	0.1
1000	24.5	0.0	30.1	0.2	30.0	0.1	23.9	0.1	25.4	0.2	24.3	0.1

Note : Average of 5 measurements

Table E4 Pour point of treated Lankrabue crude oil with other inhibitors

Concentration	EVAGMA		PLEGMA		POMA		PMAO		PEBAMA	
	Average	S.D.	Average	S.D.	Average	S.D.	Average	S.D.	Average	S.D.
0	38.1	0.0	38.1	0.0	38.1	0.0	38.1	0.0	38.1	0.0
100	33.2	0.3	32.6	0.1	25.7	0.2	22.5	0.0	30.0	0.1
200	33.1	0.1	29.9	0.1	26.1	0.1	21.0	0.1	24.6	0.1
400	30.5	0.0	27.5	0.0	24.1	0.1	20.4	0.1	32.0	0.0
600	29.3	0.3	27.1	0.1	23.1	0.1	18.5	0.0	33.0	0.1
800	27.5	0.0	26.3	0.2	24.1	0.1	18.0	0.1	33.2	0.1
1000	26.0	0.0	25.6	0.1	25.1	0.1	19.9	0.1	33.5	0.1

Note : Average of 5 measurements

Table E5 Pour point of treated U-thong crude oil with other inhibitors

Concentration ppm (wt/wt)	EVAGMA		PLEGMA		POMA		PMAO		PEBAMA	
	Average	S.D.	Average	S.D.	Average	S.D.	Average	S.D.	Average	S.D.
0	35.7	0.0	35.7	0.0	35.7	0.0	35.7	0.0	35.7	0.0
100	29.1	0.1	29.1	0.2	22.1	0.1	24.1	0.1	29.0	0.1
200	27.9	0.1	24.4	0.2	18.6	0.1	23.5	0.1	29.3	0.3
400	19.6	0.2	23.0	0.1	18.0	0.0	22.6	0.1	30.0	0.1
600	25.0	0.1	22.1	0.2	17.1	0.1	21.9	0.1	28.4	0.2
800	28.5	0.0	21.1	0.1	18.1	0.1	24.0	0.1	26.4	0.2
1000	30.1	0.1	22.0	0.1	18.5	0.0	24.9	0.1	23.4	0.1

Note : Average of 5 measurements

Table E6 Pour point of treated Fang crude oil with other inhibitors

Concentration ppm (wt/wt)	EVAGMA		PLEGMA		POMA		PMAO		PEBAMA	
	Average	S.D.	Average	S.D.	Average	S.D.	Average	S.D.	Average	S.D.
0	31.1	0.0	31.1	0.0	31.1	0.0	31.1	0.0	31.1	0.0
100	26.5	0.0	27.6	0.2	25.0	0.1	28.5	0.0	29.0	0.1
200	20.1	0.1	26.4	0.2	24.1	0.1	28.0	0.1	28.0	0.1
400	26.0	0.1	26.3	0.2	23.1	0.1	26.9	0.1	25.9	0.1
600	26.4	0.2	25.5	0.0	21.1	0.1	19.9	0.1	24.3	0.2
800	27.9	0.2	24.4	0.1	24.1	0.1	22.7	0.3	23.5	0.0
1000	29.0	0.0	25.1	0.1	24.5	0.0	23.1	0.1	20.9	0.1

Note : Average of 5 measurements

Table E7 Pour point of treated crude oil with 3 Solvents

Solvent		Lankrabue						U-thong					
% wt/wt in	Volume	n-pentane		n-hexane		n-heptane		n-pentane		n-hexane		n-heptane	
crude oil	(cm3)	Average	S.D.	Average	S.D.	Average	S.D.	Average	S.D.	Average	S.D.	Average	S.D.
0.0	0.0	38.1	0.0	38.1	0.0	38.1	0.0	35.7	0.0	35.7	0.0	35.7	0.0
3.8	1.6	36.6	0.1	36.1	0.1	34.5	0.1	33.1	0.1	32.1	0.1	30.3	0.2
7.4	3.2	33.6	0.1	33.1	0.1	31.6	0.4	31.0	0.1	30.4	0.2	29.0	0.1
10.7	4.8	31.1	0.1	30.1	0.1	28.6	0.1	29.5	0.0	29.0	0.1	27.9	0.1
16.7	8.0	28.6	0.2	26.9	0.1	25.4	0.2	27.1	0.1	26.3	0.2	25.7	0.2
28.6	16.0	18.5	0.0	17.2	0.1	15.4	0.2	15.0	0.2	14.1	0.1	13.0	0.2
33.3	20.0	12.7	0.1	11.3	0.2	9.9	0.1	10.0	0.1	9.0	0.1	7.7	0.2
37.5	24.0	10.1	0.1	9.1	0.2	7.8	0.3	8.3	0.2	7.8	0.1	6.4	0.1
44.4	32.0	-1.5	0.1	-2.3	0.3	-3.4	0.2	-3.4	0.1	-4.1	0.1	-5.1	0.1
47.4	36.0	-2.0	0.0	-2.5	0.1	-3.6	0.1	-4.0	0.1	-4.5	0.0	-5.7	0.1
50.0	40.0	-2.0	0.1	-2.5	0.0	-3.7	0.0	-4.0	0.0	-4.5	0.0	-5.7	0.1

Note : Average of 5 measurements

Table E8 Pour point of treated crude oil with 3 Solvents (continuous).

Solvent		Fang					
% wt/wt in	Volume	n-pentane		n-hexane		n-heptane	
crude oil	(cm3)	Average	S.D.	Average	S.D.	Average	S.D.
0.0	0.0	31.1	0.0	31.1	0.0	31.1	0.0
3.8	1.6	29.0	0.1	28.5	0.0	27.0	0.1
7.4	3.2	27.9	0.1	27.6	0.1	26.4	0.1
10.7	4.8	26.2	0.1	25.7	0.1	24.3	0.2
16.7	8.0	23.0	0.1	22.4	0.1	21.0	0.1
28.6	16.0	12.5	0.0	12.1	0.1	10.6	0.2
33.3	20.0	3.5	0.0	3.0	0.1	1.8	0.2
37.5	24.0	1.0	0.1	0.8	0.1	-0.7	0.2
44.4	32.0	-10.4	0.2	-10.8	0.2	-11.9	0.1
47.4	36.0	-10.0	0.1	-11.0	0.1	-12.5	0.0
50.0	40.0	-10.0	0.0	-11.1	0.1	-12.6	0.1

Note : Average of 5 measurements

Table E9 Pour point of treated Lankrabue crude oil with EVA and PMMA combined with n-pentane

Concentration ppm (wt/wt)	18 % VA in EVA		25 % VA in EVA		33 % VA in EVA		40 % VA in EVA		VH grade PMMA		MD grade PMMA	
	Average	S.D.	Average	S.D.	Average	S.D.	Average	S.D.	Average	S.D.	Average	S.D.
0	-2.0	0.0	-2.0	0.0	-2.0	0.0	-2.0	0.0	-2.0	0.0	-2.0	0.0
100	-3.5	0.1	-3.2	0.2	-5.0	0.0	-2.5	0.0	-8.5	0.1	-5.4	0.1
200	-4.5	0.0	-4.4	0.2	-5.5	0.0	-2.0	0.0	-7.1	0.1	-4.3	0.3
400	-4.7	0.2	-5.0	0.0	-6.0	0.1	-3.1	0.1	-7.5	0.0	-4.0	0.0
600	-5.1	0.1	-5.7	0.2	-6.5	0.1	-2.5	0.0	-5.0	0.1	-4.9	0.1
800	-2.9	0.1	-8.0	0.1	-5.5	0.0	-2.4	0.1	-5.4	0.2	-5.2	0.2
1000	-2.5	0.0	-5.9	0.2	-5.0	0.1	-2.0	0.1	-7.5	0.0	-5.5	0.0

Note : Average of 5 measurements

Table E10 Pour point of treated U-thong crude oil with EVA and PMMA combined with n-pentane

Concentration ppm (wt/wt)	18 % VA in EVA		25 % VA in EVA		33 % VA in EVA		40 % VA in EVA		VH grade PMMA		MD grade PMMA	
	Average	S.D.	Average	S.D.	Average	S.D.	Average	S.D.	Average	S.D.	Average	S.D.
0	-4.0	0.1	-4.0	0.1	-4.0	0.1	-4.0	0.1	-4.0	0.1	-4.0	0.1
100	-6.4	0.1	-9.7	0.2	-7.9	0.2	-8.4	0.1	-6.0	0.0	-6.4	0.1
200	-8.0	0.1	-13.9	0.1	-6.6	0.2	-7.0	0.0	-3.9	5.6	-8.4	0.1
400	-9.1	0.1	-11.5	0.1	-10.0	0.0	-9.0	0.1	-8.1	0.1	-8.6	0.2
600	-10.0	0.0	-10.3	0.3	-7.4	0.2	-6.5	0.1	-5.9	0.1	-7.1	0.1
800	-9.5	0.0	-9.6	0.2	-6.4	0.2	-6.1	0.1	-6.5	0.0	-8.9	0.1
1000	-6.5	0.1	-6.8	0.3	-5.9	0.1	-5.5	0.0	-6.1	0.1	-6.5	0.0

Note : Average of 5 measurements

Table E11 Pour point of treated Fang crude oil with EVA and PMMA combined with n-pentane

Concentration ppm (wt/wt)	18 % VA in EVA		25 % VA in EVA		33 % VA in EVA		40 % VA in EVA		VH grade PMMA		MD grade PMMA	
	Average	S.D.	Average	S.D.	Average	S.D.	Average	S.D.	Average	S.D.	Average	S.D.
0	-10.0	0.1	-10.0	0.1	-10.0	0.1	-10.0	0.1	-10.0	0.1	-10.0	0.1
100	-14.5	0.1	-16.9	0.1	-13.0	0.0	-12.4	0.1	-15.5	0.1	-13.1	0.1
200	-13.6	0.2	-18.0	0.1	-15.0	0.0	-11.0	0.0	-11.9	0.1	-11.6	0.1
400	-20.0	0.0	-17.5	0.0	-12.4	0.2	-15.4	0.2	-16.1	0.1	-15.1	0.1
600	-17.5	0.1	-18.6	0.2	-13.6	0.2	-14.5	0.1	-16.0	0.1	-15.0	0.0
800	-14.1	0.1	-15.4	0.1	-14.5	0.0	-12.2	0.1	-12.0	0.1	-11.0	0.1
1000	-12.8	0.1	-10.2	0.3	-11.0	0.1	-14.1	0.2	-15.1	0.1	-15.1	0.1

Note : Average of 5 measurements

Table E12 Pour point of treated Lankrabue crude oil with other inhibitors combined with n-pentane

Concentration ppm (wt/wt)	EVAGMA		PLEGMA		POMA		PMAO		PEBAMA	
	Average	S.D.	Average	S.D.	Average	S.D.	Average	S.D.	Average	S.D.
0	-2.0	0.0	-2.0	0.0	-2.0	0.0	-2.0	0.0	-2.0	0.0
100	-7.0	0.1	-7.4	0.1	-14.6	0.2	-13.0	0.1	-11.4	0.2
200	-7.3	0.1	-10.1	0.1	-14.5	0.0	-13.4	0.1	-17.1	0.1
400	-10.0	0.1	-12.6	0.1	-16.9	0.1	-14.5	0.1	-10.1	0.1
600	-11.4	0.1	-13.1	0.1	-18.1	0.1	-21.9	0.1	-9.6	0.2
800	-12.5	0.0	-13.9	0.1	-17.1	0.1	-18.5	0.0	-9.0	0.1
1000	-14.0	0.2	-14.5	0.0	-16.1	0.1	-18.0	0.1	-9.3	0.2

Note : Average of 5 measurements

Table E13 Pour point of treated U-thong crude oil with other inhibitors combined with n-pentane

Concentration ppm (wt/wt)	EVAGMA		PLEGMA		POMA		PMAO		PEBAMA	
	Average	S.D.	Average	S.D.	Average	S.D.	Average	S.D.	Average	S.D.
0	-4.0	0.1	-4.0	0.1	-4.0	0.1	-4.0	0.1	-4.0	0.1
100	-10.9	0.1	-10.4	0.1	-17.4	0.2	-15.5	0.0	-10.6	0.1
200	-12.0	0.1	-15.1	0.1	-21.1	0.1	-16.1	0.1	-10.5	0.0
400	-20.1	0.1	-16.4	0.2	-22.1	0.1	-16.6	0.1	-9.4	0.2
600	-14.5	0.0	-17.1	0.1	-22.5	0.0	-17.1	0.1	-11.1	0.1
800	-11.1	0.1	-18.7	0.2	-22.0	0.1	-15.8	0.2	-13.5	0.0
1000	-9.4	0.1	-17.5	0.0	-21.0	0.1	-14.4	0.1	-16.4	0.2

Note : Average of 5 measurements

Table E14 Pour point of treated Fang crude oil with other inhibitors combined with n-pentane

Concentration ppm (wt/wt)	EVAGMA		PLEGMA		POMA		PMAO		PEBAMA	
	Average	S.D.	Average	S.D.	Average	S.D.	Average	S.D.	Average	S.D.
0	-10.0	0.1	-10.0	0.1	-10.0	0.1	-10.0	0.1	-10.0	0.1
100	-14.8	0.2	-13.4	0.1	-16.1	0.1	-12.0	0.1	-11.0	0.1
200	-21.1	0.1	-14.5	0.0	-17.1	0.1	-12.4	0.2	-12.1	0.1
400	-15.4	0.1	-15.1	0.1	-18.0	0.1	-14.6	0.1	-14.1	0.1
600	-14.7	0.2	-15.4	0.1	-20.1	0.1	-20.4	0.2	-16.0	0.1
800	-13.5	0.0	-16.5	0.0	-17.0	0.1	-18.1	0.1	-16.5	0.0
1000	-12.4	0.1	-16.1	0.1	-16.5	0.0	-17.4	0.1	-19.1	0.1

Note : Average of 5 measurements

Table E15 Pour point of treated Lankrabue crude oil with EVA and PMMA combined with n-hexane

Concentration ppm (wt/wt)	18 % VA in EVA		25 % VA in EVA		33 % VA in EVA		40 % VA in EVA		VH grade PMMA		MD grade PMMA	
	Average	S.D.	Average	S.D.	Average	S.D.	Average	S.D.	Average	S.D.	Average	S.D.
0	-2.0	0.0	-2.0	0.0	-2.0	0.0	-2.0	0.0	-2.0	0.0	-2.0	0.0
100	-4.5	0.0	-4.2	0.3	-6.0	0.0	-3.4	0.2	-9.4	0.1	-6.3	0.2
200	-5.5	0.1	-5.6	0.1	-6.6	0.2	-3.0	0.1	-7.9	0.1	-5.6	0.1
400	-6.0	0.1	-6.1	0.1	-7.1	0.1	-4.5	0.1	-8.5	0.0	-5.1	0.1
600	-6.2	0.2	-6.6	0.1	-7.8	0.2	-3.3	0.1	-6.1	0.1	-6.0	0.1
800	-3.6	0.2	-9.0	0.1	-6.0	0.0	-3.0	0.1	-6.4	0.1	-6.0	0.2
1000	-3.2	0.1	-7.1	0.1	-5.4	0.2	-2.6	0.2	-8.6	0.2	-6.6	0.1

Note : Average of 5 measurements

Table E16 Pour point of treated U-thong crude oil with EVA and PMMA combined with n-hexane

Concentration ppm (wt/wt)	18 % VA in EVA		25 % VA in EVA		33 % VA in EVA		40 % VA in EVA		VH grade PMMA		MD grade PMMA	
	Average	S.D.	Average	S.D.	Average	S.D.	Average	S.D.	Average	S.D.	Average	S.D.
0	-4.0	0.1	-4.0	0.1	-4.0	0.1	-4.0	0.1	-4.0	0.1	-4.0	0.1
100	-6.9	0.1	-10.4	0.2	-8.7	0.2	-9.6	0.1	-7.1	0.1	-7.5	0.1
200	-8.9	0.1	-15.8	0.2	-7.4	0.2	-8.2	0.1	-7.6	0.1	-9.4	0.2
400	-10.1	0.1	-12.4	0.2	-11.0	0.1	-10.3	0.2	-9.4	0.2	-10.0	0.1
600	-11.1	0.1	-11.1	0.1	-8.6	0.1	-7.5	0.0	-7.0	0.1	-8.1	0.1
800	-10.0	0.0	-10.5	0.0	-7.9	0.1	-7.0	0.1	-7.5	0.0	-10.1	0.2
1000	-7.6	0.1	-8.0	0.1	-7.1	0.1	-6.4	0.2	-7.0	0.0	-7.7	0.3

Note : Average of 5 measurements

Table E17 Pour point of treated Fang crude oil with EVA and PMMA combined with n-hexane

Concentration ppm (wt/wt)	18 % VA in EVA		25 % VA in EVA		33 % VA in EVA		40 % VA in EVA		VH grade PMMA		MD grade PMMA	
	Average	S.D.	Average	S.D.	Average	S.D.	Average	S.D.	Average	S.D.	Average	S.D.
0	-10.0	0.1	-10.0	0.1	-10.0	0.1	-10.0	0.1	-10.0	0.1	-10.0	0.1
100	-14.9	0.1	-17.7	0.2	-14.1	0.1	-13.2	0.1	-16.6	0.2	-14.9	0.1
200	-13.8	0.1	-19.0	0.1	-15.5	0.0	-12.0	0.1	-12.9	0.1	-12.2	0.2
400	-21.1	0.1	-18.3	0.3	-13.1	0.1	-16.1	0.2	-17.0	0.1	-16.0	0.1
600	-18.5	0.1	-18.9	0.1	-14.6	0.1	-15.7	0.2	-17.0	0.1	-15.9	0.1
800	-15.1	0.1	-16.1	0.1	-15.1	0.1	-13.2	0.3	-13.3	0.2	-11.9	0.1
1000	-13.5	0.0	-11.1	0.1	-12.1	0.1	-14.4	0.1	-16.3	0.3	-15.7	0.2

Note : Average of 5 measurements

Table E18 Pour point of treated Lankrabue crude oil with other inhibitors combined with n-hexane

Concentration ppm (wt/wt)	EVAGMA		PLEGMA		POMA		PMAO		PEBAMA	
	Average	S.D.	Average	S.D.	Average	S.D.	Average	S.D.	Average	S.D.
0	-2.0	0.0	-2.0	0.0	-2.0	0.0	-2.0	0.0	-2.0	0.0
100	-8.0	0.1	-8.1	0.1	-15.5	0.0	-13.6	0.2	-12.4	0.2
200	-8.1	0.1	-10.9	0.1	-15.6	0.2	-14.1	0.1	-18.1	0.1
400	-10.6	0.1	-13.0	0.1	-17.1	0.1	-14.5	0.0	-10.1	0.1
600	-12.1	0.1	-13.5	0.0	-18.1	0.1	-22.4	0.2	-9.6	0.1
800	-13.0	0.0	-14.1	0.1	-17.1	0.1	-19.1	0.1	-9.1	0.1
1000	-15.1	0.1	-15.0	0.1	-16.0	0.1	-18.5	0.0	-5.1	7.4

Note : Average of 5 measurements

Table E19 Pour point of treated U-thong crude oil with other inhibitors combined with n-hexane

Concentration ppm (wt/wt)	EVAGMA		PLEGMA		POMA		PMAO		PEBAMA	
	Average	S.D. *	Average	S.D.	Average	S.D.	Average	S.D.	Average	S.D.
0	-4.0	0.1	-4.0	0.1	-4.0	0.1	-4.0	0.1	-4.0	0.1
100	-11.3	0.1	-11.1	0.1	-18.1	0.1	-16.1	0.1	-11.1	0.1
200	-12.6	0.2	-15.6	0.1	-21.8	0.1	-16.6	0.2	-11.0	0.1
400	-20.6	0.2	-17.1	0.1	-22.6	0.1	-17.1	0.1	-10.0	0.1
600	-15.0	0.1	-17.5	0.0	-23.1	0.1	-17.5	0.0	-11.9	0.1
800	-11.7	0.2	-19.1	0.1	-22.4	0.1	-16.6	0.2	-14.1	0.1
1000	-10.1	0.1	-18.1	0.1	-22.0	0.1	-15.1	0.1	-17.1	0.1

Note : Average of 5 measurements

Table E20 Pour point of treated Fang crude oil with other inhibitors combined with n-hexane

Concentration ppm (wt/wt)	EVAGMA		PLEGMA		POMA		PMAO		PEBAMA	
	Average	S.D.	Average	S.D.	Average	S.D.	Average	S.D.	Average	S.D.
0	-10.0	0.1	-10.0	0.1	-10.0	0.1	-10.0	0.1	-10.0	0.1
100	-16.0	0.1	-14.4	0.1	-17.2	0.1	-13.0	0.1	-12.1	0.2
200	-22.1	0.1	-15.6	0.1	-18.0	0.1	-13.6	0.1	-13.0	0.1
400	-17.4	0.2	-16.1	0.1	-19.1	0.1	-15.5	0.0	-15.0	0.1
600	-16.1	0.1	-16.5	0.0	-21.2	0.1	-21.6	0.2	-17.0	0.1
800	-15.7	0.1	-17.5	0.0	-18.1	0.1	-19.1	0.1	-17.4	0.1
1000	-13.9	0.1	-17.0	0.1	-17.6	0.1	-18.3	0.2	-20.1	0.1

Note : Average of 5 measurements

Table E21 Pour point of treated Lankrabue crude oil with EVA and PMMA combined with n-heptane

Concentration ppm (wt/wt)	18 % VA in EVA		25 % VA in EVA		33 % VA in EVA		40 % VA in EVA		VH grade PMMA		MD grade PMMA	
	Average	S.D.	Average	S.D.	Average	S.D.	Average	S.D.	Average	S.D.	Average	S.D.
0	-2.0	0.0	-2.0	0.0	-2.0	0.0	-2.0	0.0	-2.0	0.0	-2.0	0.0
100	-5.8	0.2	-5.7	0.3	-7.4	0.1	-4.9	0.2	-10.9	0.1	-8.0	0.1
200	-7.3	0.2	-6.9	0.1	-8.5	0.1	-4.8	0.1	-9.4	0.1	-7.0	0.1
400	-7.5	0.0	-7.5	0.0	-8.9	0.1	-6.1	0.1	-9.9	0.1	-6.5	0.0
600	-7.9	0.1	-7.9	0.1	-9.4	0.2	-4.9	0.1	-7.8	0.3	-7.4	0.1
800	-5.1	0.1	-10.4	0.2	-8.5	0.0	-4.5	0.0	-8.0	0.0	-7.5	0.0
1000	-4.6	0.2	-8.5	0.0	-7.1	0.1	-4.2	0.1	-9.9	0.1	-8.0	0.1

Note : Average of 5 measurements

Table E22 Pour point of treated U-thong crude oil with EVA and PMMA combined with n-heptane

Concentration ppm (wt/wt)	18 % VA in EVA		25 % VA in EVA		33 % VA in EVA		40 % VA in EVA		VH grade PMMA		MD grade PMMA	
	Average	S.D.	Average	S.D.	Average	S.D.	Average	S.D.	Average	S.D.	Average	S.D.
0	-4.0	0.1	-4.0	0.1	-4.0	0.1	-4.0	0.1	-4.0	0.1	-4.0	0.1
100	-8.2	0.1	-11.3	0.3	-9.8	0.3	-11.1	0.1	-8.5	0.1	-9.0	0.1
200	-10.0	0.1	-16.8	0.3	-8.9	0.2	-9.1	0.1	-9.0	0.1	-11.0	0.1
400	-11.5	0.1	-13.6	0.2	-12.1	0.2	-11.5	0.0	-11.1	0.1	-11.6	0.2
600	-12.1	0.2	-12.3	0.3	-9.8	0.3	-8.7	0.2	-8.6	0.1	-9.1	0.1
800	-11.0	0.1	-11.7	0.3	-9.2	0.2	-8.1	0.1	-9.1	0.1	-11.5	0.0
1000	-8.8	0.3	-9.2	0.2	-8.6	0.1	-7.4	0.1	-9.3	0.2	-9.9	0.1

Note : Average of 5 measurements

Table E23 Pour point of treated Fang crude oil with EVA and PMMA combined with n-heptane

Concentration ppm (wt/wt)	18 % VA in EVA		25 % VA in EVA		33 % VA in EVA		40 % VA in EVA		VH grade PMMA		MD grade PMMA	
	Average	S.D.	Average	S.D.	Average	S.D.	Average	S.D.	Average	S.D.	Average	S.D.
0	-10.0	0.1	-10.0	0.1	-10.0	0.1	-10.0	0.1	-10.0	0.1	-10.0	0.1
100	-15.6	0.1	-18.4	0.2	-15.1	0.1	-14.5	0.0	-17.9	0.1	-16.4	0.1
200	-15.0	0.1	-20.1	0.1	-16.6	0.2	-13.4	0.1	-14.5	0.1	-13.7	0.3
400	-22.6	0.1	-19.0	0.0	-14.5	0.1	-17.7	0.2	-18.5	0.0	-18.0	0.1
600	-19.5	0.0	-20.3	0.3	-15.7	0.2	-16.9	0.1	-18.3	0.2	-17.7	0.2
800	-16.4	0.1	-17.3	0.3	-16.2	0.3	-14.3	0.1	-15.0	0.0	-14.4	0.1
1000	-14.6	0.2	-12.8	0.3	-13.1	0.2	-16.0	0.1	-17.4	0.2	-17.0	0.1

Note : Average of 5 measurements

Table E24 Pour point of treated Lankrabue crude oil with other inhibitors combined with n-heptane

Concentration ppm (wt/wt)	EVAGMA		PLEGMA		POMA		PMAO		PEBAMA	
	Average	S.D.	Average	S.D.	Average	S.D.	Average	S.D.	Average	S.D.
0	-2.0	0.0	-2.0	0.0	-2.0	0.0	-2.0	0.0	-2.0	0.0
100	-8.9	0.1	-9.0	0.1	-16.5	0.0	-19.6	0.1	-14.1	0.1
200	-9.1	0.1	-12.1	0.1	-16.1	0.1	-21.0	0.1	-19.6	0.2
400	-11.5	0.0	-14.0	0.1	-18.1	0.1	-21.4	0.1	-12.1	0.1
600	-13.1	0.1	-14.6	0.1	-19.2	0.1	-23.6	0.1	-11.5	0.0
800	-14.5	0.0	-15.3	0.2	-18.0	0.1	-24.1	0.1	-11.6	0.2
1000	-16.1	0.1	-16.1	0.1	-17.1	0.1	-22.1	0.1	-10.1	0.1

Note : Average of 5 measurements

Table E25 Pour point of treated U-thong crude oil with other inhibitors combined with n-heptane

Concentration ppm (wt/wt)	EVAGMA		PLEGMA		POMA		PMAO		PEBAMA	
	Average	S.D.	Average	S.D.	Average	S.D.	Average	S.D.	Average	S.D.
0	-4.0	0.1	-4.0	0.1	-4.0	0.1	-4.0	0.1	-4.0	0.1
100	-13.1	0.1	-12.4	0.1	-19.1	0.1	-18.1	0.1	-13.8	0.1
200	-14.0	0.0	-17.1	0.1	-23.0	0.1	-18.9	0.1	-13.5	0.0
400	-22.1	0.1	-18.5	0.0	-23.5	0.0	-19.5	0.0	-12.6	0.2
600	-16.0	0.1	-19.0	0.1	-24.1	0.1	-20.1	0.1	-14.0	0.1
800	-14.1	0.1	-20.6	0.1	-23.6	0.2	-18.6	0.1	-16.1	0.1
1000	-12.0	0.1	-19.4	0.2	-23.1	0.1	-17.1	0.1	-19.1	0.1

Note : Average of 5 measurements

Table E26 Pour point of treated Fang crude oil with other inhibitors combined with n-heptane

Concentration ppm (wt/wt)	EVAGMA		PLEGMA		POMA		PMAO		PEBAMA	
	Average	S.D.	Average	S.D.	Average	S.D.	Average	S.D.	Average	S.D.
0	-10.0	0.1	-10.0	0.1	-10.0	0.1	-10.0	0.1	-10.0	0.1
100	-17.1	0.1	-16.1	0.1	-18.6	0.1	-15.5	0.0	-13.1	0.1
200	-23.0	0.1	-17.1	0.1	-19.4	0.2	-15.1	0.1	-14.1	0.1
400	-18.4	0.2	-17.5	0.0	-20.6	0.1	-17.1	0.1	-16.1	0.1
600	-17.0	0.0	-18.1	0.1	-22.5	0.0	-24.1	0.1	-18.5	0.0
800	-16.4	0.2	-19.1	0.1	-19.5	0.0	-21.1	0.1	-19.1	0.1
1000	-15.1	0.1	-18.5	0.0	-19.1	0.1	-21.0	0.1	-21.1	0.1

Note : Average of 5 measurements

Appendix F Physical Properties Results

F1 Pour Point Testing

Table F11 Pour point of Lankrabue crude oil

Test No.	Pour Point (°C)
1	37.9
2	38.0
3	37.5
4	38.5
Average	38.0

Table F12 Pour point of U-Thong crude oil

Test No.	Pour Point (°C)
1	33.8
2	33.5
3	34.0
4	33.0
Average	33.6

Table F13 Pour point of Fang crude oil

Test No.	Pour Point (°C)
1	31.1
2	31.2
3	31.1
4	31.0
Average	31.1

F2 Density Test

Table F21 Density of each crude oils at their pour point temperature

Sample	Test No.	Density (g/cm ³)
Lankrabue Crude Oil	1	0.882
	2	0.875
	3	0.880
	4	0.878
Average		0.879
U-thong Crude Oil	1	0.857
	2	0.855
	3	0.853
	4	0.856
Average		0.855
Fang Crude Oil	1	0.847
	2	0.846
	3	0.845
	4	0.846
Average		0.846

F3 Wax Content

Table F31 The amount of wax content in each crude oils

Sample	Weight (g)						Percent wax content
	Sample dissolved in solvent n-pentane 40 ml.	Sample in solution 5 ml.	Bottle	Filter paper	Bottle+Filter paper+wax crystal	Wax crystal	
Lankrabue crude oil	1.25	0.15625	234.19	0.922	235.15	0.0380	24.32
	1.08	0.13500	234.18	0.928	235.14	0.0320	23.70
	1.18	0.14750	234.16	0.925	235.12	0.0350	23.73
	1.27	0.15875	234.22	0.932	235.19	0.0380	23.94
Average							23.92
U-thong crude oil	1.01	0.12625	234.19	0.923	235.14	0.0270	21.39
	1.06	0.13250	234.18	0.931	235.14	0.0290	21.89
	1.02	0.12750	234.20	0.932	235.16	0.0280	21.96
	1.09	0.13625	234.19	0.930	235.15	0.0300	22.02
Average							21.82
Fang crude oil	1.02	0.12750	234.19	0.925	235.14	0.0257	20.16
	1.03	0.12875	234.18	0.928	235.13	0.0259	20.11
	1.02	0.12750	234.19	0.927	235.14	0.0257	20.15
	1.05	0.13125	234.18	0.925	235.13	0.0264	20.11
Average							20.13

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