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## APPENDICES

### Appendix A Predicted Mole Fraction

Table A1 Predicted mole fraction at 300°C

W/F (hr)	Tetralin	<i>cis</i> -Decalin	<i>trans</i> -Decalin
0.0000	0.0387	0.0000	0.0000
0.0005	0.0384	0.0001	0.0003
0.0010	0.0380	0.0003	0.0005
0.0015	0.0377	0.0004	0.0008
0.0020	0.0373	0.0005	0.0011
0.0025	0.0370	0.0007	0.0013
0.0030	0.0366	0.0008	0.0016
0.0035	0.0363	0.0009	0.0018
0.0040	0.0360	0.0011	0.0021
0.0045	0.0356	0.0012	0.0023
0.0050	0.0353	0.0013	0.0026
0.0055	0.0350	0.0014	0.0028
0.0060	0.0346	0.0016	0.0031
0.0065	0.0343	0.0017	0.0033
0.0070	0.0340	0.0018	0.0036
0.0075	0.0337	0.0019	0.0038
0.0080	0.0333	0.0020	0.0041
0.0085	0.0330	0.0022	0.0043
0.0090	0.0327	0.0023	0.0045
0.0095	0.0324	0.0024	0.0048
0.0100	0.0321	0.0025	0.0050
0.0105	0.0318	0.0026	0.0052
0.0110	0.0315	0.0028	0.0055
0.0115	0.0312	0.0029	0.0057
0.0120	0.0309	0.0030	0.0059
0.0125	0.0306	0.0031	0.0061
0.0130	0.0303	0.0032	0.0064
0.0135	0.0300	0.0033	0.0066
0.0140	0.0297	0.0034	0.0068
0.0145	0.0294	0.0035	0.0070
0.0150	0.0291	0.0037	0.0072

W/F (hr)	Tetralin	<i>cis</i> -Decalin	<i>trans</i> -Decalin
0.0155	0.0288	0.0038	0.0075
0.0160	0.0285	0.0039	0.0077
0.0165	0.0283	0.0040	0.0079
0.0170	0.0280	0.0041	0.0081
0.0175	0.0277	0.0042	0.0083
0.0180	0.0274	0.0043	0.0085
0.0185	0.0271	0.0044	0.0087
0.0190	0.0269	0.0045	0.0089
0.0195	0.0266	0.0046	0.0091
0.02	0.0263	0.0047	0.0093
0.0205	0.0261	0.0048	0.0095
0.021	0.0258	0.0049	0.0097
0.0215	0.0256	0.0050	0.0099
0.022	0.0253	0.0051	0.0101
0.0225	0.0250	0.0052	0.0103
0.023	0.0248	0.0053	0.0105
0.0235	0.0245	0.0054	0.0107
0.024	0.0243	0.0055	0.0109
0.0245	0.0240	0.0056	0.0111
0.025	0.0238	0.0057	0.0112
0.0255	0.0236	0.0058	0.0114
0.026	0.0233	0.0058	0.0116
0.0265	0.0231	0.0059	0.0118
0.027	0.0228	0.0060	0.0120
0.0275	0.0226	0.0061	0.0121
0.028	0.0224	0.0062	0.0123
0.0285	0.0221	0.0063	0.0125
0.029	0.0219	0.0064	0.0127
0.0295	0.0217	0.0065	0.0128
0.03	0.0215	0.0065	0.0130

**Table A2** Predicted mole fraction at 285°C

W/F (hr)	Tetralin	<i>cis</i> -Decalin	<i>trans</i> -Decalin
0.0000	0.0387	0.0000	0.0000
0.0005	0.0383	0.0002	0.0003
0.0010	0.0378	0.0004	0.0007
0.0015	0.0373	0.0005	0.0010
0.0020	0.0368	0.0007	0.0014
0.0025	0.0364	0.0009	0.0017
0.0030	0.0359	0.0011	0.0020
0.0035	0.0355	0.0012	0.0024
0.0040	0.0350	0.0014	0.0027
0.0045	0.0346	0.0016	0.0030
0.0050	0.0341	0.0017	0.0033
0.0055	0.0337	0.0019	0.0037
0.0060	0.0333	0.0020	0.0040
0.0065	0.0328	0.0022	0.0043
0.0070	0.0324	0.0024	0.0046
0.0075	0.0320	0.0025	0.0049
0.0080	0.0316	0.0027	0.0052
0.0085	0.0312	0.0028	0.0055
0.0090	0.0308	0.0030	0.0058
0.0095	0.0304	0.0031	0.0061
0.0100	0.0300	0.0033	0.0064
0.0105	0.0296	0.0034	0.0067
0.0110	0.0292	0.0036	0.0069
0.0115	0.0288	0.0037	0.0072
0.0120	0.0284	0.0039	0.0075
0.0125	0.0280	0.0040	0.0078
0.0130	0.0277	0.0041	0.0080
0.0135	0.0273	0.0043	0.0083
0.0140	0.0269	0.0044	0.0086
0.0145	0.0266	0.0046	0.0088
0.0150	0.0262	0.0047	0.0091
0.0155	0.0259	0.0048	0.0094
0.0160	0.0255	0.0050	0.0096
0.0165	0.0252	0.0051	0.0099
0.0170	0.0248	0.0052	0.0101

W/F (hr)	Tetralin	<i>cis</i> -Decalin	<i>trans</i> -Decalin
0.0175	0.0245	0.0053	0.0104
0.0180	0.0242	0.0055	0.0106
0.0185	0.0238	0.0056	0.0108
0.0190	0.0235	0.0057	0.0111
0.0195	0.0232	0.0058	0.0113
0.0200	0.0229	0.0060	0.0115
0.0205	0.0226	0.0061	0.0118
0.0210	0.0223	0.0062	0.0120
0.0215	0.0219	0.0063	0.0122
0.0220	0.0216	0.0064	0.0124
0.0225	0.0213	0.0065	0.0127
0.0230	0.0211	0.0066	0.0129
0.0235	0.0208	0.0068	0.0131
0.0240	0.0205	0.0069	0.0133
0.0245	0.0202	0.0070	0.0135
0.0250	0.0199	0.0071	0.0137
0.0255	0.0196	0.0072	0.0139
0.0260	0.0194	0.0073	0.0141
0.0265	0.0191	0.0074	0.0143
0.0270	0.0188	0.0075	0.0145
0.0275	0.0186	0.0076	0.0147
0.0280	0.0183	0.0077	0.0149
0.0285	0.0180	0.0078	0.0151
0.0290	0.0178	0.0079	0.0153
0.0295	0.0175	0.0080	0.0155
0.0300	0.0173	0.0081	0.0157

**Table A3** Predicted mole fraction at 270°C

W/F (hr)	Tetralin	<i>cis</i> -Decalin	<i>trans</i> -Decalin
0.0000	0.0387	0.0000	0.0000
0.0005	0.0381	0.0002	0.0005
0.0010	0.0375	0.0005	0.0009
0.0015	0.0368	0.0007	0.0013
0.0020	0.0362	0.0009	0.0018
0.0025	0.0356	0.0012	0.0022

W/F (hr)	Tetralin	<i>cis</i> -Decalin	<i>trans</i> -Decalin
0.0030	0.0350	0.0014	0.0026
0.0035	0.0344	0.0016	0.0031
0.0040	0.0338	0.0018	0.0035
0.0045	0.0332	0.0021	0.0039
0.0050	0.0326	0.0023	0.0043
0.0055	0.0321	0.0025	0.0047
0.0060	0.0315	0.0027	0.0051
0.0065	0.0310	0.0029	0.0055
0.0070	0.0304	0.0031	0.0058
0.0075	0.0299	0.0033	0.0062
0.0080	0.0294	0.0035	0.0066
0.0085	0.0289	0.0037	0.0070
0.0090	0.0283	0.0039	0.0073
0.0095	0.0278	0.0041	0.0077
0.0100	0.0273	0.0042	0.0080
0.0105	0.0269	0.0044	0.0084
0.0110	0.0264	0.0046	0.0087
0.0115	0.0259	0.0048	0.0090
0.0120	0.0254	0.0050	0.0094
0.0125	0.0250	0.0051	0.0097
0.0130	0.0245	0.0053	0.0100
0.0135	0.0241	0.0055	0.0103
0.0140	0.0237	0.0056	0.0106
0.0145	0.0232	0.0058	0.0110
0.0150	0.0228	0.0059	0.0113
0.0155	0.0224	0.0061	0.0116
0.0160	0.0220	0.0063	0.0118
0.0165	0.0216	0.0064	0.0121
0.0170	0.0212	0.0066	0.0124
0.0175	0.0208	0.0067	0.0127
0.0180	0.0204	0.0069	0.0130
0.0185	0.0200	0.0070	0.0132
0.0190	0.0196	0.0071	0.0135
0.0195	0.0193	0.0073	0.0138
0.0200	0.0189	0.0074	0.0140
0.0205	0.0186	0.0075	0.0143
0.0210	0.0182	0.0077	0.0145
0.0215	0.0179	0.0078	0.0148
0.0220	0.0175	0.0079	0.0150



W/F (hr)	Tetralin	<i>cis</i> -Decalin	<i>trans</i> -Decalin
0.0225	0.0172	0.0081	0.0153
0.0230	0.0169	0.0082	0.0155
0.0235	0.0166	0.0083	0.0157
0.0240	0.0163	0.0084	0.0160
0.0245	0.0159	0.0085	0.0162
0.0250	0.0156	0.0087	0.0164
0.0255	0.0153	0.0088	0.0166
0.0260	0.0150	0.0089	0.0168
0.0265	0.0148	0.0090	0.0170
0.0270	0.0145	0.0091	0.0172
0.0275	0.0142	0.0092	0.0174
0.0280	0.0139	0.0093	0.0176
0.0285	0.0137	0.0094	0.0178
0.0290	0.0134	0.0095	0.0180
0.0295	0.0131	0.0096	0.0182
0.0300	0.0129	0.0097	0.0184

**Table A4** Predicted mole fraction at 255°C

W/F (hr)	Tetralin	<i>cis</i> -Dec	<i>trans</i> -Dec
0.0000	0.0387	0.0000	0.0000
0.0005	0.0379	0.0003	0.0006
0.0010	0.0371	0.0006	0.0012
0.0015	0.0363	0.0010	0.0018
0.0020	0.0356	0.0013	0.0023
0.0025	0.0348	0.0016	0.0029
0.0030	0.0341	0.0019	0.0034
0.0035	0.0333	0.0022	0.0040
0.0040	0.0326	0.0024	0.0045
0.0045	0.0319	0.0027	0.0050
0.0050	0.0312	0.0030	0.0055
0.0055	0.0305	0.0033	0.0061
0.0060	0.0298	0.0036	0.0066
0.0065	0.0291	0.0038	0.0070
0.0070	0.0285	0.0041	0.0075
0.0075	0.0278	0.0043	0.0080
0.0080	0.0272	0.0046	0.0085

W/F (hr)	Tetralin	<i>cis</i> -Decalin	<i>trans</i> -Decalin
0.0085	0.0266	0.0048	0.0089
0.0090	0.0260	0.0051	0.0094
0.0095	0.0254	0.0053	0.0098
0.0100	0.0248	0.0056	0.0103
0.0105	0.0242	0.0058	0.0107
0.0110	0.0236	0.0060	0.0111
0.0115	0.0231	0.0062	0.0115
0.0120	0.0225	0.0065	0.0119
0.0125	0.0220	0.0067	0.0123
0.0130	0.0214	0.0069	0.0127
0.0135	0.0209	0.0071	0.0131
0.0140	0.0204	0.0073	0.0134
0.0145	0.0199	0.0075	0.0138
0.0150	0.0194	0.0077	0.0142
0.0155	0.0190	0.0079	0.0145
0.0160	0.0185	0.0080	0.0148
0.0165	0.0181	0.0082	0.0152
0.0170	0.0176	0.0084	0.0155
0.0175	0.0172	0.0086	0.0158
0.0180	0.0167	0.0087	0.0161
0.0185	0.0163	0.0089	0.0164
0.0190	0.0159	0.0091	0.0167
0.0195	0.0155	0.0092	0.0170
0.0200	0.0151	0.0094	0.0173
0.0205	0.0147	0.0095	0.0176
0.0210	0.0144	0.0097	0.0179
0.0215	0.0140	0.0098	0.0182
0.0220	0.0136	0.0100	0.0184
0.0225	0.0133	0.0101	0.0187
0.0230	0.0130	0.0103	0.0189
0.0235	0.0126	0.0104	0.0192
0.0240	0.0123	0.0105	0.0194
0.0245	0.0120	0.0106	0.0196
0.0250	0.0117	0.0108	0.0199
0.0255	0.0114	0.0109	0.0201
0.0260	0.0111	0.0110	0.0203
0.0265	0.0108	0.0111	0.0205

W/F (hr)	Tetralin	<i>cis</i> -Decalin	<i>trans</i> -Decalin
0.0270	0.0105	0.0112	0.0207
0.0275	0.0102	0.0113	0.0209
0.0280	0.0099	0.0114	0.0211
0.0285	0.0097	0.0115	0.0213
0.0290	0.0094	0.0116	0.0215
0.0295	0.0092	0.0117	0.0217
0.0300	0.0089	0.0118	0.0219

## Appendix B Experimental Mole Fraction

**Table B1** Experimental mole fraction at 300 °C

Tetralin flow rate is 3.66 mL/hr (3.55 g/hr).

W (g)	W/F (hr)	Tetralin	<i>cis</i> -Decalin	<i>trans</i> -Decalin
0.02	0.0056	0.0353	0.0015	0.0024
0.04	0.0085	0.0343	0.0020	0.0031
0.05	0.0113	0.0307	0.0035	0.0056
0.06	0.0141	0.0300	0.0036	0.0062
0.07	0.0169	0.0294	0.0041	0.0065
0.08	0.0225	0.0263	0.0052	0.0088
0.1	0.0282	0.0248	0.0061	0.0096

**Table B2** Experimental mole fraction at 285 °C

Tetralin flow rate is 3.66 mL/hr (3.55 g/hr).

W (g)	W/F (hr)	Tetralin	<i>cis</i> -Decalin	<i>trans</i> -Decalin
0.02	0.0056	0.0319	0.0029	0.0048
0.04	0.0085	0.0291	0.0039	0.0071
0.05	0.0113	0.0286	0.0041	0.0074
0.06	0.0141	0.0243	0.0051	0.0113
0.07	0.0169	0.0232	0.0060	0.0116
0.08	0.0225	0.0202	0.0072	0.0138
0.1	0.0282	0.0194	0.0065	0.0154

**Table B3** Experimental mole fraction at 270 °C

Tetralin flow rate is 3.66 mL/hr (3.55 g/hr).

W (g)	W/F (hr)	Tetralin	<i>cis</i> -Decalin	<i>trans</i> -Decalin
0.02	0.0056	0.0309	0.0035	0.0054
0.04	0.0085	0.0284	0.0047	0.0070
0.05	0.0113	0.0274	0.0049	0.0079
0.06	0.0141	0.0222	0.0062	0.0125
0.07	0.0169	0.0199	0.0070	0.0144
0.08	0.0225	0.0148	0.0092	0.0179
0.1	0.0282	0.0147	0.0086	0.0186

**Table B4** Experimental mole fraction at 255 °C

Tetralin flow rate is 3.66 mL/hr (3.55 g/hr).

W (g)	W/F (hr)	Tetralin	<i>cis</i> -Decalin	<i>trans</i> -Decalin
0.02	0.0056	0.0061	0.0043	0.0296
0.04	0.0085	0.0076	0.0051	0.0276
0.05	0.0113	0.0087	0.0051	0.0266
0.06	0.0141	0.0116	0.0070	0.0223
0.08	0.0225	0.0186	0.0095	0.0139

### Appendix C Calculations of Product Distribution

Tetralin feed = 3.66 ml/hr

$$\begin{aligned} \text{Convert to mole flowrate} &= 3.66 \frac{\text{mL}}{\text{hr}} * 0.97 \frac{\text{g}}{\text{mL}} * \frac{\text{gmol}}{132\text{g}} \\ &= 0.027 \frac{\text{gmol}}{\text{hr}} \end{aligned}$$

**Table C1** %Area reported by GC at W/F = 0.0113 hr and temperature of 255 °C

<i>trans</i> -decalin	<i>cis</i> -Decalin	Tetralin
22.05	12.82	64.21

%Area is related to mass composition.

Calculation of mole fraction in liquid

Mole fraction of *trans*-decalin

$$\begin{aligned} &= (22.05/138) / (22.05/138 + 12.82/138 + 64.21/132) \\ &= 0.2162 \end{aligned}$$

Mole fraction of *cis*-decalin

$$\begin{aligned} &= (12.82/138) / (22.05/138 + 12.82/138 + 64.21/132) \\ &= 0.1257 \end{aligned}$$

Mole of fraction tetralin

$$\begin{aligned} &= (64.21/132) / (22.05/138 + 12.82/138 + 64.21/132) \\ &= 0.6581 \end{aligned}$$

Mole flowrates of hydrocarbon

$$\begin{aligned} \text{trans-Decalin} &= 0.2162 * 0.027 \frac{\text{gmol}}{\text{hr}} \\ &= 0.0058 \frac{\text{gmol}}{\text{hr}} \end{aligned}$$

$$\text{cis-Decalin} = 0.1257 * 0.027 \frac{\text{gmol}}{\text{hr}}$$

$$= 0.0034 \frac{\text{gmol}}{\text{hr}}$$

$$\text{Tetralin} = 0.6581 * 0.027 \frac{\text{gmol}}{\text{hr}}$$

$$= 0.0178 \frac{\text{gmol}}{\text{hr}}$$

Mole flowrates of hydrogen

Hydrogen feed flowrates = 250 cm<sup>3</sup>/min at STP

$$250 \frac{\text{cm}^3}{\text{min}} * 60 \frac{\text{min}}{\text{hr}} * \frac{\text{gmol} * K}{0.082 * 1000 \text{cm}^3 * \text{atm}} * \frac{1 \text{atm}}{273K}$$

$$= 0.6701 \frac{\text{gmol}}{\text{hr}}$$

1 gmol of tetralin reacted with 3 gmol of H<sub>2</sub>

$$\text{Hydrogen consumption} = 3 * (0.0058 + 0.0034) = 0.0276 \frac{\text{gmol}}{\text{hr}}$$

$$\text{Hydrogen remain} = 0.6701 - 0.0276 = 0.6425 \frac{\text{gmol}}{\text{hr}}$$

**Table C2** Mole fraction of total products

Mole	<i>t</i> -Decalin	<i>c</i> -Decalin	Tetralin	Hydrogen	Total
Flowrate (gmole/hr)	0.0058	0.0034	0.0178	0.6425	0.6695
Fraction	0.0087	0.0051	0.0266	0.9600	1

## CURRICULUM VITAE

**Name:** Mr. Thatree Saributr

**Date of Birth:** December 10, 1980

**Nationality:** Thai

**University Education:**

1999-2003 Bachelor Degree of Science in Chemical Engineering, Faculty of Science, Chulalongkorn University, Bangkok, Thailand