

Materials List for:

# Laboratory Production of Biofuels and Biochemicals from a Rapeseed Oil through Catalytic Cracking Conversion

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## Materials

Name	Company	Catalog Number	Comments
Advanced Cracking Evaluation (ACE) Unit	Kayser Technology Inc.	ACE R+ 46	Assembled by Zeton Inc. SN:505-46; consisting of (1) a reactor; (2) catalyst addition system; (3) feed delivery system; (4) liquid collection system; (5) gas collection system; (6) gas analyzing system; (7) catalyst regeneration system; (8) CO catalytic converter; (9) coke analyzing system
Reactor (ACE)	Kayser Technology Inc.	V-105	A 1.6 cm ID stainless steel tube having a tapered conical bottom and with a diluent (nitrogen) flowing from the bottom to fluidize the catalyst and also serve as the stripping gas at the end of the run
Catalyst Addition System (ACE)	Kayser Technology Inc.		Six hoppers (V-120F, with respective valves) for addition of catalyst for up to 6 runs
Feed Delivery System (ACE)	Kayser Technology Inc.		Consisting of feed bottle (V-100), syringe (FS-115), pump (P-100), and injector (with 1.125 inch injector height, <i>i.e.</i> , the distance from the lowest point of the conical reactor bottom to the bottom end of the feed injector)
Liquid Collection System (ACE)	Kayser Technology Inc.		Six liquid receivers (V-110F) immersed in a common coolant bath (Ethylene glycol/water mixture in 50:50 mass ratio) at about -15 °C in a large tank (V-145)
Gas Collection System (ACE)	Kayser Technology Inc.		Based on water displacement principle; consisting of gas collection vessel (V-150) with a motor-driven stirrer (MTR-100), and a weight scale (WT-100) for weighing the displaced water collected in a beaker (V-160).
Gas Analyzing System (ACE)	Kayser Technology Inc.		Key element being Agilent micro GC (model 3000A) with four capillary columns equipped with respective thermal conductivity detectors (TCDs)
Catalyst Regeneration System (ACE)	Kayser Technology Inc.	V-105	Spent catalyst in reactor being burned <i>in situ</i> in air at +700 °C to ensure complete removal of carbon deposited on the catalyst

CO Catalytic Converter (ACE)	Kayser Technology Inc.		A reactor (V-140) with CuO as catalyst to oxidize any CO and hydrocarbons in exhausted flue gas to CO <sub>2</sub> (to be analyzed by IR gas analyzer) and H <sub>2</sub> O (to be absorbed by a dryer)
Coke Analyzing System (ACE)	Kayser Technology Inc.		Servomex (Model 1440C) IR analyzer for measuring CO <sub>2</sub> in exhausted flue gas
R+MM Software Suite	Kayser Technology Inc.		Including iFIX 3.5
Agilent Micro GC	Agilent Technologies	3000A	For gas analysis after cracking
Cerity Networked Data System	Agilent Technologies		Software for Agilent Micro GC
CO <sub>2</sub> Gas Analyser	Servomex Inc.	1440C	SN: 01440C1C02/2900
NESLAB Refrigerated Bath	Thermo Electron Corporation	RTE 740	SN: 104300061
Orion Sage Syringe Pump	Thermo Electron Corporation	M362	For delivering feed oil to injector tube
Synthetic Crude Oil (SCO)	Suncor Energy Inc.		Identified as Suncor OSA 10-4.1
Catalyst P	Petro-Canada Refinery		Equilibrium catalyst
Balance	Mettler Toledo	AB304-S	For weighing liquid product receivers
Balance	Mettler Toledo	XS8001S	For weighing water displaced by gas product
Ethylene Glycol	Fisher Scientific Inc.	CAS 107-21-1	Mixed with distilled water as coolant (50 v% )
Drierite	W.A. Hammond Drierite Co. Ltd.	24001	For water absorption after CO catalytic converter
Copper Oxide	LECO Corporation	501-170	Catalyst for conversion of CO to CO <sub>2</sub>
Toluene	Fisher Scientific Co.	CAS 108-88-3	For cleaning liquid receivers
Acetone	Fisher Scientific Co.	CAS 67-64-1	For cleaning liquid receivers
Micro GC Calibration Gas	Air Liquid Canada Inc.	SPG-25MX0015306	Multicomponent standard gas
19.8% CO <sub>2</sub> Standard Gas	BOC Canada Ltd.	24069890	For calibration of IR analyzer
Argon Gas	Linde Canada Ltd.	24001306	Grade 5.0 Purity
Helium Gas	Linde Canada Ltd.	24001333	Grade 5.0 Purity
Gas analyzer GC Module	Inficon	GCMOD-15	Channel A
Gas analyzer GC Module	Inficon	GCMOD-03	Channel B
Gas analyzer GC Module	Inficon	GCMOD-04	Channel C
Gas analyzer GC Module	Inficon	GCMOD-73	Channel D
HP 6890 GC	Hewlett-Packard Co.	G1530A	For simulated distillation
ASTM 2887 Standard Sample	PAC L.P.	26650.150	For quality control in simulated distillation
ASTM 2887 Standard Sample	PAC L.P.	25950.200	For calibration in simulated distillation
Column for GC 6890 (simulated distillation)	Agilent Technologies	CP7562	10 m x 0.53 mm x 1.2 μm, HP 6890 GC column
Liquid Nitrogen	Air Liquid Canada Inc.	SPG-NIT1AC240LC	For use in simulated distillation
Nitrogen	Air Liquid Canada Inc.	Bulk (building N2)	For use in ACE unit operation
Isotemp Programmable Furnace	Thermo Fisher Scientific Inc.	10-750-126	For calcination of catalyst
GC Vials, Crimp Top	Chromatographic Specialties Inc	C223682C	2 ml, for liquid product
Seals, Crimp Top	Chromatographic Specialties Inc	C221150	11 mm, for use with GC vials

4 oz clear Boston round bottles	Fisher Scientific Co.	02-911-784	With PE cone lined caps, for use in feed system
Sieve	Endecotts Ltd.	6140269	Aperture 38 micron
Sieve	Endecotts Ltd.	6146265	Aperture 250 $\mu$ m
Shaker	Endecotts Ltd.	MIN 2737-11	Minor-Meinzer 2 Sieve Shaker for catalyst screening
V20 Volumetric KF Titrator	Mettler Toledo	5131025056	For water content analysis of the liquid product
Hydranal Composite 5	Sigma-Aldrich	34805-1L-R	Reagent for Karl Fischer titration
Methanol (extremely low water grade)	Fisher Scientific Co.	A413-4	Mixed with toluene (40:60 w/w) for KF titration; also used to recover water in receiver
Glass Wool	Fisher Scientific Co.	11-388	Placed inside the top of receiver outlet arm