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APPENDIX

Appendix A Standard Analysis

The chemical standards of products from catalytic activity testing such as dodecane eicosane ($n\text{-C}_{20}$), hexadecanol, octadecanol, palmitic acid, oleic acid, stearic acid, ester group, monoglyceride group, diglyceride group, and triglyceride group were analyzed by gas chromatograph equipped with an FID detector (Agilent 7890) to identify peaks of compositions of feedstocks, intermediates and products. The chromatograms are shown in Figures A1 – A5. The retention time and response factor of the standards are shown in Table A1.

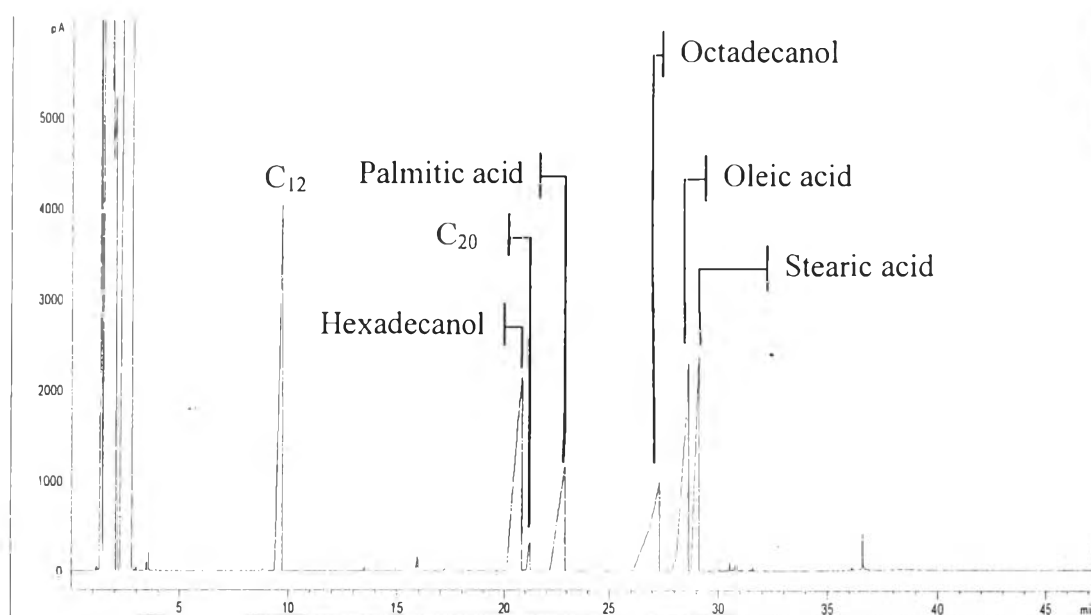


Figure A1 Chromatograms of standard fatty alcohols and fatty acids: hexadecanol, octadecanol, palmitic acid, stearic acid, and oleic acid.

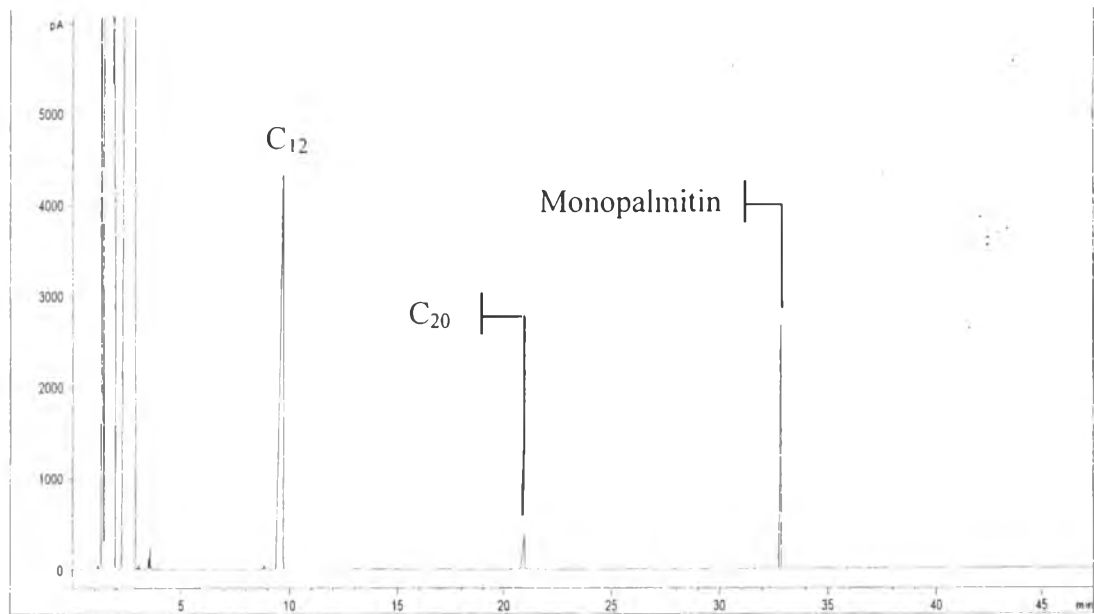


Figure A2 Chromatograms of standard monoglyceride: monopalmitin.

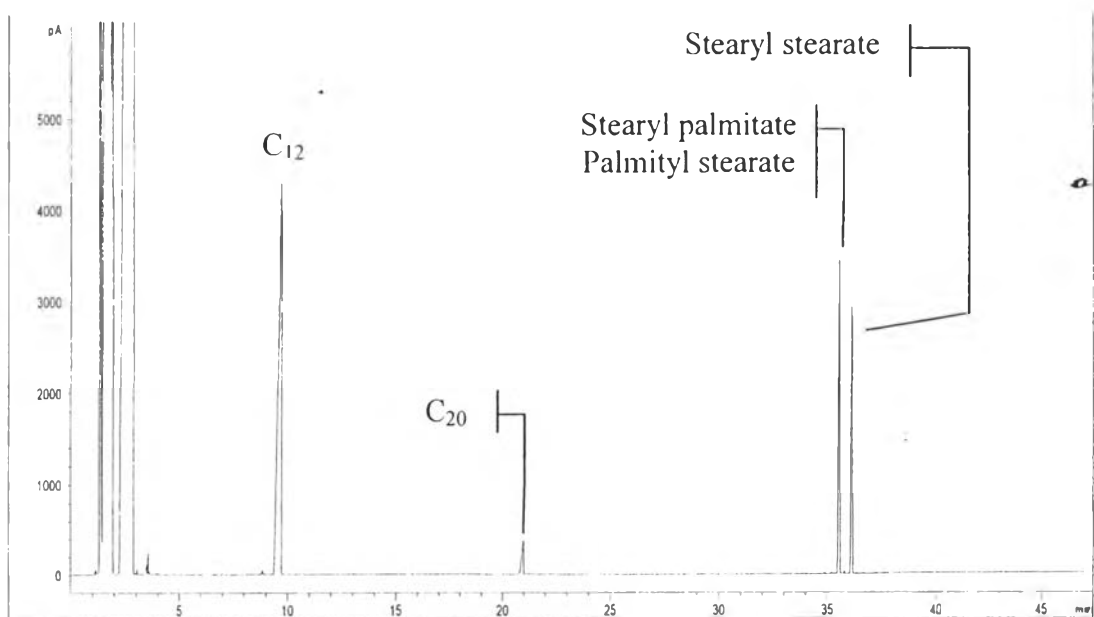


Figure A3 Chromatograms of standard fatty esters: stearyl palmitate, palmityl stearate, stearyl stearate.

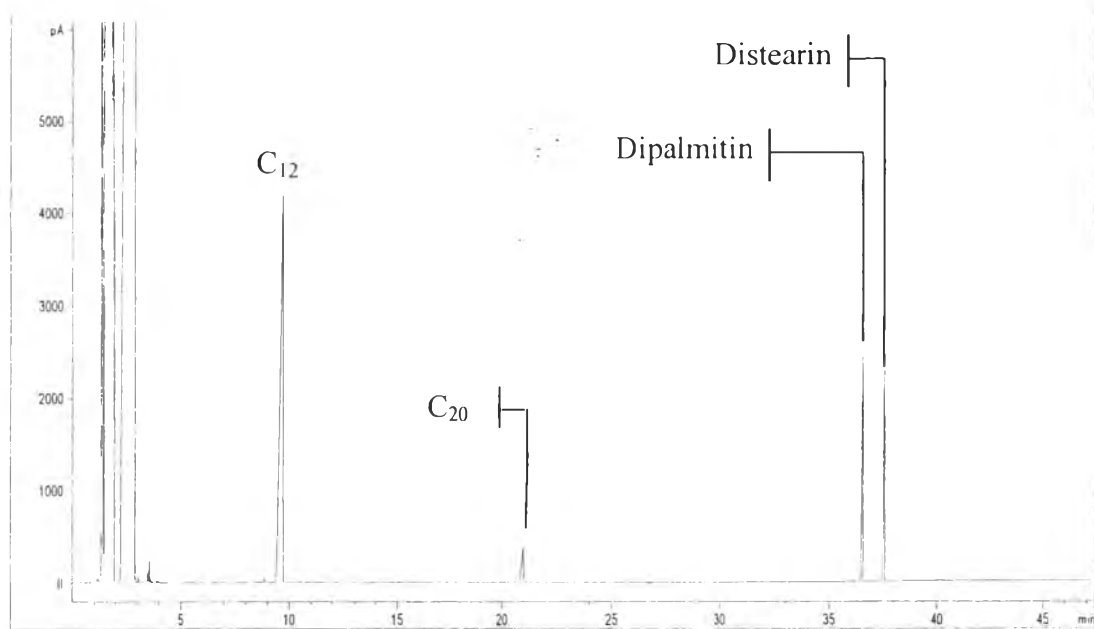


Figure A4 Chromatograms of standard diglycerides: dipalmitin and distearin.

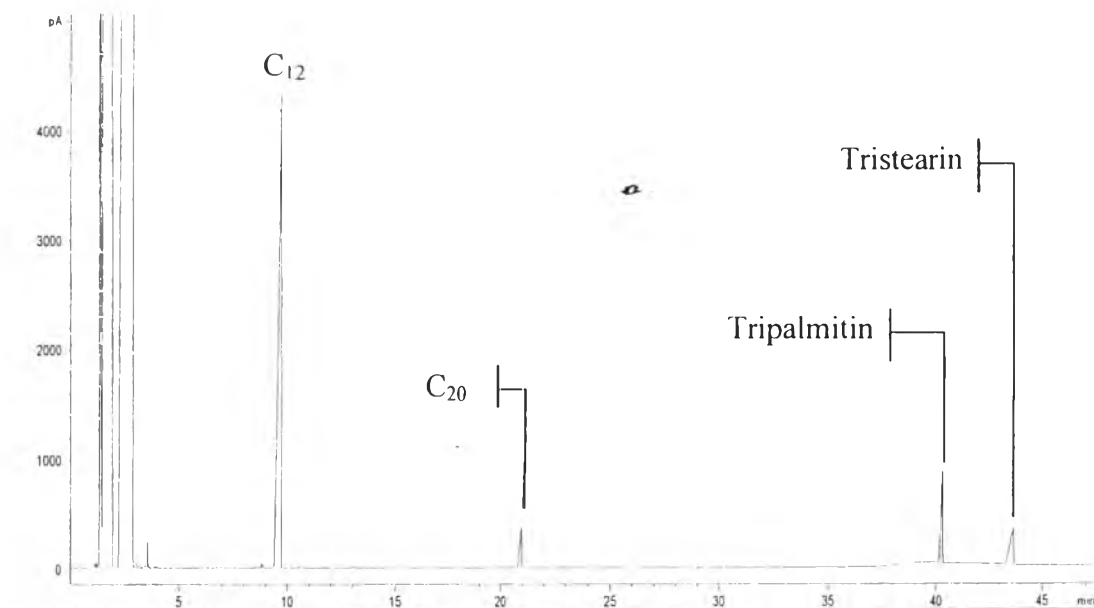


Figure A5 Chromatograms of standard triglycerides: tripalmitin and tristearin.

Table A1 Retention Times and Response Factors of Standard Chemicals

Standard chemicals	Retention Times	Response Factors
n-Pentane	1.140	1
n-Hexane	1.294	1
n-Heptane	1.445	1
n-Octane	2.024	1
n-Nonane	2.954	1
n-Decane	5.470	1
n-Dodecane	10.410	1
n-Pentadecane	14.208	1
n-Hexadecane	15.506	1
n-Heptadecane	16.679	1
n-Octadecane	17.904	1
Hexadecanol	20.707	1.092
Octadecanol	27.293	1.078
Palmitic acid	22.878	1.103
Stearic acid	29.082	1.045
Oleic acid	28.600	0.985
Stearyl palmitate	35.562	1.077
Palmityl stearate		0.912
Stearyl stearate	36.132	0.975
Monopalmitin	32.835	1.103
Dipalmitin	36.559	0.972
Distearin	37.558	0.971
Tripalmitin	40.326	0.989
Tristearin	43.685	0.946

For the reference standard of gas products, it was analyzed by a GC/FID (Shimadzu GC-17A) equipped with HP-Plot Al₂O₃ column. The FID signal of standard gas mixture is shown in Figure A6 and the retention times for each standard gas mixture are also listed in Table A2.

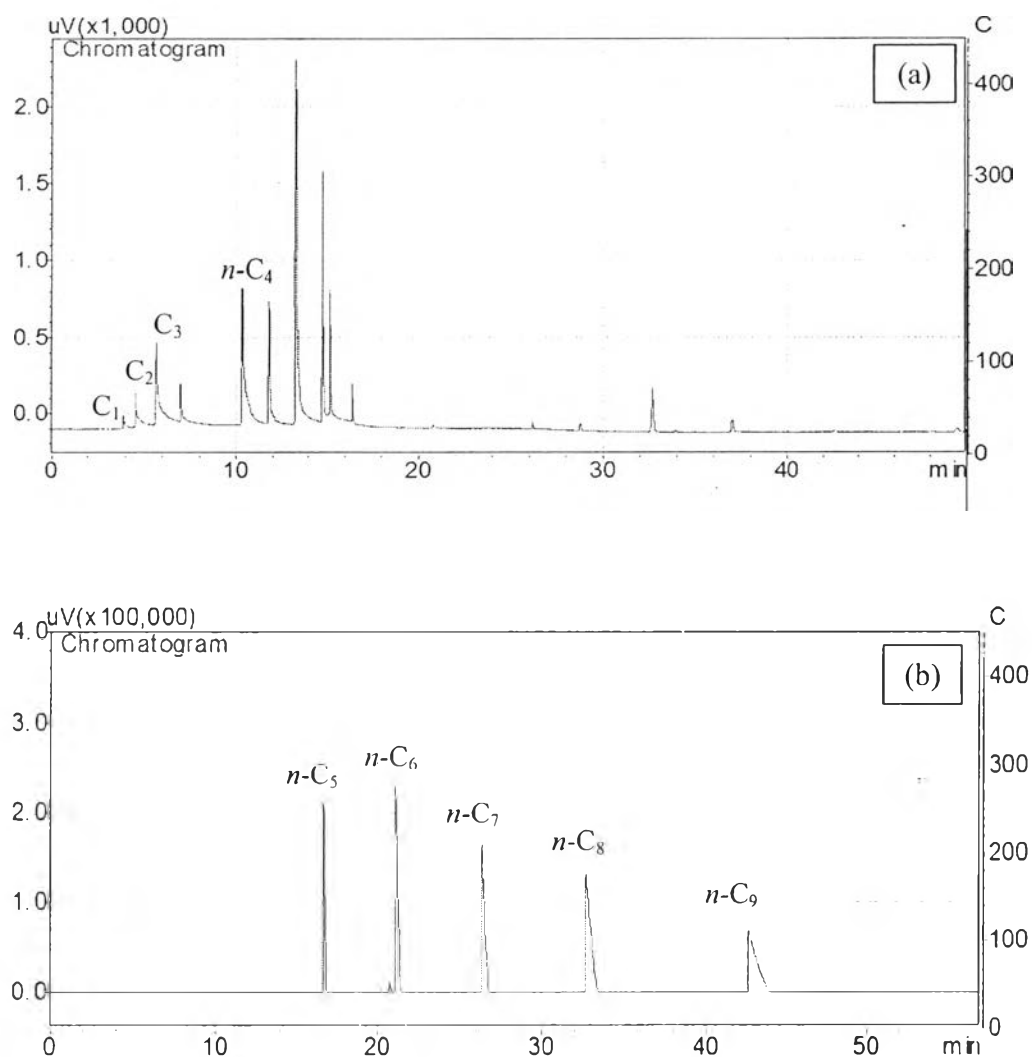


Figure A6 Chromatogram of the standard gases, (a) methane, ethane, propane and butane, (b) pentane, hexane, heptane, octane and nonane.

Table A2 Retention Times of Standard Chemicals and Standard Gas Mixture Analyzed by a GC/FID (Agilent GC 7890A and Shimadzu GC-17A, respectively)

Standard Gas Mixture	Retention Times
Methane (C ₁)	3.92
Ethane (C ₂)	4.56
Propane (C ₃)	6.96
<i>n</i> -Butane (<i>n</i> -C ₄)	11.80
<i>n</i> -Pentane (<i>n</i> -C ₅)	15.95
<i>n</i> -Hexane (<i>n</i> -C ₆)	20.32
<i>n</i> -Heptane (<i>n</i> -C ₇)	26.13
<i>n</i> -Octane (<i>n</i> -C ₈)	32.30
<i>n</i> -Nonane (<i>n</i> -C ₉)	41.73

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1. Umnuayporn, V.; Jongpatiwut, S.; Butnark, S.; and Tachakritikul, C. (2015, May 20 – 23) Renewable fuel from one-pot reaction of jatropha oil using core-shell catalysts. Poster presented at EST - the International Conference and Exhibition on Energy, Science & Technology, Karlsruhe, Germany.
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