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มหาบัณฑิต, สาขาวิชาปิโตรเคมี, สหสาขาวิชาปิโตรเคมี-โพลีเมอร์,  
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ปิโตรเคมี, สหสาขาวิชาปิโตรเคมี-โพลีเมอร์, จุฬาลงกรณ์มหาวิทยาลัย,  
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**Table A1** The molecular weight distributions of heavy distillate, dewaxed oil, desulfurized oil, and isomerized oil

Molecular weight	No. of Carbon	HD Crude		Dewaxed Oil		HDS Oil		HDI Oil	
		%Peak area	t <sub>R</sub> (min)	%Peak area	t <sub>R</sub> (min)	%Peak area	t <sub>R</sub> (min)	%Peak area	t <sub>R</sub> (min)
240	C <sub>17</sub>	0.09	20.19	0.19	20.50				
254	C <sub>18</sub>	0.20	22.81	0.39	23.15	0.21	22.80		
268	C <sub>19</sub>	0.35	25.33	0.67	25.66	0.62	25.32		
282	C <sub>20</sub>	0.72	27.72	1.25	28.09	0.20	27.76		
296	C <sub>21</sub>	1.22	30.01	1.70	30.38	3.77	30.10	1.30	29.52
310	C <sub>22</sub>	2.13	32.23	2.28	32.59	2.84	32.35	2.26	31.69
324	C <sub>23</sub>	2.99	34.35	1.64	34.70	3.73	34.50	2.63	33.79
338	C <sub>24</sub>	5.11	36.37	1.63	36.73	4.33	36.55	3.30	35.82
352	C <sub>25</sub>	6.53	38.33	1.26	38.68	2.87	38.55	3.84	37.75
366	C <sub>26</sub>	9.94	40.21	2.00	40.57	4.38	40.47	10.59	40.25
272				1.42	41.26	3.31	41.10	3.31	40.77
380	C <sub>27</sub>	11.95	42.04	1.92	42.20	2.03	42.33	2.52	42.00
414				7.65	45.03	7.31	44.98	4.37	43.87
398				4.74	48.07	4.76	47.99	8.65	45.34
412				14.01	49.47	14.07	49.44	8.27	46.832
426				12.22	50.99	11.82	50.86	2.52	48.21
440				3.06	52.23	2.93	52.07		
394	C <sub>28</sub>	14.74	43.78						
408	C <sub>29</sub>	13.34	45.45						
422	C <sub>30</sub>	14.11	47.04						
436	C <sub>31</sub>	9.85	48.59						
450	C <sub>32</sub>	7.75	50.09						
464	C <sub>33</sub>	4.58	51.55						
478	C <sub>34</sub>	3.35	52.95						
492	C <sub>35</sub>	1.40	54.31						
506	C <sub>36</sub>	0.95	55.66						
520	C <sub>37</sub>	0.44	56.96						
534	C <sub>38</sub>	0.22	58.29						

**Table A2** The molecular weight distributions of components in desulfurized oils from reaction using various catalyst types

Molecular weight	No. of Carbon	Retention time (min)				
		Dewaxed oil	Mo/Ni/Co	Ni/W	Ni/Mo	Raney nickel
156	C <sub>11</sub>					4.289
170	C <sub>12</sub>					6.376
184	C <sub>13</sub>					9.131
198	C <sub>14</sub>					12.010
212	C <sub>15</sub>					15.002
226	C <sub>16</sub>					17.770
240	C <sub>17</sub>	20.504	20.509	20.512	20.984	20.062
254	C <sub>18</sub>	23.418	23.419	23.420	23.120	23.163
268	C <sub>19</sub>	25.662	25.750	25.784	25.688	25.752
282	C <sub>20</sub>	28.088	28.056	28.101	28.099	28.088
296	C <sub>21</sub>	30.385	30.367	30.395	30.939	30.385
310	C <sub>22</sub>	32.595	32.675	32.680	32.650	32.651
324	C <sub>23</sub>	34.680	34.680	34.724	34.705	34.487
338	C <sub>24</sub>	36.665	36.800	36.811	36.789	36.789
352	C <sub>25</sub>	38.641	38.668	38.710	38.648	38.650
366	C <sub>26</sub>					40.085
272		41.241	41.240	41.245	41.240	41.246
380	C <sub>27</sub>					42.356
414		44.953	44.953	44.995	44.999	45.033
398		47.943	47.943	47.970	47.988	48.067
412		49.336	49.336	49.349	49.365	49.351
426		50.913	50.913	50.944	50.945	50.928
426		51.030	51.030	51.127	51.146	51.130
440		52.142	52.142	52.142	52.142	52.088
492	C <sub>38</sub>	54.620	54.620	54.620	54.620	54.600

**Table A3** The sulfur content of desulfurized oil and physical properties of desulfurized lube fraction from reaction using various types of catalysts (constant conditions: reaction temperature 350 °C, hydrogen pressure 500 psig, reaction time 4 hrs, catalyst concentration 5% by weight of oil and agitation speed 500 rpm)

Properties	dewaxed oil	Catalysts			
		Mo/Ni/Co on Al <sub>2</sub> O <sub>3</sub>	Ni/W on Al <sub>2</sub> O <sub>3</sub>	Ni/Mo on Al <sub>2</sub> O <sub>3</sub>	Raney nickel
Desulfurized oil Sulfur, %wt	0.338	0.039	0.084	0.092	0.214
Desulfurized lube fraction					
Color, visual	>8	3.5	2.5	4	4
Viscosity @ 40 °C,cSt	159.69	91.79	96.98	99.92	113.12
@ 100 °C,cSt	11.10	8.89	8.64	8.68	9.28
VI	22	36	37	32	30
%yield	100	92.30	93.67	93.84	87.60
Pour point, °C	6	4	4	4	4
Characteristic of catalyst before use	-	cylinder	cylinder	cylinder	powder
used catalyst	-	cylinder	powder	cylinder	powder

**Table A4** The molecular weight distributions of components in desulfurized oil produced at various reaction temperatures

Molecular weight	No. of Carbon	Retention time (min.)					
		Dewaxed oil	200 °C	250 °C	300 °C	350 °C	400 °C
156	C <sub>11</sub>						4.289
170	C <sub>12</sub>						6.488
184	C <sub>13</sub>						9.131
198	C <sub>14</sub>						12.010
212	C <sub>15</sub>					15.000	15.002
226	C <sub>16</sub>					17.768	17.773
240	C <sub>17</sub>	20.504	20.509	20.512	20.984	20.060	20.062
254	C <sub>18</sub>	23.418	23.819	23.819	23.120	23.161	23.160
268	C <sub>19</sub>	25.662	25.750	25.784	25.688	25.750	25.752
282	C <sub>20</sub>	28.088	28.056	28.056	28.101	28.099	28.098
296	C <sub>21</sub>	30.385	30.367	30.367	30.395	30.393	30.390
310	C <sub>22</sub>	32.595	32.675	32.680	32.650	32.648	32.591
324	C <sub>23</sub>	34.680	34.680	34.680	34.724	34.705	34.487
338	C <sub>24</sub>	36.665	36.800	36.811	36.789	36.737	36.739
352	C <sub>25</sub>	38.641	38.668	38.710	38.648	38.651	38.650
272		41.241	41.240	41.245	41.240	41.244	41.246
414		45.033	44.953	44.953	44.995	44.999	44.994
398		48.067	47.943	47.943	47.970	47.988	47.975
412		49.475	49.336	49.336	49.349	49.365	49.351
426		50.992	50.913	50.913	50.944	50.945	50.928
426		51.030	51.020	51.020	51.127	51.146	51.180
440		52.227	52.142	52.142	52.127	52.448	52.433
492	C <sub>38</sub>	54.620	54.620	54.620	54.620	54.600	54.600



**Table A5** The sulfur content of desulfurized oil and physical properties of desulfurized lube fraction produced at various reaction temperatures

(constant condition: hydrogen pressure 500 psig, reaction time 4 hrs, Mo/Ni/Co catalyst concentration 5% by weight of oil and agitation speed 500 rpm.)

Properties	Dewaxed oil	Reaction Temperatures (°C)				
		200	250	300	350	400
Desulfurized oil Sulfur, %wt	0.338	0.307	0.250	0.117	0.039	0.010
Desulfurized lube fraction						
Color, visual	>8	>8	7	5	3.5	3
Viscosity @ 40 °C	159.69	156.44	147.31	111.60	102.45	94.72
@ 100 °C	11.10	11.06	10.80	9.28	8.89	8.64
VI	22	24	28	33	36	42
Pour Point, °C	6	6	6	5	4	4
%yield	100	98.70	98.32	97.94	95.86	92.53

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**Table A6** The molecular weight distributions of components in desulfurized oil produced under various hydrogen pressures

Molecular weight	No. of Carbon	Retention time (min.)					
		Dewaxed oil	200 psig	300 psig	400 psig	500 psig	600 psig
156	C <sub>11</sub>		4.310	4.306	4.308	4.310	4.313
170	C <sub>12</sub>		6.452	6.441	6.443	6.485	6.488
184	C <sub>13</sub>		9.169	9.164	9.166	9.170	9.172
198	C <sub>14</sub>		12.029	12.025	12.027	12.030	12.032
212	C <sub>15</sub>		15.002	15.000	15.002	15.006	15.008
226	C <sub>16</sub>		17.769	17.768	17.769	17.770	17.773
240	C <sub>17</sub>	20.104	20.064	20.062	20.064	20.066	20.068
254	C <sub>18</sub>	23.168	23.160	23.160	23.178	23.163	23.167
268	C <sub>19</sub>	25.902	25.862	25.862	25.865	25.861	25.899
282	C <sub>20</sub>	28.099	28.099	28.093	28.094	28.098	28.100
296	C <sub>21</sub>	30.393	30.393	30.385	30.404	30.390	30.393
310	C <sub>22</sub>	32.591	32.591	32.589	32.605	32.598	32.609
324	C <sub>23</sub>	34.705	34.705	34.714	34.487	34.487	34.487
338	C <sub>24</sub>	36.742	36.742	36.731	36.749	36.739	36.739
352	C <sub>25</sub>	38.650	38.650	38.653	38.656	38.648	38.648
272		41.241	41.241	41.245	41.246	41.248	41.248
414		44.999	44.999	44.985	45.001	44.994	44.996
398		47.988	47.988	47.974	47.980	47.975	47.968
412		49.365	49.365	49.351	49.373	49.351	49.361
426		50.947	50.945	50.947	50.951	50.928	50.939
426		51.030	51.180	51.180	51.180	51.180	51.141
440		52.191	52.191	52.179	52.181	52.176	52.100
492	C <sub>38</sub>	54.600	54.600	54.560	54.564	54.558	54.600

**Table A7** The sulfur content of desulfurized oil and physical properties of desulfurized lube fraction produced under various hydrogen pressures

(constant condition: reaction temperature 400 °C, reaction time 4 hrs, Mo/Ni/Co catalyst concentration 5% by weight of oil and agitation speed 500 rpm.)

Properties	Dewaxed oil	Hydrogen Pressures (psig)				
		200	300	400	500	600
Desulfurized oil Sulfur, %wt	0.338	0.193	0.098	0.057	0.010	0.005
Desulfurized lube fraction						
Color, visual	>8	5	4	3.5	3	2.5
Viscosity @ 40 °C	159.69	118.34	112.77	102.89	94.72	89.27
@ 100 °C	11.10	9.36	9.20	8.84	8.64	8.43
VI	22	24	28	33	42	45
Pour Point, °C	6	6	5	5	4	4
%yield	100	92.80	92.70	92.75	92.53	92.40

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**Table A8** The molecular weight distributions of components in desulfurized oil after various reaction times

Molecular weight	No. of Carbon	Retention time (min.)					
		Dewaxed oil	2 hrs	4 hrs	6 hrs	8 hrs	10 hrs
142	C <sub>10</sub>				3.500	3.500	1.383
156	C <sub>11</sub>			4.001	4.000	4.000	4.016
170	C <sub>12</sub>			6.125	6.020	6.100	6.123
184	C <sub>13</sub>			8.680	8.651	8.719	8.668
198	C <sub>14</sub>			11.500	11.089	11.100	11.110
212	C <sub>15</sub>		13.088	13.500	13.601	13.647	13.500
226	C <sub>16</sub>	15.982	15.575	15.943	15.941	15.987	15.986
240	C <sub>17</sub>	18.098	17.960	18.098	17.125	17.126	17.200
254	C <sub>18</sub>	20.553	20.238	20.268	20.189	20.200	20.200
268	C <sub>19</sub>	22.156	22.099	22.196	22.400	22.398	22.421
282	C <sub>20</sub>	24.120	24.098	24.088	24.300	24.357	24.378
296	C <sub>21</sub>	26.089	26.066	26.159	26.201	26.199	26.201
310	C <sub>22</sub>	27.750	27.748	27.889	28.00	27.998	2800
324	C <sub>23</sub>	29.553	29.652	29.647	29.688	29.690	29.690
338	C <sub>24</sub>	31.187	31.186	31.235	31.350	31.350	31.352
352	C <sub>25</sub>	32.885	32.886	32.800	32.788	32.790	32.988
272		34.310	34.300	34.250	34.500	34.490	34.500
414		37.969	37.676	37.771	38.171	38.105	38.779
398		40.389	40.489	40.500	40.750	40.750	47.80
412		41.614	41.614	41.686	41.816	41.683	41.816
426		42.784	42.784	42.834	42.941	42.830	42.941
440		43.751	43.751	43.802	44.066	44.830	44.066

**Table A9** The sulfur content of desulfurized oil and physical properties of desulfurized lube fraction after various reaction times

(constant condition: reaction temperature 400 °C, hydrogen pressure 600 psig, Mo/Ni/Co catalyst concentration 5% by weight of oil and agitation speed 500 rpm.)

Properties	Dewaxed oil	Reaction times (hrs)				
		2	4	6	8	10
Desulfurized oil Sulfur, %wt	0.338	0.017	0.005	<0.001	<0.001	<0.001
Desulfurized lube fraction						
Color, visual	>8	4	3	2.5	2.5	2.5
Viscosity @ 40 °C	159.69	104.6	89.27	77.59	70.63	66.14
@ 100 °C	11.10	9.07	8.43	7.86	7.43	7.21
VI	22	38	45	49	49	50
Pour Point, °C	6	5	4	3	3	2
%yield	100	95.64	92.53	90.15	86.50	78.20

**Table A10** The molecular weight distributions of components in desulfurized oil produced using various catalyst concentrations

Molecular weight	No. of Carbon	Retention time (min.)					
		Dewaxed oil	1 %	2 %	3 %	4 %	5 %
170	C <sub>12</sub>		1.380	1.380	1.383	1.382	1.384
184	C <sub>13</sub>		4.250	4.250	4.307	4.288	4.288
198	C <sub>14</sub>		6.489	6.490	6.490	6.490	6.398
212	C <sub>15</sub>		9.149	9.149	9.200	9.129	9.135
226	C <sub>16</sub>		12.011	12.028	12.009	12.008	12.013
240	C <sub>17</sub>	20.500	14.980	14.980	14.980	14.988	14.986
254	C <sub>18</sub>	23.100	17.772	17.787	17.768	17.768	17.775
268	C <sub>19</sub>	25.680	20.680	20.698	20.680	20.698	20.700
282	C <sub>20</sub>	28.099	28.097	28.096	28.077	28.096	28.101
296	C <sub>21</sub>	30.393	30.390	30.406	30.387	30.389	30.395
310	C <sub>22</sub>	32.650	32.593	32.607	32.560	32.590	32.595
324	C <sub>23</sub>	34.705	34.800	34.804	34.802	34.700	34.860
338	C <sub>24</sub>	36.742	36.739	36.740	36.750	36.740	36.741
352	C <sub>25</sub>	38.750	38.600	38.620	38.622	38.665	38.680
272		41.065	41.088	41.100	41.100	41.150	41.166
414		44.999	44.975	44.994	44.968	44.993	44.995
398		47.988	47.964	47.985	47.942	47.968	47.970
412		49.365	49.352	49.361	49.337	49.344	49.349
426		50.945	50.930	50.956	50.988	50.924	50.944
440		52.191	52.189	52.187	52.180	52.175	52.175

**Table A11** The sulfur content of desulfurized oil and physical properties of desulfurized lube fraction produced using various catalyst concentrations (constant condition: reaction temperature 400 °C, hydrogen pressure 600 psig, reaction time 6 hrs, and agitation speed 500 rpm.)

Properties	Dewaxed oil	Catalyst Concentrations (% by weight of oil)				
		1	2	3	4	5
Desulfurized oil Sulfur, %wt	0.338	0.026	0.009	0.004	<0.001	<0.001
Desulfurized lube fraction Color, visual	>8	3.5	3.5	3-3.5	2.5	2.5
Viscosity @ 40 °C	159.69	113.80	99.50	91.62	81.44	77.59
@ 100 °C	11.10	9.47	8.83	8.54	8.06	7.86
VI	22	36	40	45	49	49
Pour Point, °C	6	3	3	3	3	3
%yield	100	92.43	91.45	91.18	91.04	90.15

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**Table A12** The molecular weight distributions of components in isomerized oil produced at various reaction temperatures

Molecular weight	No. of Carbon	Retention time (min.)				
		HDS Oil	250 °C	300 °C	350 °C	400 °C
156	C <sub>11</sub>	4.288	4.286	4.285	4.288	4.289
170	C <sub>12</sub>	6.490	6.432	6.489	6.442	6.476
184	C <sub>13</sub>	9.147	9.147	9.146	9.108	9.111
198	C <sub>14</sub>	12.029	12.029	11.992	12.030	11.993
212	C <sub>15</sub>	14.988	14.988	14.896	14.894	14.860
226	C <sub>16</sub>	17.772	17.772	17.757	17.733	17.757
240	C <sub>17</sub>	20.545	20.545	20.512	20.498	20.500
254	C <sub>18</sub>	23.098	23.098	23.100	23.135	23.153
268	C <sub>19</sub>	25.703	25.703	25.689	25.664	25.665
282	C <sub>20</sub>	28.108	28.108	28.095	28.069	28.096
296	C <sub>21</sub>	30.405	30.405	30.392	30.366	30.393
310	C <sub>22</sub>	32.550	32.550	32.560	32.650	32.582
324	C <sub>23</sub>	34.738	34.738	34.726	34.678	34.705
338	C <sub>24</sub>	36.860	36.860	36.811	36.789	36.789
352	C <sub>25</sub>	38.668	38.668	38.710	38.648	38.650
272		40.980	40.980	40.981	40.900	40.989
414		45.031	45.031	44.999	44.970	44.969
398		48.021	48.021	48.011	47.960	47.963
412		49.408	49.408	49.400	49.347	49.351
426		50.968	50.968	50.939	50.907	50.911
440		52.425	52.425	52.389	52.398	52.375



**Table A13** The physical properties of isomerized oil produced at various reaction temperatures

(constant condition: hydrogen pressure 600 psig, reaction time 4 hrs, Pt/F catalyst concentration 6% by weight of oil, and agitation speed 500 rpm.)

Properties	Pretreated oil	Reaction Temperatures (°C)			
		250	300	350	400
Sulfur, %wt	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Color, visual	2.5	1.5	0.5-1.0	0.5	1
Viscosity					
@ 40 °C	81.44	67.85	63.12	61.30	57.36
@ 100 °C	8.06	7.57	7.40	7.32	7.09
Viscosity Index	49	63	70	73	74
Pour Point, °C	4	2	2	1	0
%yield raffinate (330 °C+)	100	88.43	88.49	86.92	77.59

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**Table A14** The molecular weight distributions of components in isomerized oil produced under various hydrogen pressures

Molecular weight	No. of Carbon	Retention time (min.)				
		HDS Oil	300 psig	400 psig	500 psig	600 psig
156	C <sub>11</sub>	4.288	4.300	4.285	4.288	4.289
170	C <sub>12</sub>	6.500	6.422	6.489	6.442	6.476
184	C <sub>13</sub>	9.147	9.108	9.111	9.108	9.111
198	C <sub>14</sub>	12.029	12.031	11.993	12.030	12.028
212	C <sub>15</sub>	14.988	14.894	14.896	14.894	14.890
226	C <sub>16</sub>	17.772	17.733	17.754	17.733	17.755
240	C <sub>17</sub>	20.545	20.545	20.512	20.498	20.500
254	C <sub>18</sub>	23.189	23.188	23.150	23.165	23.189
268	C <sub>19</sub>	25.703	25.664	25.685	25.664	25.765
282	C <sub>20</sub>	28.108	28.069	28.102	28.069	28.088
296	C <sub>21</sub>	30.405	30.366	30.393	30.366	30.385
310	C <sub>22</sub>	32.690	32.600	32.582	32.620	32.682
324	C <sub>23</sub>	34.738	34.678	34.705	34.678	34.805
338	C <sub>24</sub>	36.860	36.858	36.811	36.789	36.789
352	C <sub>25</sub>	38.668	38.666	38.710	38.648	38.650
272		40.980	40.981	40.981	40.979	40.981
414		45.031	44.970	44.969	44.970	44.969
398		48.021	47.960	47.963	47.960	47.963
412		49.408	49.347	49.351	49.408	49.400
426		50.968	50.907	50.911	50.907	50.906
440		52.424	52.420	52.419	52.498	52.375

**Table A15** The physical properties of isomerized oil produced under various hydrogen pressures

(constant condition: reaction temperature 350 °C, reaction time 4 hrs, Pt/F catalyst concentration 6% by weight of oil, and agitation speed 500 rpm.)

Properties	Pretreated oil	Hydrogen Pressures (psig)			
		300	400	500	600
Sulfur, %wt	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Color, visual	2.5	1	0.5	0.5	0.5
Viscosity					
@ 40 °C	81.44	67.36	65.65	63.30	61.30
@ 100 °C	8.06	7.71	7.62	7.47	7.32
Viscosity Index	49	69	71	72	73
Pour Point, °C	4	3	2	1	1
%yield raffinate (330 °C+)	100	87.84	87.70	87.16	86.92

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**Table A16** The molecular weight distributions of components in isomerized oil after various reaction times

Molecular weight	No. of Carbon	Retention time (min.)				
		HDS Oil	4 hrs	8 hrs	12 hrs	16 hrs
156	C <sub>11</sub>	4.288	4.288	4.288	4.288	4.289
170	C <sub>12</sub>	6.500	6.500	6.442	6.398	6.510
184	C <sub>13</sub>	9.147	9.147	9.108	9.129	9.191
198	C <sub>14</sub>	12.029	12.029	12.030	12.013	12.071
212	C <sub>15</sub>	14.988	14.988	14.894	14.917	14.920
226	C <sub>16</sub>	17.772	17.772	17.733	17.778	17.833
240	C <sub>17</sub>	20.545	20.545	20.498	20.498	20.500
254	C <sub>18</sub>	23.189	23.189	23.165	23.165	23.189
268	C <sub>19</sub>	25.703	25.703	25.664	25.687	25.750
282	C <sub>20</sub>	28.108	28.108	28.069	28.092	28.171
296	C <sub>21</sub>	30.405	30.405	30.366	30.410	30.473
310	C <sub>22</sub>	32.690	32.690	32.620	32.620	32.661
324	C <sub>23</sub>	34.738	34.738	34.678	34.722	34.781
338	C <sub>24</sub>	36.860	36.860	36.789	36.738	36.802
352	C <sub>25</sub>	38.668	38.668	38.665	38.710	38.743
272		40.980	40.980	40.979	40.979	40.981
414		45.031	45.031	44.970	44.970	44.969
398		48.021	48.021	47.960	47.960	47.963
412		49.408	49.408	49.347	49.349	49.406
426		50.968	50.968	50.907	59.414	49.406
440		52.424	52.424	52.498	52.498	52.375

**Table A17** The physical properties of isomerized oil after various reaction times

(constant condition: reaction temperature 350 °C, hydrogen pressure 600 psig, Pt/F catalyst concentration 6% by weight of oil, and agitation speed 500 rpm.)

Properties	Pretreated oil	Reaction Times (hrs)			
		4	8	12	16
Sulfur, %wt	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Color, visual	2.5	0.5	0.5	0.5	0.5
Viscosity					
@ 40 °C	81.44	61.30	58.70	54.87	40.19
@ 100 °C	8.06	7.32	7.16	6.98	5.78
Viscosity Index	49	73	73	78	78
Pour Point, °C	4	1	1	0	0
%yield raffinate (330 °C+)	100	86.92	85.12	81.49	74.96

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**Table A18** The molecular weight distributions of components in isomerized oil produced using various catalyst concentrations

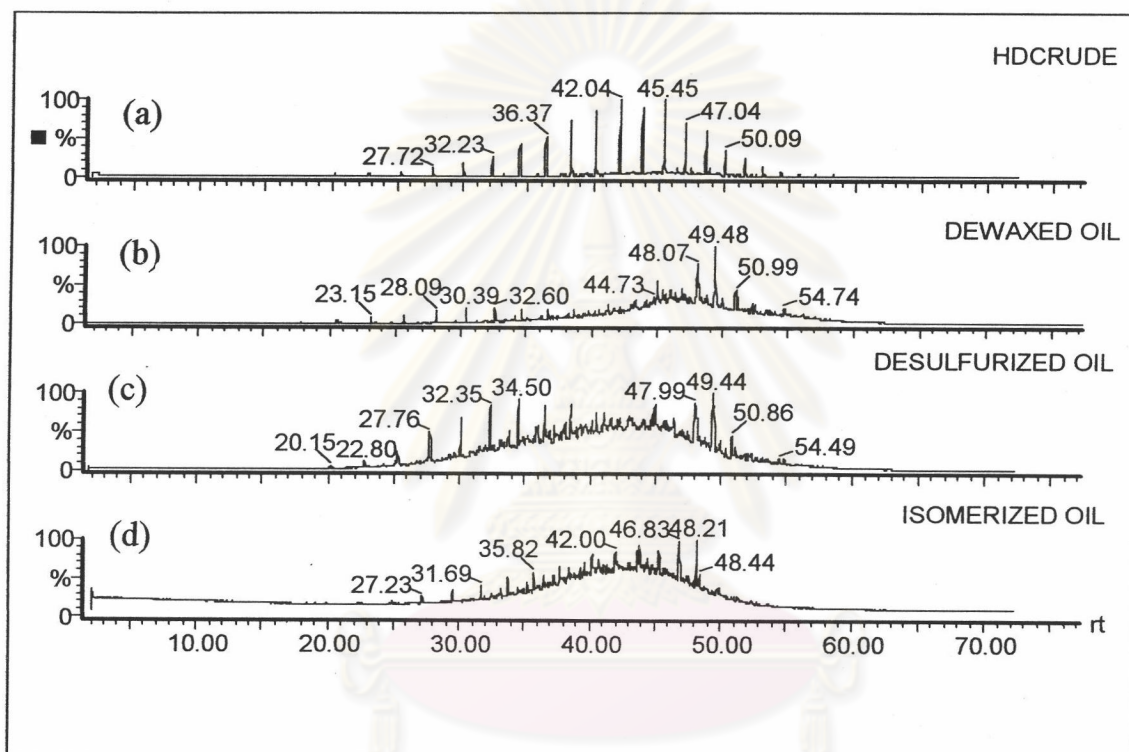
Molecular weight	No. of Carbon	Retention time (min.)				
		HDS Oil	2 %	4 %	6 %	8 %
156	C <sub>11</sub>	4.288	4.274	4.288	4.278	4.289
170	C <sub>12</sub>	6.500	6.500	6.463	6.442	6.442
184	C <sub>13</sub>	9.147	9.131	9.128	9.108	9.108
198	C <sub>14</sub>	12.029	12.000	12.012	12.013	12.071
212	C <sub>15</sub>	14.933	14.917	14.916	14.894	14.894
226	C <sub>16</sub>	17.772	17.755	17.754	17.733	17.733
240	C <sub>17</sub>	20.545	20.535	20.435	20.432	20.432
254	C <sub>18</sub>	23.189	23.186	23.150	23.128	23.128
268	C <sub>19</sub>	25.703	25.686	25.685	25.664	25.664
282	C <sub>20</sub>	28.108	28.091	28.090	28.069	28.069
296	C <sub>21</sub>	30.405	30.388	30.387	30.366	30.366
310	C <sub>22</sub>	32.690	32.688	32.686	32.661	32.661
324	C <sub>23</sub>	34.738	34.700	34.699	34.678	34.678
338	C <sub>24</sub>	36.860	36.737	36.736	36.714	36.714
352	C <sub>25</sub>	38.704	38.660	38.665	38.710	38.710
272		40.980	40.976	40.968	40.979	40.979
414		45.031	44.992	44.970	44.970	44.970
398		48.021	47.983	47.960	47.960	47.960
412		49.408	49.369	49.347	49.347	49.347
426		50.968	50.930	50.907	50.907	50.907
440		52.489	52.498	52.498	52.498	52.498

**Table A19** The physical properties of isomerized oil produced using various Pt/F catalyst concentrations

(constant condition: reaction temperature 350 °C, hydrogen pressure 600 psig, reaction time 12 hrs, and agitation speed 500 rpm.)

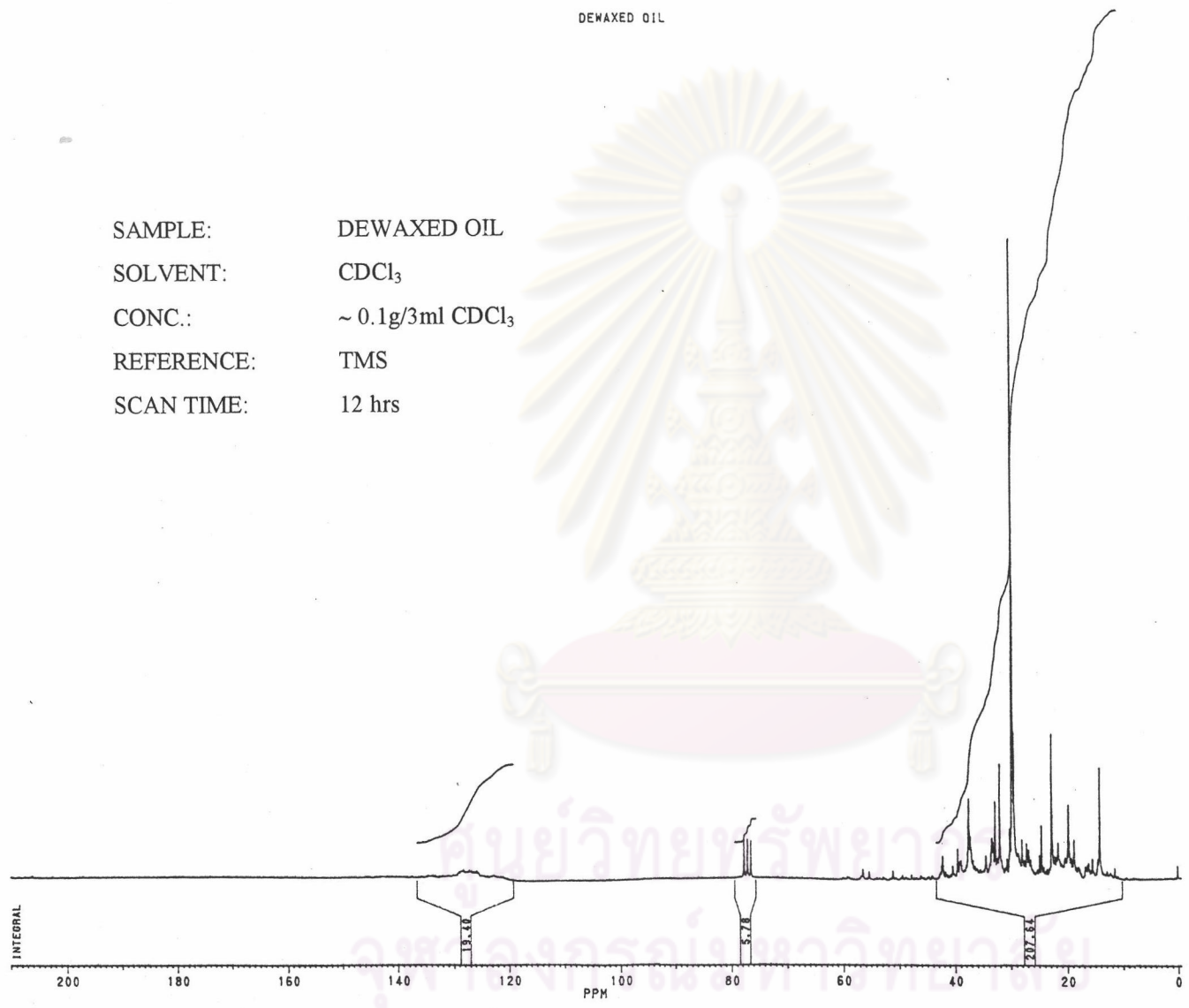
Properties	Pretreated oil	Catalyst Concentrations (% by weight of oil)			
		2	4	6	8
Sulfur, %wt	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Color, visual	2.5	1	0.5-1.0	0.5	0.5
Viscosity					
@ 40 °C	81.44	63.48	59.23	54.87	48.65
@ 100 °C	8.06	7.25	7.21	6.98	6.54
Viscosity Index	49	62	73	78	79
Pour Point, °C	4	1	1	0	0
%yield raffinate (330 °C+)	100	82.29	82.30	81.49	80.62

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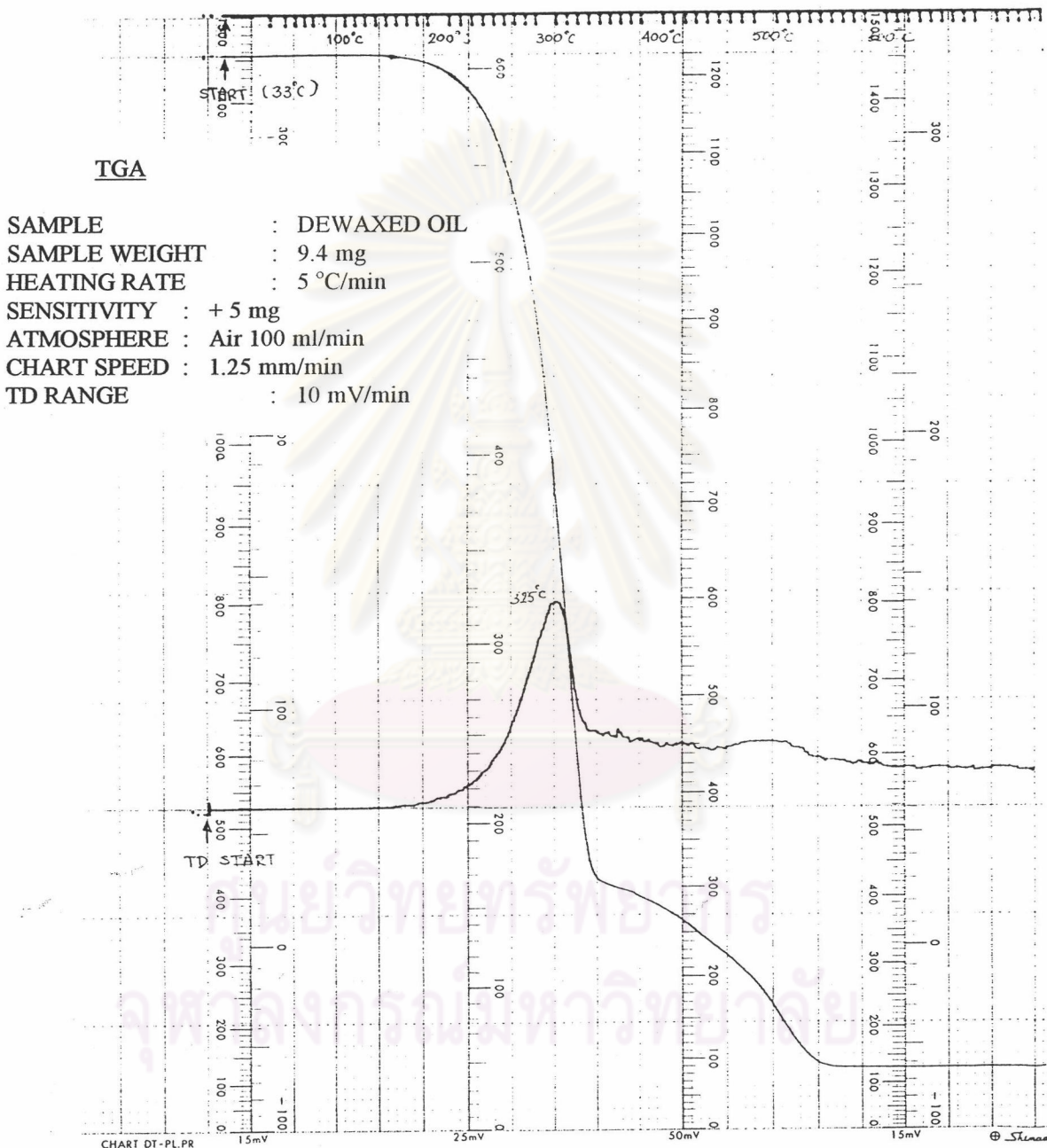


**Figure A1** GC/MS chromatograms of heavy distillate (a), dewaxed oil (b), desulfurized oil (c) and isomerized oil (d)

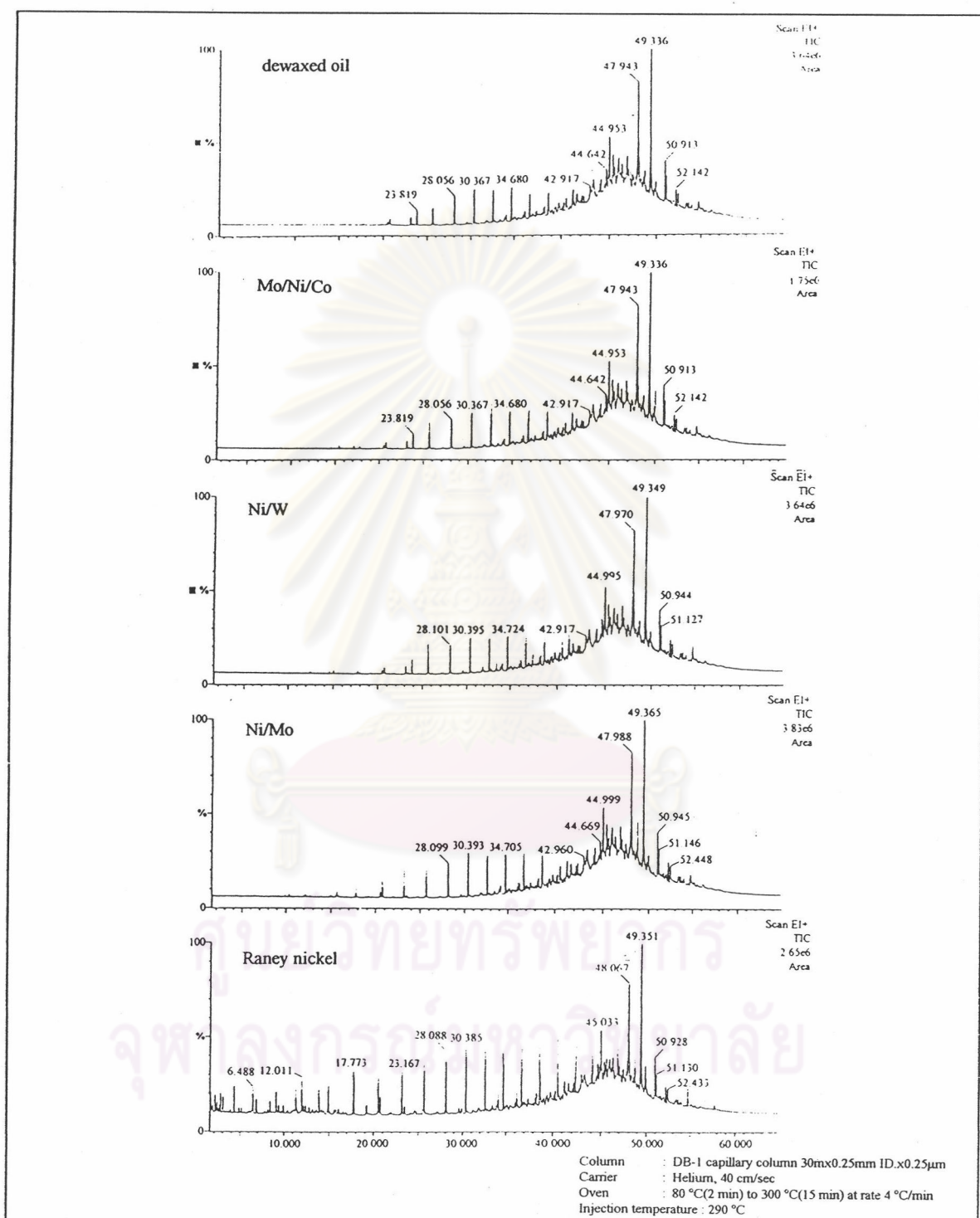




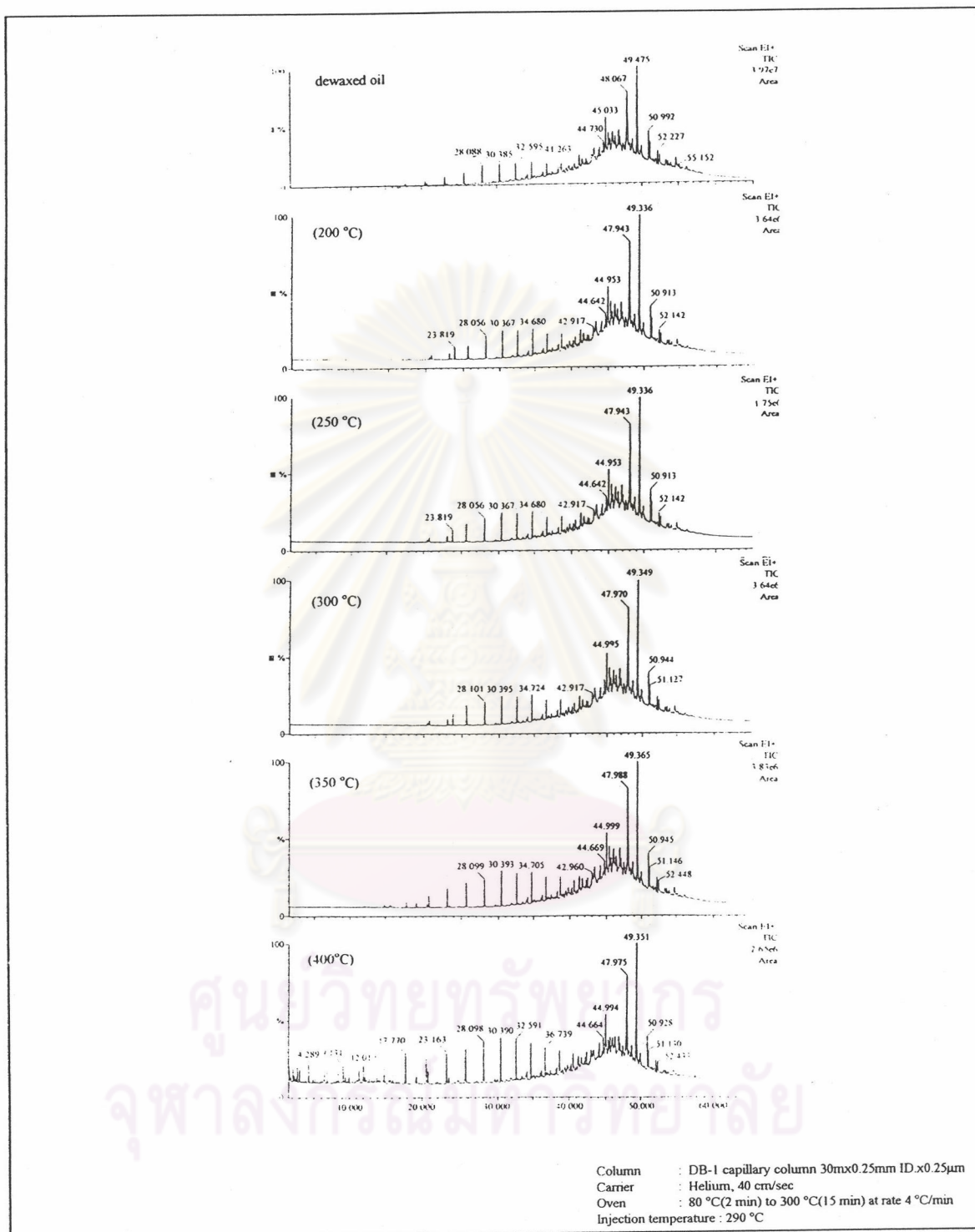
**Figure A2**  $^{13}\text{C}$ -NMR spectrum of dewaxed oil



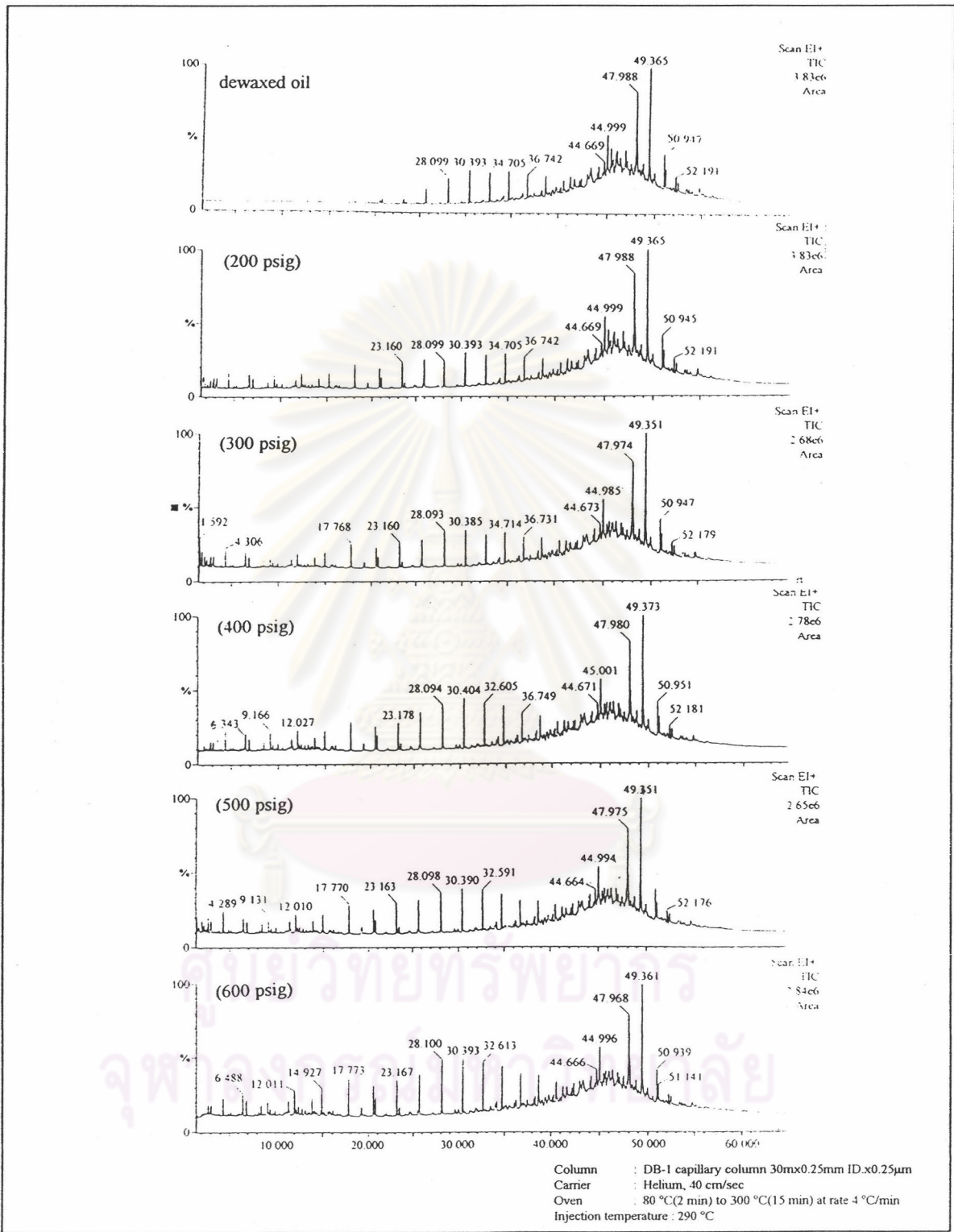
**Figure A3** Thermooxidation stability curve of dewaxed oil



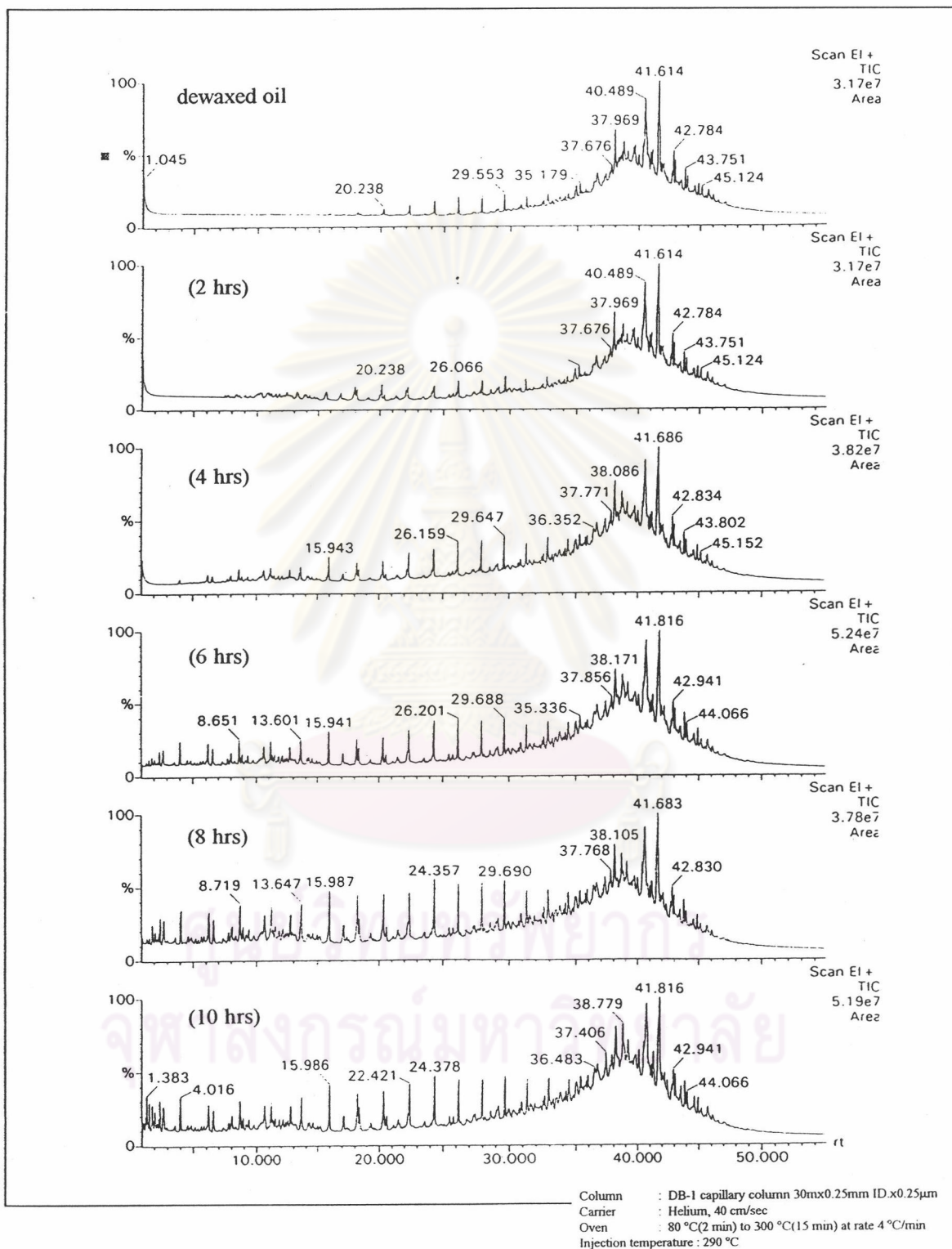
**Figure A4** GC/MS chromatograms of desulfurized oil from reaction using various catalyst types



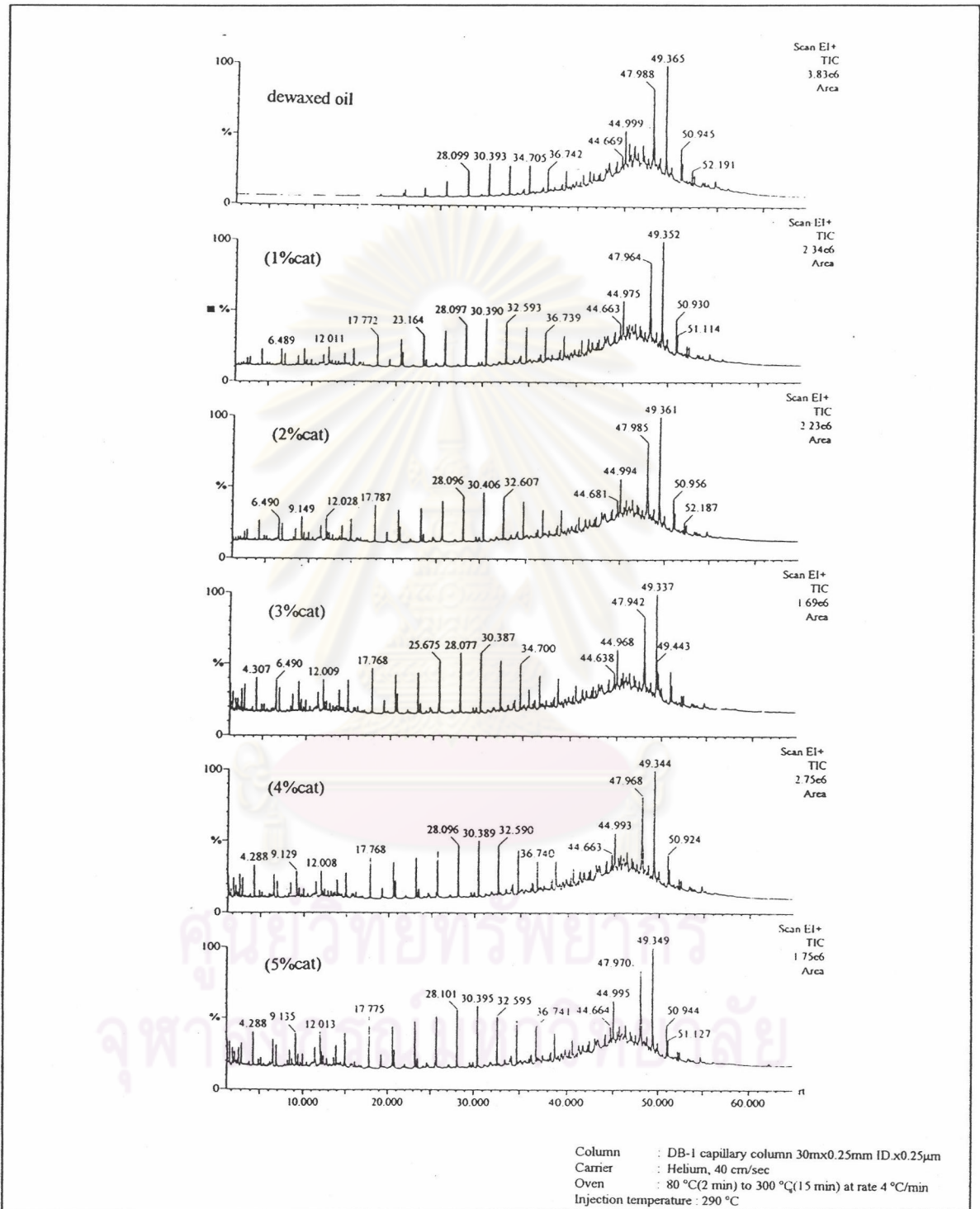
**Figure A5** GC/MS chromatograms of desulfurized oil produced at various reaction temperatures



**Figure A6** GC/MS chromatograms of desulfurized oil produced under various hydrogen pressures

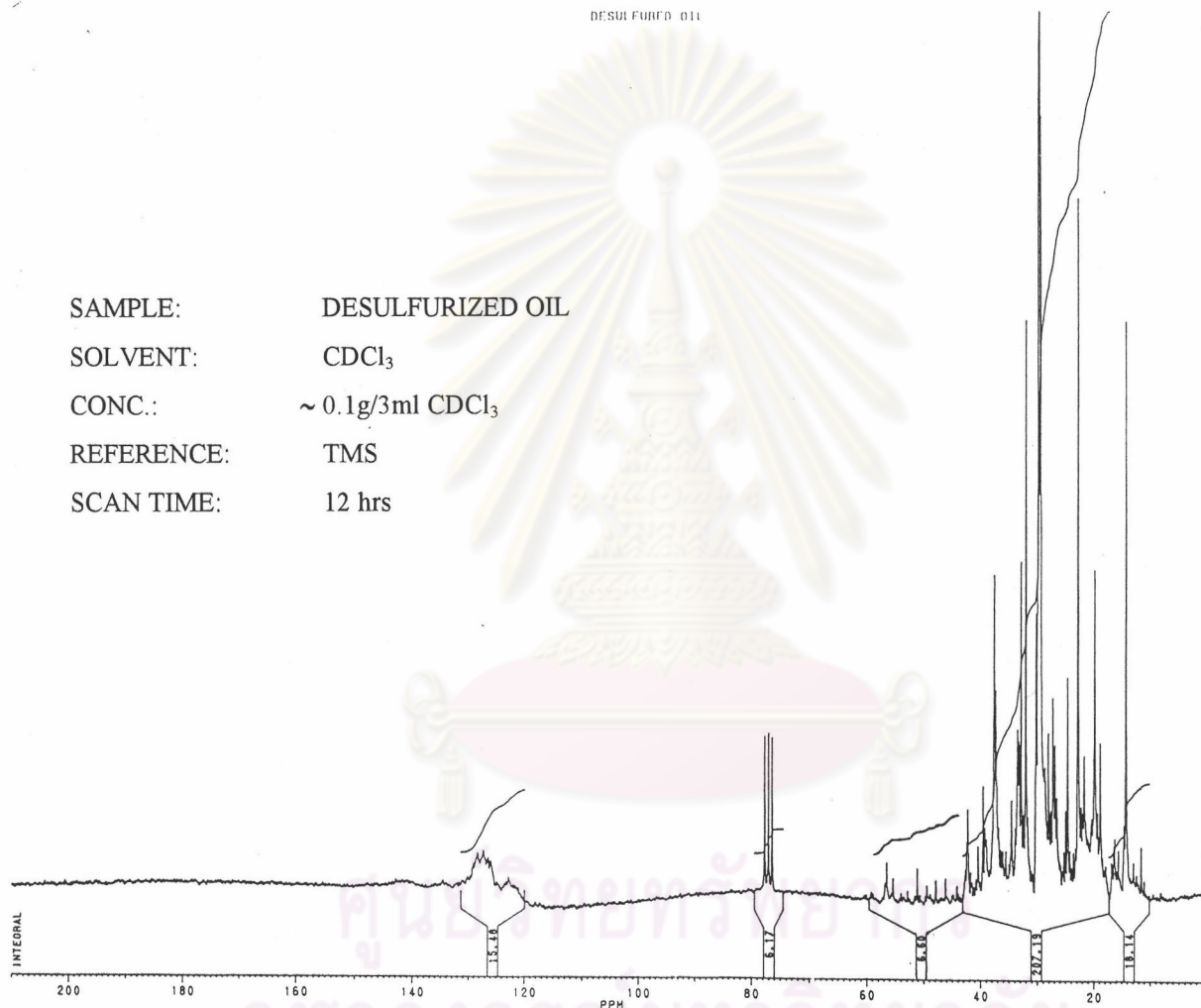


**Figure A7** GC/MS chromatograms of desulfurized oil after various reaction times



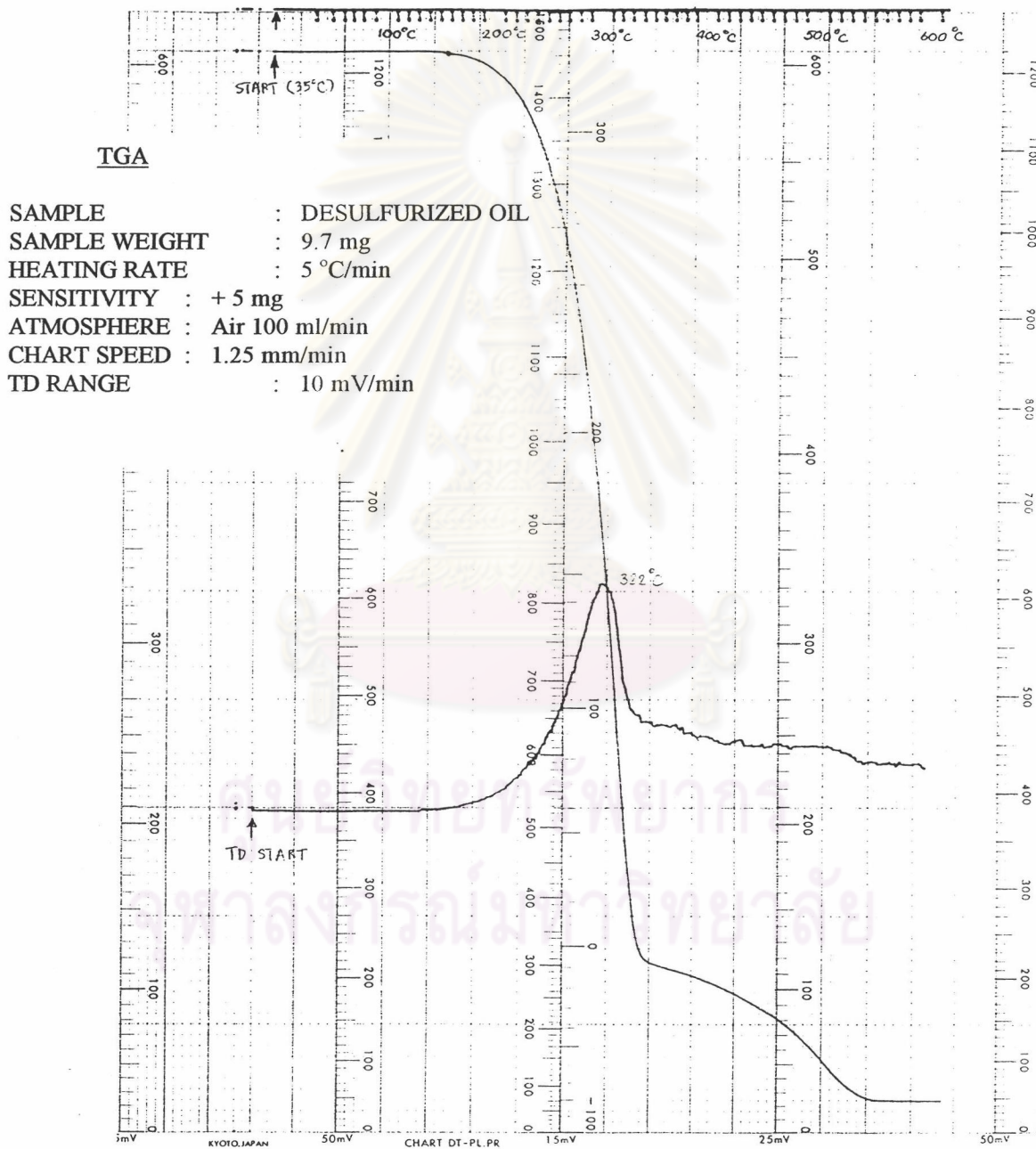
**Figure A8** GC/MS chromatograms of desulfurized oil produced using various catalyst concentrations

SAMPLE: DESULFURIZED OIL  
SOLVENT:  $\text{CDCl}_3$   
CONC.:  $\sim 0.1\text{g}/3\text{ml } \text{CDCl}_3$   
REFERENCE: TMS  
SCAN TIME: 12 hrs

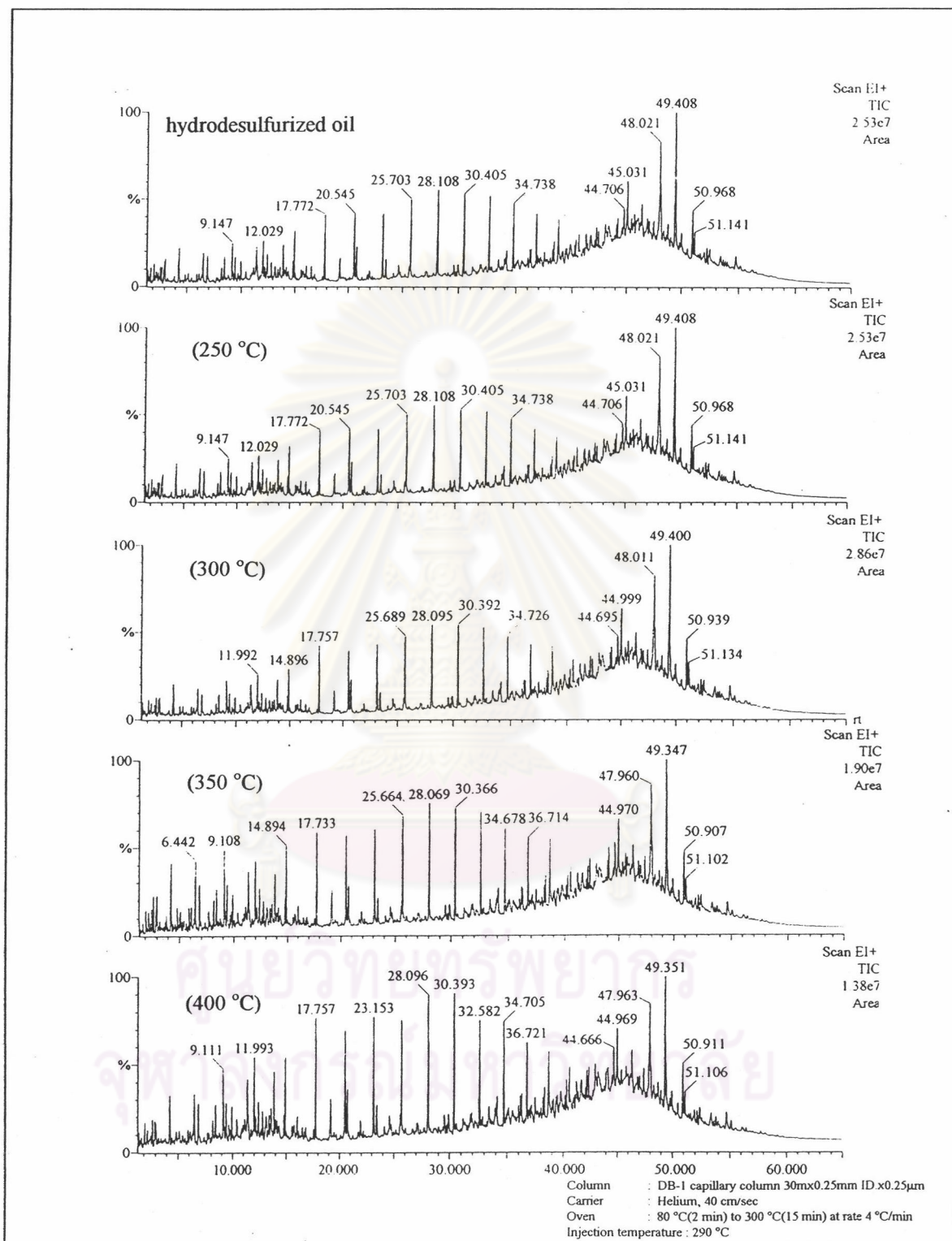


**Figure A9**  $^{13}\text{C}$ -NMR spectrum of desulfurized oil

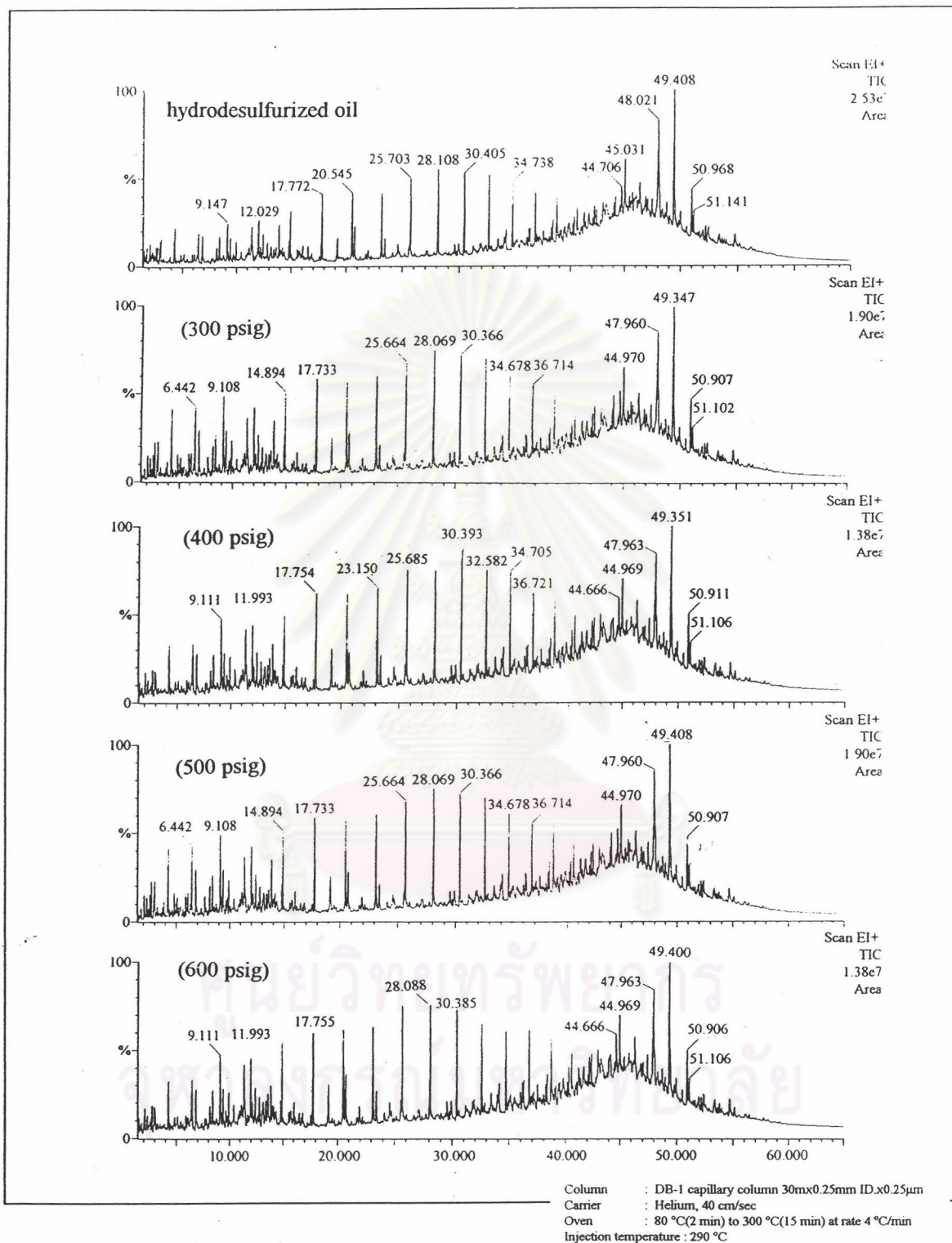




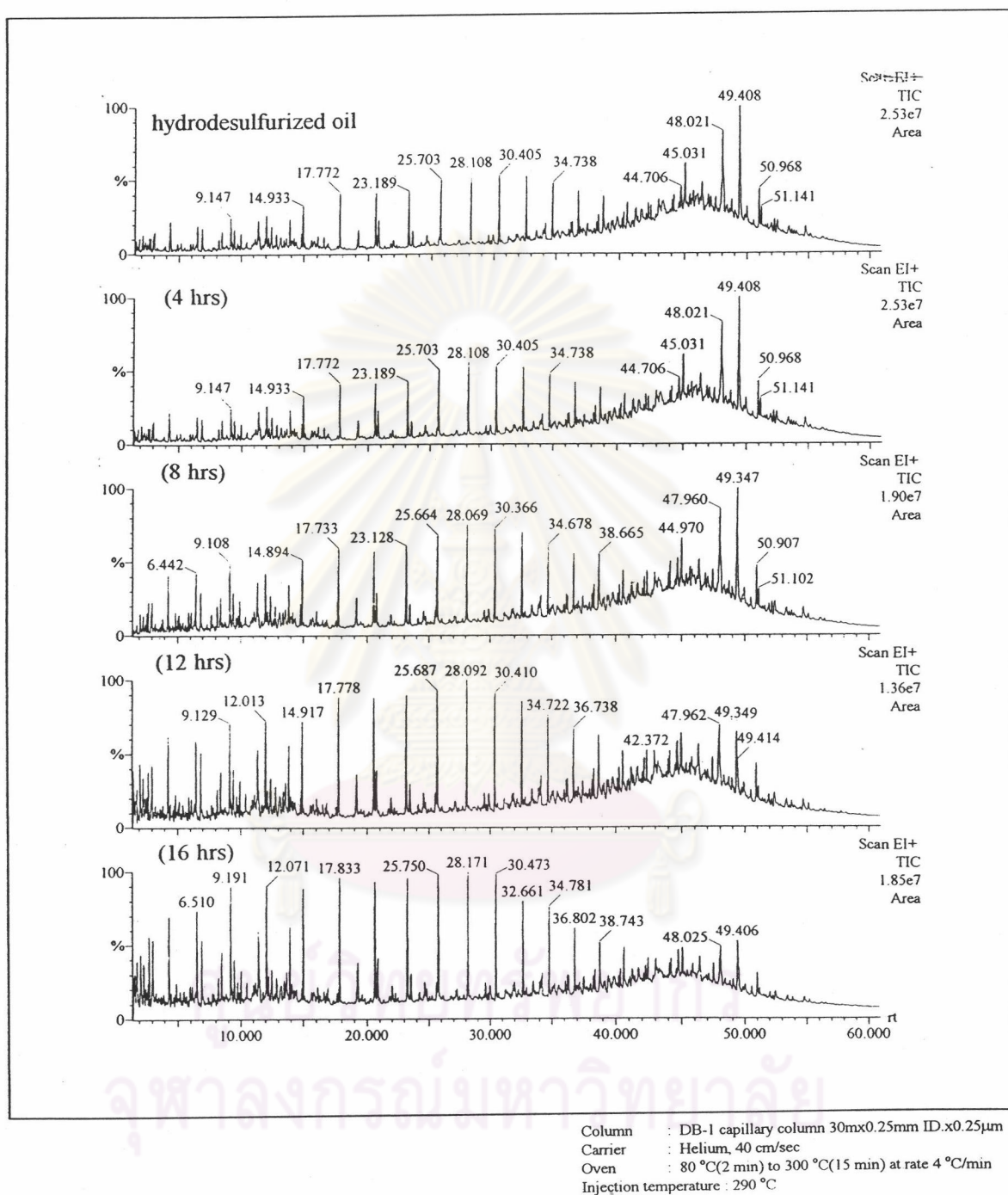
**Figure A10** Thermooxidation stability curve of desulfurized oil



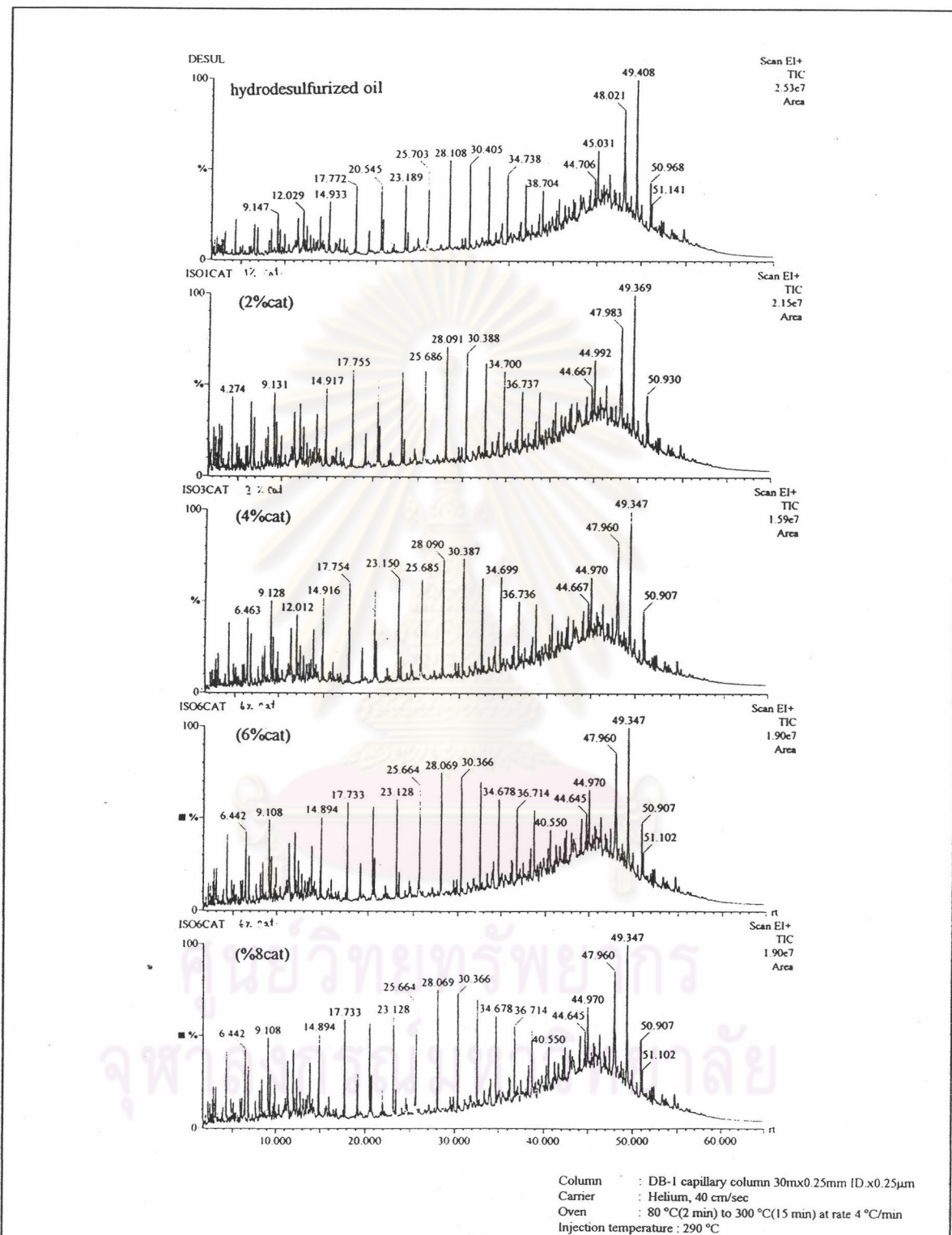
**Figure A11** GC/MS chromatograms of isomerized oil produced at various reaction temperatures



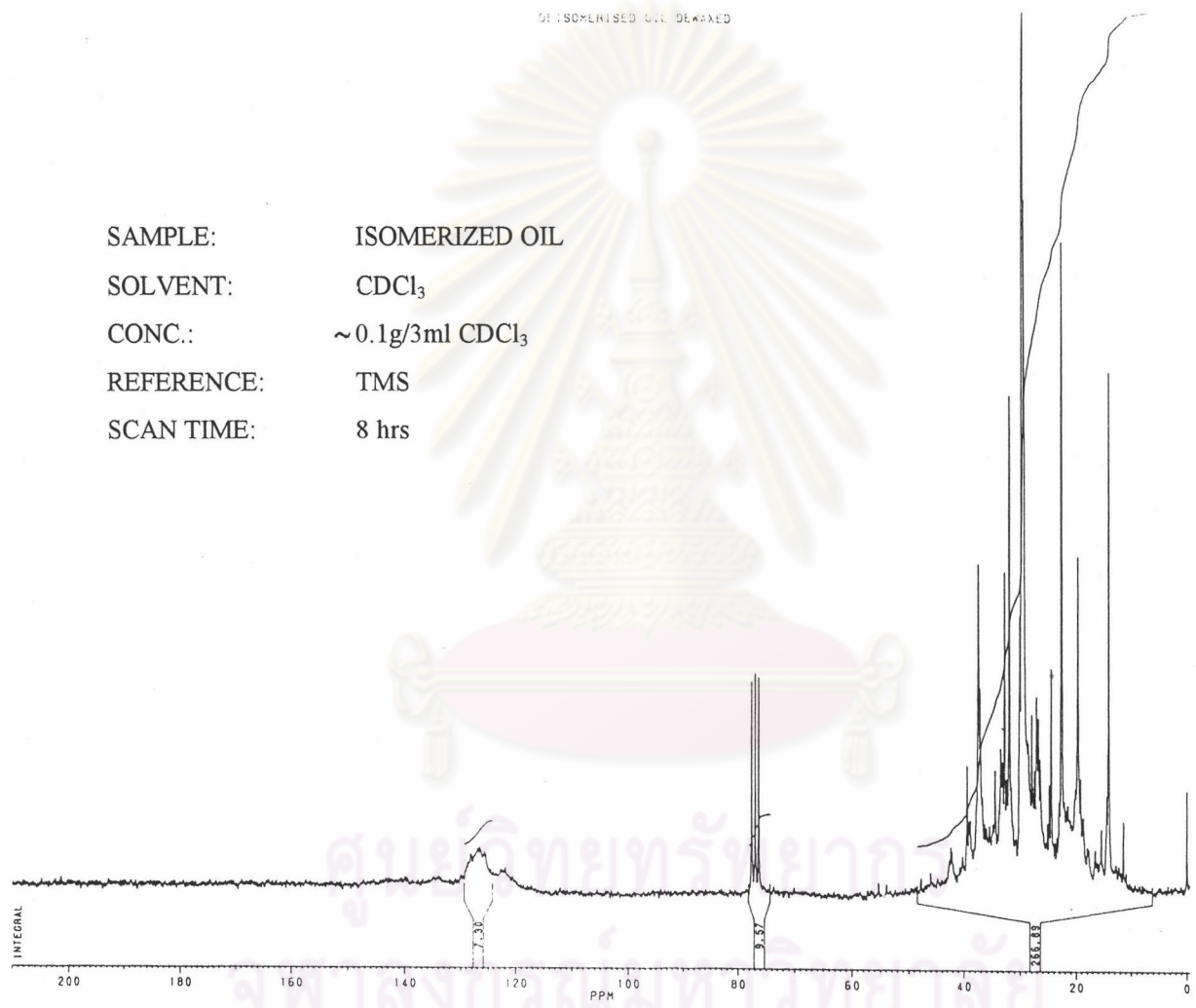
**Figure A12** GC/MS chromatograms of isomerized oil produced under various hydrogen pressures



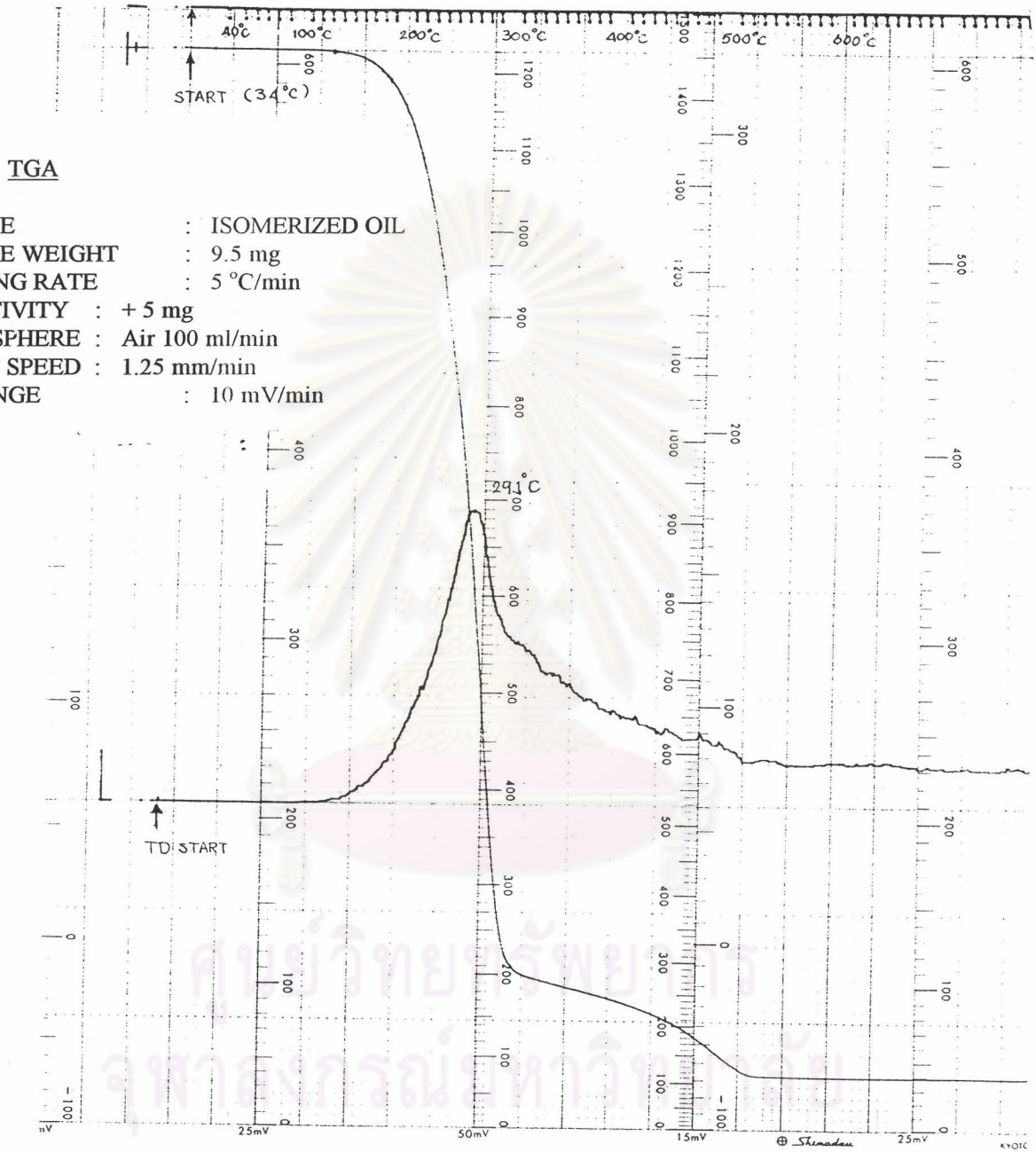
**Figure A13** GC/MS chromatograms of isomerized oil after various reaction times



**Figure A14** GC/MS chromatograms of isomerized oil produced using various catalyst concentrations



**Figure A15** <sup>13</sup>C-NMR spectrum of isomerized oil



**Figure A16** Thermooxidation stability curve of isomerized oil

## VITA

Miss Amporn Chomngam was born on October 11, 1970 in Chonburi. She received her Bachelor's Degree of Science in Chemistry from Chulalongkorn University in 1992. She has been a graduate student studying Petrochemistry in Chulalongkorn University since 1992.



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