

NOMENCLATURE

FFA	free fatty acid	%
Na	Sodium (alkaline metal)	mg/Kg
K	Potassium (alkaline metal)	mg/Kg
H ₂ SO ₄	Sulfuric acid	N
CH ₃ OH	methanol	%
CH ₃ COOR	methyl ester	%
RCOOH	fatty acid	%
Greek letters		
°	degree	
ρ	density	kg/m ³

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REFERENCES

- [1] Gaurav, N., et al., *Utilization of bioresources for sustainable biofuels: A Review*. Renewable and Sustainable Energy Reviews, 2017. **73**: p. 205-214.
- [2] de Jong, S., et al., *Cost optimization of biofuel production – The impact of scale, integration, transport and supply chain configurations*. Applied Energy, 2017. **195**: p. 1055-1070.
- [3] Azadi, P., et al., *The evolution of the biofuel science*. Renewable and Sustainable Energy Reviews, 2017. **76**: p. 1479-1484.
- [4] Golimowski, W., et al., *Biofuel parameter dependence on waste fats' fatty acids profile*. Fuel, 2017. **197**: p. 482-487.
- [5] Marchetti, J.M. and A.F. Errazu, *Esterification of free fatty acids using sulfuric acid as catalyst in the presence of triglycerides*. Biomass and Bioenergy, 2008. **32**(9): p. 892-895.
- [6] Brito, A., M.E. Borges, and N. Otero, *Zeolite Y as a Heterogeneous Catalyst in Biodiesel Fuel Production from Used Vegetable Oil*. Energy & Fuels, 2007. **21**(6): p. 3280-3283.
- [7] Ayoub, M., et al., *Process Optimization for Biodiesel Production from Waste Frying Oil over Montmorillonite Clay K-30*. Procedia Engineering, 2016. **148**: p. 742-749.
- [8] *Coconut oil as biofuel, Engineers without borders Australia*. 2010 Online]; Available from: <https://www.ewb.org.au/>.
- [9] Chhetri, A., K. Watts, and M. Islam, *Waste Cooking Oil as an Alternate Feedstock for Biodiesel Production*. Energies, 2008. **1**(1): p. 3.
- [10] Zappi, M., et al., *A Review of The Engineering Aspects of The Biodiesel Industry*, M.E.T.R.a.A.L.D. C., Editor. 2003, Swalm School of Chemical Engineering Mississippi University: Mississippi.
- [11] *Final Report on The Safety Assessment of Oleic Acid, Lauric Acid, Palmitic Acid, Myristic Acid, And Stearic Acid*. Journal of the American College of Toxicology, 1987. **6**(3).
- [12] Banerjee, A. and R. Chakraborty, *Parametric sensitivity in transesterification of waste cooking oil for biodiesel production—A review*. Resources, Conservation and Recycling, 2009. **53**(9): p. 490-497.
- [13] amgboye, A.I. and A.C. Hansen, *Prediction of cetane number of biodiesel fuel from the fatty acid methyl ester (FAME) composition*. International Agrophysics, 2008. **22**(1): p. 21-29.
- [14] Chang, D.Y.Z., et al., *Fuel properties and emissions of soybean oil esters as diesel fuel*. Journal of the American Oil Chemists' Society, 1996. **73**(11): p. 1549-1555.
- [15] Hayyan, A., et al., *Biodiesel Production from Acidic Crude Palm Oil Using Perchloric Acid*. Energy Procedia, 2014. **61**: p. 2745-2749.
- [16] Wannahari, R., *The recovery of used palm cooking oil using bagasse as adsorbent*. 2012, Universiti Malaysia Kelantan.
- [17] Su, C.-H., *Recoverable and reusable hydrochloric acid used as a homogeneous catalyst for biodiesel production*. Applied energy, 2013. **104**: p. 503-509.
- [18] Kumar, V., et al., *Physiological, haematological and histopathological responses in common carp (Cyprinus carpio L.) fingerlings fed with differently detoxified Jatropha curcas kernel meal*. Food and Chemical Toxicology, 2010. **48**(8-9): p. 2063-2072.
- [19] Berchmans, H.J. and S. Hirata, *Biodiesel production from crude Jatropha curcas L. seed oil with a high content of free fatty acids*. Bioresource Technology, 2008. **99**(6): p. 1716-1721.
- [20] Daniyan, I.A., et al., *Effects of Reaction Time on Biodiesel Yield*. J. of Bioprocessing and Chemical Engineering, 2015. 312.