SYNTHESIS, CHARACTERIZATION AND CATALYTIC ACTIVITY OF CaO-BASED CATALYSTS IN TRANSESTERIFICATION OF NON-EDIBLE AND WASTE COOKING OILS INTO GLYCEROL-FREE FATTY ACID METHYL ESTER

YANNA SYAMSUDDIN

UNIVERSITI SAINS MALAYSIA

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by

YANNA SYAMSUDDIN

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LIST OF ABBREVIATIONS

ASTM	American Society for Testing Material
B7	7% Biodiesel
B10	10% Biodiesel
B20	20% Biodiesel
B100	100% Biodiesel
BET	Brunnauer-Emmet-Teller
CJO	Crude Jatropha Oil
CKO	Crude Karanj Oil
CPKO	Crude Palm Kernel Oil
CPO	Crude Palm Oil
DDGC	Distillers Dried Grain Solubles
DMC	Dimethyl Carbonate
EDX	Energy Dispersive X-ray
FAGC	Fatty Acid Glycerol Carbonate
FAME	Fatty Acid Methyl Ester
FFA	Free Fatty Acid
FTIR	Fourier Transform Infra Red
GC	Glycerol Carbonate
GDC	Glycerol Dicarbonate
GHG	Greenhouse Gases
IEA	International Energy Agency
JCPDS	Joint Committee of the Powder Diffraction Standard
MPOB	Malaysia Palm Oil Board
RED	Renewable Energy Directive

SAP	Super Absorbent Polymer
SEM	Scanning Electron Microscopy
TG	Triglyceride
TGA	Thermogravimetric Analyzer
TPD	Temperature Programmed Desorption
US EIA	United States-Energy Information Administration
WCO	Waste Cooking Oil

LIST OF SYMBOLS

θ	Theta
ρ	Rho
γ	Gamma

SINTESIS, PENCIRIAN DAN PRESTASI MANGKIN OLEH MANGKIN BERASAS CaO DALAM TRANSESTERIFIKASI MINYAK SAYUR TIDAK BOLEH DIMAKAN DAN SISA MINYAK SAYUR UNTUK MENGHASILKAN METIL ESTER ASAM BERLEMAK BEBAS GLISEROL

ABSTRAK

Biodiesel juga dikenali sebagai asid lemak metil ester (ALME), telah menjadi lebih menarik sebagai bahan api alternatif disebabkan oleh keboleh perbaharui dan pengeluaran bahan cemar yang rendah. Sintesis biodiesel telah dijalankan melalui transesterifikasi menggunakan dimetil karbonat (DC) untuk pengganti metanol menggunakan pemangkin heterogen untuk mengatasi produk hasil sampingan gliserol yang berlebihan dan untuk mengelakkan penggunaan air sisa yang besar untuk proses penulenan. Penyelidikan ini bertujuan untuk membangunkan mangkin heterogen yang aktif, stabil dan boleh diguna semula untuk transesterifikasi minyak sayur tidak boleh dimakan dan sisa minyak masak (SMM) dengan DC untuk menghasilkan ALME bebas gliserol. Mangkin-mangkin campuran oksida berasas CaO (Ca–Zn, Ca–La dan Ca–La–Al) telah dibangunkan melalui kaedah permendakan diikuti oleh pengkalsinan antara suhu 300 °C hingga 900 °C dan masa 1 jam hingga 5 jam. Analisis termal gravimetri, isoterma penjerapan-nyah jerapan N_2, penyerakan X-ray, Infra merah pengubahan Fourier, mikroskopi elektron imbasan-X-ray taburan tenaga dan analisis penyahjerapan program suhu telah dijalankan untuk mencirikan mangkin. Prestasi mangkin telah dinilai berdasarkan tindak balas transesterifikasi menggunakan proses kelompok pada keadaan operasi yang berbeza, termasuk suhu (110-190 °C), masa tindak balas (30-360 min), nisbah DC kepada minyak (2:1-18:1) dan jumlah mangkin (1-13 % berat, bergantung kepada berat minyak). Keputusan menunjukkan bahawa mangkin campuran oksida