REFERENCES

Balat, M. and Balat, H. (2008). A critical review of bio-diesel as a vehicular fuel. Energy Conversion and Management, 49, 2727–2741.

Betteridge, S. and Burch, R. (1986). Reducibility-activity correlations for $Ni/Mo/Al_2O_3$ and $Co/Mo/Al_2O_3$ hydrodesulphurization catalysts. Applied Catalysis, 23, 413-424.

Boda, L., Onyestyak, G., Solt, H., Lonyi, F., Valyon, J., and Thernesz, A. (2010). Catalytic hydroconversion of tricaprylin and caprylic acid as model reaction for biofuel production from triglycerides. Applied Catalysis A: General, 374, 158–169.

De Rogatis, L., Montini, T., Cognigni, A., Olivi, L., and Fornasiero, P. (2009). Methane partial oxidation on NiCu-based catalysts. Catalysis Today, 145, 176–185.

Ferrari, M., Delmon, B., and Grange, P. (2002). Influence of the active phase loading in carbon supported molybdenum–cobalt catalysts for hydrodeoxygenation reactions. Microporous and Mesoporous Materials, 56, 279–290.

Ferrari, M., Maggi, R., Delmon, B., and Grange, P. (2001). Influences of the hydrogen sulfide partial pressure and of a nitrogen compound on the hydrodeoxygenation activity of a CoMo/carbon catalyst. Journal of Catalysis, 198, 47–55.

Fisk, C.A., Morgan, T., Ji, Y., Crocker, M., Crofcheck, C., Lewis S.A. (2009). Bio-oil upgrading over platinum catalysts using in situ generated hydrogen. Applied Catalysis A: General, 358, 150–156.

Furimsky, E. (1977). Catalytic deoxygenation of heavy gas oil. Fuel, 57, 494-496

Gandarias, I., Barrio, V.L., Requies, J., Arias, P.L., Cambra, J.F., and Guemez, M.B. (2008). From biomass to fuels: Hydrotreating of oxygenated compounds. International Journal of Hydrogen Energy, 33, 3485-3488.

Gutierrez, A., Kaila, R.K., Honkela, M.L., Slioor, R., and Krause A.O.I. (2009). Hydrodeoxygenation of guaiacol on noble metal catalysts. Catalysis Today, 147, 239–246.

Guzman, A., Torres, J.E., Prada, L.P., and Nunez, M.L. (2010). Hydroprocessing of crude palm oil at pilot plant scale. Catalysis Today, In Press.

Hancsok, J., Krar, M., Magyar, S., Boda, L., Hollo, A., and Kallo, D. (2007). Investigation of the production of high cetane number bio gas oil from pre-hydrogenated vegetable oils over Pt/HZSM-22/Al_2O_3. Microporous and Mesoporous Materials, 101, 148-152.

Holmgren, J., Gosling, C., Marinangeli, R., Marker, T., Faraci, G., and Perego, C. (2007). New developments in renewable fuels offer more choices. Hydrocarbon Processing, 67-71.

Huber, G.W., O'Connor, P., and Corma, A. (2007). Processing biomass in conventional oil refineries: Production of high quality diesel by hydrotreating vegetable oils in heavy vacuum oil mixtures. Applied Catalysis A: General, 329, 120-129.

Knothe, G. (2010). Biodiesel and renewable diesel: A comparison. Progress in Energy and Combustion Science, 36, 364-373.

Kubicka, D. and Kaluza, L. (2010). Deoxygenation of vegetable oils over sulfided Ni, Mo and NiMo catalysts. Applied Catalysis A: General, 372, 199–208

Kubickova, I., Snare, M., Eranen, K., Maki-Arvela, P., and Murzin, D.Yu. (2005). Hydrocarbons for diesel fuel via decarboxylation of vegetable oils. Catalysis Today, 106, 197-200.

Lopez-Suarez, F.E., Bueno-Lopez, A., and Illan-Gomez, M.J. (2008). Cu/Al_2O_3 catalysts for soot oxidation: Copper loading effect. Applied Catalysis B: Environmental, 84, 651–658.

Maher, K.D. and Bressler, D.C. (2007). Pyrolysis of triglyceride materials for the production of renewable fuels and chemicals. Bioresource Technology, 98, 2351–2368.

Maki-Arvela, P., Kubickova, I., Snare, M., Eranen, K., and Murzin, D.Yu. (2007). Catalytic Deoxygenation of Fatty Acids and Their Derivatives. Energy & Fuels, 21, 30-41.

Marker, T., Petri, J., and Kalnes, T. (2005). Opportunities for Biorenewables in Oil Refineries. Illinois: UOP.

Navarro, R.M., lvarez-Galvan, M.C., Cruz Sanchez-Sanchez, M., Rosa, F., and Fierro, J.L.G. (2005). Production of hydrogen by oxidative reforming of ethanol over Pt catalysts supported on Al_2O_3 modified with Ce and La. Applied Catalysis B: Environmental, 55, 229–241.

Nava, R., Pawelec, B., Castano, P., Alvarez-Galvan, M.C., Loricera, C.V., and Fierro, J.L.G. (2009). Upgrading of bio-liquids on different mesoporous silica-supported CoMo catalysts. Applied Catalysis B: Environmental, 92, 154-167.

Pandey, A. (2009). Handbook of Plant-Based Biofuels. Boca Raton: Taylor & Francis Group.

Perego, C. and Bianchi, D. (2010). Biomass upgrading through acid–base catalysis. Chemical Engineering Journal.

Senol, O.I., Viljava, T.R., and Krause, A.O.I. (2005). Hydrodeoxygenation of methyl esters on sulphided NiMo/γ-Al_2O_3 and CoMo/γ-Al_2O_3 catalysts. Catalysis Today, 100, 331–335.

Simacek, P., Kubicka, D., Sebor, G., and Pospisil, M. (2009). Hydroprocessed rapeseed oil as a source of hydrocarbon-based biodiesel. Fuel, 88, 456–460.

Shekar, S.C., Rama Rao, K.S., Sahle-Demessie, E. (2005). Characterization of palladium supported on γ-Al_2O_3 catalysts in hydrodechlorination of CCl_2F_2. Applied Catalysis A: General, 294, 235–243.

Snare, M., Kubickova, I., Malki-Arvela, P., Eralnen, K., and Murzin, D.Yu. (2006). Heterogeneous catalytic deoxygenation of stearic acid for production of biodiesel. Industrial Engineering Chemistry Research, 45, 5708-5715.

Snare, M., Kubickova, I., Maki-Arvela, P., Chichova, D., Eranen, K., and Murzin, D.Yu. (2008). Catalytic deoxygenation of unsaturated renewable feedstocks for production of diesel fuel hydrocarbons. Fuel, 87, 933–945.

Srivastava, A. and Prasad, R. (2000). Triglycerides-based diesel fuels. Renewable and Sustainable Energy Reviews, 4, 111-133.

Stumborg, M., Wongb, A., and Hogan, E. (1996). Hydroprocessed Vegetable Oils for Diesel Fuel Improvement. Bioresource & technology, 56, 13-18.

Yakovlev, V.A., Khromova, S.A., Sherstyuk, O.V., Dundich, V.O., Ermakov, D.Yu., Novopashina, V.M., Lebedev, M.Yu., Bulavchenko, O., and Parmon, V.N.

(2009). Development of new catalytic systems for upgraded bio-fuels production from bio-crude-oil and biodiesel. Catalysis Today, 144, 362–366.

Yang, Y., Gilbert, A., and Xu, C. (2009). Hydrodeoxygenation of bio-crude in supercritical hexane with sulfide CoMo and CoMoP catalysts supported on MgO: A model compound study using phenol. Applied Catalysis A: General, 360, 242-249.

APPENDIX

Appendix A Mass Balance of Deoxygenation Reaction of Jatropha Oil

Table A1 Mass balance of deoxygenation reaction of jatropha oil at LHSV of 1 h^{-1}

Components (wt.%)	Active metals*					
	Pd	Pt	Cu	NiCu	NiMo	CoMo
CJO remained	10.88	0.57	33.29	7.57	14.64	20.03
H_2 remained	2.00	1.99	1.98	2.01	1.99	1.98
CO_2	6.25	2.73	0.59	6.26	0.92	0.58
CO	1.66	4.17	0.56	2.32	0.72	0.45
CH_4	0.57	0.60	0.53	0.19	0.19	0.12
C_3H_8	4.33	4.83	4.77	4.53	4.12	3.82
H_2O	3.68	6.07	10.68	2.99	7.23	5.72
n-C15	10.53	11.32	1.33	13.36	3.28	1.44
n-C16	2.64	3.90	2.80	3.67	9.74	6.01
n-C17	44.89	46.73	5.96	41.78	10.25	7.21
n-C18	6.46	10.05	14.02	3.43	33.89	29.65
hexadecanol	0	0	0	0	0.50	2.24
octadecanol	0.22	0	0.53	0	0.89	3.61
palmitic acid	1.06	0.48	1.51	3.28	2.67	4.65
stearic acid	3.51	1.91	21.37	8.00	8.01	9.61
fatty esters	1.01	4.08	9.33	0.33	0.64	1.44
monoglycerides	0.34	0.56	0.70	0.27	0.33	1.44

*All active metals were supported on Al_2O_3.

Table A2 Mass balance of deoxygenation reaction of jatropha oil at LHSV of 2 h^{-1}

Components (wt.%)	Active metals*					
	Pd	Pt	Cu	NiCu	NiMo	CoMo
CJO remained	27.41	8.12	75.67	26.12	46.60	55.25
H_2 remained	2.01	1.95	2.03	1.97	2.02	2.02
CO_2	3.22	2.54	0.03	4.81	0.15	0.12
CO	0.85	3.89	0.03	1.78	0.12	0.09
CH_4	0.29	0.56	0.02	0.15	0.03	0.02
C_3H_8	3.53	4.37	1.14	3.51	2.59	2.15
H_2O	1.48	5.37	0.27	1.87	2.79	2.53
n-C15	4.98	16.41	0.18	8.37	0.38	0
n-C16	0.35	3.28	0.34	1.91	3.08	3.43
n-C17	23.67	36.93	0.54	34.26	1.90	1.76
n-C18	1.50	7.80	1.02	0.64	15.19	13.19
hexadecanol	0.33	0	0.24	0	0.40	0.47
octadecanol	1.99	0	1.12	0	1.81	1.92
palmitic acid	2.09	0.88	1.81	1.35	2.38	2.26
stearic acid	21.93	2.87	9.72	8.62	11.08	9.94
fatty esters	4.36	1.95	5.84	2.61	9.47	4.84
monoglycerides	0	3.08	0	2.03	0	0

*All active metals were supported on Al_2O_3.

Table A3 Mass balance of deoxygenation reaction of jatropha oil at LHSV of 3 h^{-1}

Components (wt.%)	Active metals*					
	Pd	Pt	Cu	NiCu	NiMo	CoMo
CJO remained	60.08	17.05	76.59	31.43	60.02	64.36
H_2 remained	2.01	1.99	2.01	2.01	2.01	2.01
CO_2	1.17	2.05	0.01	3.93	0.11	0.15
CO	0.31	3.13	0.01	1.46	0.09	0.12
CH_4	0.11	0.45	0.01	0.12	0.02	0.03
C_3H_8	1.87	4.00	1.06	3.32	1.90	1.68
H_2O	0.54	4.58	0.15	1.76	2.01	2.01
n-C15	1.23	6.32	0.09	8.52	0.39	0.13
n-C16	0.07	1.52	0.22	1.91	2.87	1.34
n-C17	9.24	37.55	0.28	26.06	1.24	2.15
n-C18	0.62	9.29	0.54	1.76	10.18	9.01
hexadecanol	0	0	0	0.41	0.26	2.10
octadecanol	0.17	0	1.91	2.49	3.26	2.69
palmitic acid	4.69	2.75	2.78	4.15	3.26	4.16
stearic acid	15.0	7.49	8.94	9.23	9.14	6.21
fatty esters	2.30	1.51	4.58	0.77	2.91	1.69
monoglycerides	0.59	0.32	0.81	0.68	0.31	0.54

*All active metals were supported on Al_2O_3.

Table A4 Mass balance of deoxygenation reaction of jatropha oil at LHSV of 4 h^{-1}

Components (wt.%)	Active metals*					
	Pd	Pt	Cu	NiCu	NiMo	CoMo
CJO remained	63.13	23.46	80.81	38.28	64.95	70.30
H_2 remained	2.01	2.00	2.03	2.01	1.47	2.02
CO_2	0.93	1.77	0.02	3.28	0.08	0.11
CO	0.25	2.71	0.02	1.22	0.05	0.08
CH_4	0.08	0.39	0.02	0.10	0.01	0.02
C_3H_8	1.72	3.70	0.87	2.98	1.67	1.39
H_2O	0.47	3.87	0.18	1.63	1.47	1.18
n-C15	1.93	5.56	0.14	7.71	0.26	0.07
n-C16	0.42	1.30	0.26	1.96	2.21	1.12
n-C17	6.29	32.41	0.35	21.12	0.73	1.55
n-C18	0.36	7.41	0.63	2.16	7.42	6.33
hexadecanol	0	0	0	0.49	0.42	1.70
octadecanol	0.32	0.34	3.41	2.45	5.94	2.88
palmitic acid	5.11	3.07	3.24	4.26	3.89	3.48
stearic acid	14.10	8.25	7.31	8.34	5.72	5.16
fatty esters	2.05	3.60	0.70	1.16	2.65	2.26
monoglycerides	0.81	0.18	0	0.84	0.14	0.35

*All active metals were supported on Al_2O_3.

CURRICULUM VITAE

Name: Ms. Teeralak Tharawut

Date of Birth: August 23, 1986

Nationality: Thai

University Education:

2005–2009 Bachelor Degree of Science, Faculty of Science, Mahidol University, Bangkok, Thailand

Work Experience:

2008 Position: Chemist Assistant (Student Internship)

Company: Rhodia Thai Industries LTD., Samut Prakan, Thailand

Presentations:

1. Tharawut, T., Osuwan, S., Butnark, S., and Jongpatiwut, S. (2011, January 5-7) Effect of Active Metal Catalysts on the Deoxygenation of Jatropha Oil. Pure and Applied Chemistry International Conference 2011, Bangkok, Thailand.
2. Tharawut, T. and Jongpatiwut, S. (2011, April 11-14) Selective Deoxygenation of Jatropha Oil over Different Active Metal Catalysts. First EuCheMS Inorganic Chemistry Conference, Manchester, United Kingdom.
3. Tharawut, T., Jongpatiwut, S., Osuwan, S., and Resasco, D.E. (2011, April 26) Deoxygenation of Vegetable Oil for the Production of Hydrogenated Biodiesel: Effect of Active Metals. Proceedings of The 2^{nd} Research Symposium on Petroleum, Petrochemicals, and Advanced Materials and The 17^{th} PPC Symposium on Petroleum, Petrochemicals, and Polymers, Bangkok, Thailand.