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APPENDICES

APPENDIX A

DETAILS OF SOME EXPERIMENTAL RESULTS

A-1:

PRESSURE	5 bars
TEMPERATURE	240 ^{o}C
LIQUID HOURLY SPACE VELOCITY	2.7 h^{-1}
CATALYST TYPE	0.5 wt% Pt/USY

Component	Selectivity (%)	Product Distribution (wt%)	STY (g/cm^3cat-h)
C_3H_8	1.27	1.31	$1.01x10^{-2}$
i-C_4H_{10}	1.32	1.34	$1.04x10^{-2}$
2,2-DMP	3.08	3.08	$2.43x10^{-2}$
2,4-DMP	4.70	4.70	$3.72x10^{-2}$
3,3-DMP	1.70	1.70	$1.35x10^{-2}$
2-MH	45.81	45.79	0.36
3-MH	38.90	38.88	0.31
3-EP	3.20	3.20	$2.53x10^{-2}$

n-Heptane conversion (%)	42.80
Selectivity of C_7 isomers (%)	97.40
Selectivity of cracked products (%)	2.60
STY of C_7 isomers (g/cm^3-h)	0.77
STY of cracked products (g/cm^3-h)	0.02

A-2:

PRESSURE	5 bars
TEMPERATURE	260 ^{o}C
LIQUID HOURLY SPACE VELOCITY	2.7 h^{-1}
CATALYST TYPE	0.5 wt% Pt/USY

Component	Selectivity (%)	Product Distribution (wt%)	STY (g/cm^3cat-h)
C_3H_8	8.36	8.56	0.12
i-C_4H_{10}	8.43	8.52	0.12
2,2-DMP	6.24	6.22	$9.14x10^{-2}$
2,4-DMP	6.69	6.66	$9.80x10^{-2}$
2,2,3-TMB	0.79	0.79	$1.16x10^{-2}$
3,3-DMP	4.01	4.00	$5.88x10^{-2}$
2-MH	32.69	32.58	0.48
2,3-DMP	3.02	3.00	$4.42x10^{-2}$
3-MH	27.42	27.32	0.40
3-EP	2.35	2.34	$3.45x10^{-2}$

n-Heptane conversion (%)	79.34
Selectivity of C_7 isomers (%)	83.21
Selectivity of cracked products (%)	16.79
STY of C_7 isomers (g/cm^3-h)	1.22
STY of cracked products (g/cm^3-h)	0.25

A-3:

PRESSURE	5 bars
TEMPERATURE	280 ^{o}C
LIQUID HOURLY SPACE VELOCITY	2.7 h^{-1}
CATALYST TYPE	0.5 wt% Pt/USY

Component	Selectivity (%)	Product Distribution (wt%)	STY (g/cm^3cat-h)
C_3H_8	25.63	26.04	0.44
$i-C_4H_{10}$	23.93	24.03	0.41
$N-C_4H_{10}$	0.68	0.69	$1.18x10^{-2}$
$i-C_5H_{12}$	0.21	0.21	$3.68x10^{-3}$
2,2-DMP	4.84	4.79	$8.33x10^{-2}$
2,4-DMP	4.12	4.08	$7.09x10^{-2}$
2,2,3-TMB	1.10	1.09	$1.90x10^{-2}$
3,3-DMP	3.53	3.50	$6.08x10^{-2}$
2-MH	16.63	16.45	0.29
2,3-DMP	3.48	3.44	$5.99x10^{-2}$
3-MH	14.61	14.46	0.25
3-EP	1.23	1.22	$2.11x10^{-2}$

n-Heptane conversion (%)	93.19
Selectivity of C_7 isomers (%)	49.54
Selectivity of cracked products (%)	50.46
STY of C_7 isomers (g/cm^3-h)	0.85
STY of cracked products (g/cm^3-h)	0.87

A-4:

PRESSURE	5 bars
TEMPERATURE	300 ^{o}C
LIQUID HOURLY SPACE VELOCITY	2.7 h^{-1}
CATALYST TYPE	0.5 wt% Pt/USY

Component	Selectivity (%)	Product Distribution (wt%)	STY (g/cm^3cat-h)
C_3H_8	43.86	44.23	0.80
$i-C_4H_{10}$	41.41	41.28	0.75
$N-C_4H_{10}$	1.83	1.82	$3.33x10^{-2}$
$i-C_5H_{12}$	0.36	0.36	$6.61x10^{-3}$
2,2-DMP	1.12	1.10	$2.04x10^{-2}$
2,4-DMP	0.93	0.91	$1.69x10^{-2}$
2,2,3-TMB	0.37	0.36	$6.75x10^{-3}$
3,3-DMP	0.85	0.84	$1.55x10^{-2}$
2-MH	3.96	3.88	$7.20x10^{-2}$
2,3-DMP	1.39	1.36	$2.52x10^{-2}$
3-MH	3.63	3.57	$6.61x10^{-2}$
3-EP	0.29	0.28	$5.23x10^{-3}$

n-Heptane conversion (%)	98.52
Selectivity of C_7 isomers (%)	12.54
Selectivity of cracked products (%)	87.46
STY of C_7 isomers (g/cm^3-h)	0.23
STY of cracked products (g/cm^3-h)	1.59

A-5:

PRESSURE	5 bars
TEMPERATURE	320 ^{o}C
LIQUID HOURLY SPACE VELOCITY	2.7 h^{-1}
CATALYST TYPE	0.5 wt% Pt/USY

Component	Selectivity (%)	Product Distribution (wt%)	STY (g/cm^3cat-h)
C_3H_8	50.59	50.87	0.93
$i-C_4H_{10}$	46.08	45.81	0.85
$N-C_4H_{10}$	2.94	2.93	$5.44x10^{-2}$
$i-C_5H_{12}$	0.39	0.39	$7.26x10^{-3}$

n-Heptane conversion (%)	100
Selectivity of C_7 isomers (%)	0
Selectivity of cracked products (%)	100
STY of C_7 isomers (g/cm^3-h)	0
STY of cracked products (g/cm^3-h)	1.85

APPENDIX B

EXAMPLE OF CALCULATION

PRESSURE	5 bars
TEMPERATURE	240 ^{o}C
LIQUID HOURLY SPACE VELOCITY	2.7 h^{-1}
CATALYST TYPE	0.5 wt% Pt/USY
SIZE RANGE OF CATALYST	20-30 mesh
AMOUNT OF CATALYST	1.3447 g
VOLUME OF CATALYST	1.5 cm^3
RATIO OF H_2/N-HEPTANE	10 mol/mol
N-HEPTANE FEED RATE	2.77 g/h

MATERIAL BALANCE

Basis : 1 hour operation

Input

Component	G-mol	Grams
1. H_2	0.3499	0.6998
2. n-Heptane	0.0277	2.7731
Total	0.3776	3.4729

Output

Component	G-mol	Grams
1. H_2	0.3496	0.6992
2. C_3H_8	5.54×10^{-4}	1.56×10^{-2}
3. i-C_4H_{10}	2.74×10^{-4}	1.59×10^{-2}
4. 2,2-DMP	3.66×10^{-4}	3.66×10^{-2}
5. 2,4-DMP	5.58×10^{-4}	5.58×10^{-2}
6. 3,3-DMP	2.02×10^{-4}	2.02×10^{-2}
7. 2-MH	5.44×10^{-3}	0.544
8. 3-MH	4.62×10^{-3}	0.462
9. 3-EP	3.80×10^{-4}	3.80×10^{-2}
10. n-Heptane	1.59×10^{-2}	1.586
Total	0.3779	3.4733

CONVERSION OF N-HEPTANE

$$\text{N-HEPTANE CONVERSION} = \frac{\text{GRAM MOLES OF N-HEPTANE CONVERTED}}{\text{GRAM MOLES OF N-HEPTANE FED}} \times 100$$

$$= \frac{(2.77 \times 10^{-2}) - (1.59 \times 10^{-2})}{2.77 \times 10^{-2}} \times 100$$

$$= 42.80\ \%$$

ISO-HEPTANE SELECTIVITY

$$\text{ISO-HEPTANE SELECTIVITY} = \frac{\text{GRAM ATOMS OF CARBON IN ALL i-}C_7\text{ PRODUCTS}}{\text{GRAM ATOMS OF CARBON IN CONVERTED N-}C_7H_{16}} \times 100$$

$$= \frac{\{(3.66+5.58+2.02+54.4+46.2+3.8)\times10^{-4})\times7\}}{\{(2.77\times10^{-2} - 1.59\times10^{-2}) \times 7\}} \times 100$$

$$= 97.40\ \%$$

SPACE TIME YIELD (STY)

$$\text{STY OF i-}C_7H_{16}\ [g/cm^3\text{-h}] = \frac{\%\text{CONV} \times \%\text{SEL} \times \text{N-HEPTANE FEED RATE (mol h}^{-1})}{100 \times 100 \times \text{CATALYST VOLUME (cm}^3)}$$

$$= \frac{42.80 \times 97.40 \times 0.028}{100 \times 100 \times 1.5}$$

$$= 7.70\times10^{-3}\ \text{mol/cm}^3\text{-h} \quad (0.77\ \text{g/cm}^3\text{-h})$$

PRODUCT DISTRIBUTION

COMPONENT	PRODUCT DISTRIBUTION (wt%)
C_3H_8	1.31
i-C_4H_{10}	1.34
2,2-DMP	3.08
2,4-DMP	4.70
3,3-DMP	1.70
2-MH	45.79
3-MH	38.88
3-EP	3.20
TOTAL	100.00

Note : % PRODUCT DISTRIBUTION OF EACH COMPONENT

$$= \frac{\text{GRAM(S) OF EACH COMPONENT IN PRODUCT}}{\text{TOTAL GRAMS OF ALL COMPONENT}} \times 100$$

VITA

Mr. Mana Amornkitbamrung was born on March 30, 1965, in Nongkhai, Thailand. He graduated from Chulalongkorn University, with a Bachelor of Science in Chemical Engineering in 1987. Prior to study in Master's program he worked at Lever Brothers (Thailand) Ltd. as production supervisor in 1987-1988.