



APEC, Agricultural Technical Cooperation Working Group

Biodiesel from Waste Food Oil in China

14-18 September, Seoul, Korea

William Kao, CEO

高资明

**COBRA, a division of Pro-Tek (Xiamen) Electroplating Development Ltd.,
生物柴油部, 先锋 (厦门) 电镀开发有限公司**

Content

History of Biodiesel in China

COST of producing Biodiesel in China

Waste Oil as Feedstock

The COBRA Process

History of Biodiesel in China

Begun with Professor Din, Fuzhou University. Technology is an extended application of Fatty Acid distillation and purification plants

2001, Hainan Zhenghe operational

2002, Hebei Zhenghe begins construction

2002, Sichuan Gushan operational

2003, Longyan New Energy Zhuoyue operational

2003 Summer, Power shortage caused rush on diesel. Brown out still continue in Guandong Province

2004, Fujian Gushan begins construction

2005, SinoPec and China Petroleum forms a pact, 'Diesel Inverse Pricing' policy begins. Wholesale price higher than retail price. Wholesalers turn to biodiesel to retain profit

History of Biodiesel in China

2005, A flood of 100,000+ T/year projects are proposed across China

2005, Diesel hoarding begins

2005 Summer, Typhoon caused diesel supply shortage in the southern provinces.

2006 January, Gutter oil at RMB 1800/T

2006 March 26, China retail diesel price increased from RMB 4.05/L to RMB 4.19/L. Pricing inverse worsen, whole-sale demand for biodiesel increase

2006 April, International oil price reaches USD 70 per barrel

2006 May 26, China retail diesel price increased from RMB 4.19/L to RMB 4.64/L

History of Biodiesel in China

2006 July, International oil price reached all time high USD 78 per barrel. Biodiesel wholesale price at all time high RMB 5100/T

2006 September, Gutter oil priced at RMB 3200/T

2006 September, International oil price drops below USD 70 per barrel

2006 October, International oil price at USD 62 per barrel, smuggled diesel enters Chinese market

2006 October 15, biodiesel market crashing, smuggled diesel price RMB 4900/ T, non-spec diesel is even cheaper. Biodiesel is no longer favored due to density, use and profit considerations

2006 October 30, biodiesel wholesale price RMB 4700/ T

History of Biodiesel in China

2006 December, Sinopec and China Petroleum breaks pact, wholesale price falls below retail price

2006 December, many plants are closed due to market and winter issues

2007 March, many new plants begin production

2007 April, rapid rise of Soy Bean Oil and Palm Oil prices.

2008 February, Soy Bean Oil reached RMB 13810/MT, Palm Oil RMB 10600/MT

Edible Oil price far above Fossil Fuel prices making Biodiesel non-viable

High edible oil price translates to high waste oil price

History of Biodiesel in China

2008 May, Three months before Beijing Olympics, Chinese government ensures unlimited supply and subsidizes any losses

With record low crude price, Sino-Pec and China Petroleum 2 year stockpile is released and Chinese government keeps retail price high to prevent massive losses

2008 June 20, China retail diesel price increased to RMB 6870/MT

2008 December 19, China retail diesel price decreased to RMB 5770/MT

2009 January 15, China retail diesel price decreased to RMB 5610/MT

History of Biodiesel in China

2009 March 25, China retail diesel price increased to RMB 5790/MT

2009 May 31, China retail diesel price increased to RMB 6390/MT

2009 June 29, China retail diesel price increased to RMB 6790/MT

Today

Crude Oil price reached and fell to USD 147 and USD 31 a barrel within 6 months.

Financial Crisis

President Obama announces stimulation of the US economy through stimulating the Renewable Energy Industry

2009 July 28, China retail diesel price drop from RMB 4.05/L to RMB 4.19/L, RMB 6570/MT

Government Incentives

No laws regulating Biodiesel as a product

Renewable Energy Law defining the renewable energy sector. Government encourages high technology, sustainable, renewable and environmentally friendly foreign investments

Specific regulation for renewable power generation, complete with methods of accounting, subsidies, incentives and taxes for different technologies

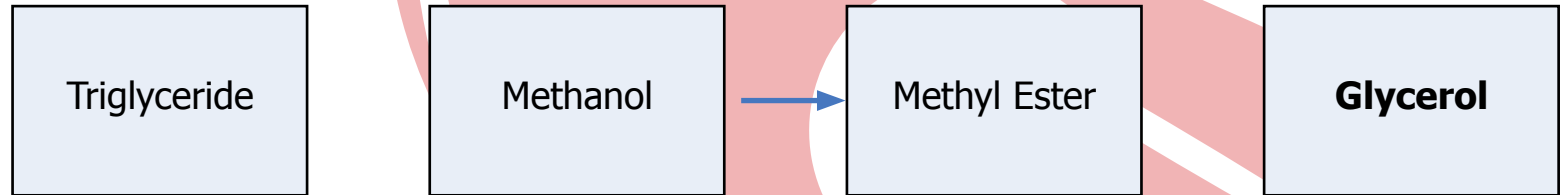
Renewable energy, recycling, energy saving businesses can apply for VAT exemption, government grants, 0% and low interests loans

Stimulus package for Alternative fuel vehicle manufacturing with emphasis on electric and hybrid vehicles

Chinese Biodiesel Standard GB-T 20828-2007, identical to ASTM

Not restriction on Biodiesel Export

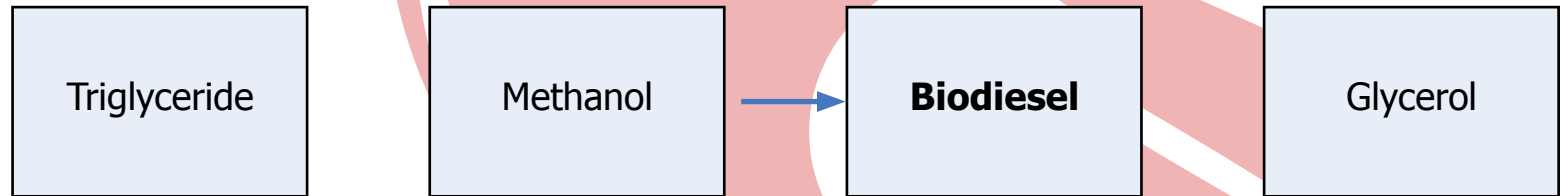
Producing Biodiesel



1945 August 28, US Patent 2,383,579, Patent awarded to Inventors Harold Dwaine Allen and William Ashley Kline, researchers at Colgate-Palmolive-Peet

Glycerol was the product to supply the Explosive industry, Methyl Ester was the side product

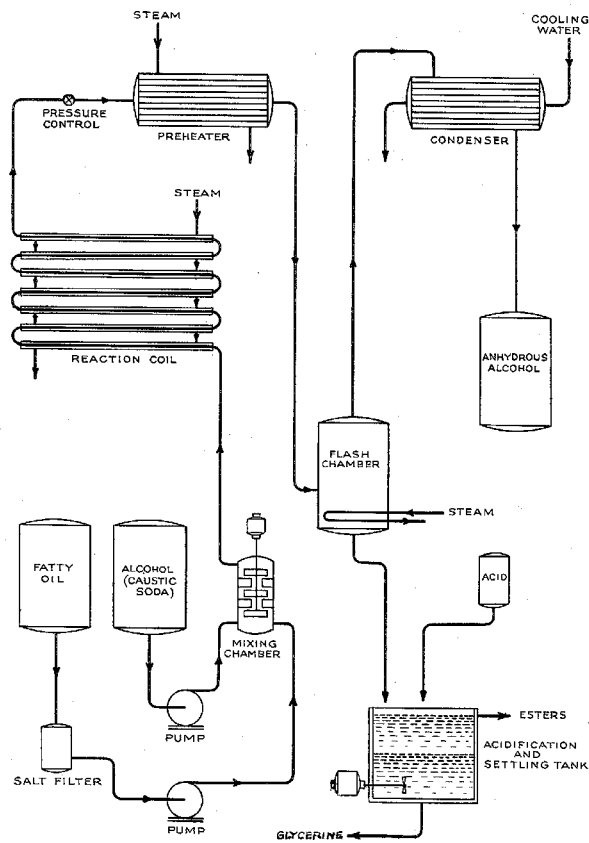
Producing Biodiesel



Fatty Acid Methyl Ester (FAME), C17-C19 and mineral Diesel, C14-C20, has similar material properties

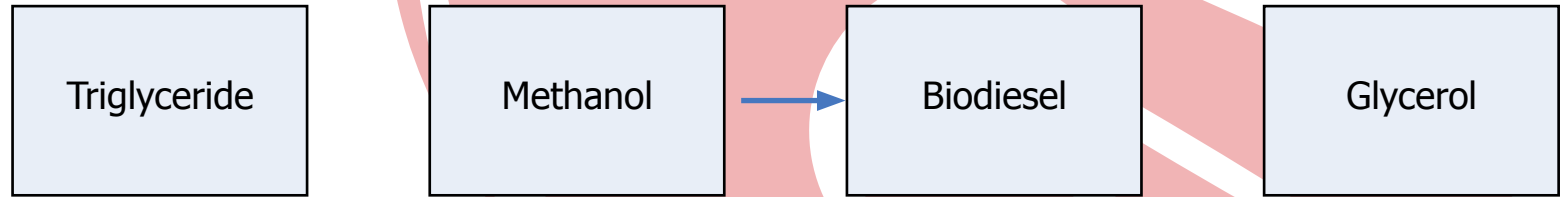
US Patent 2,383,579

Aug. 28, 1945. H. D. ALLEN ET AL 2,383,579
PROCESS FOR TREATING PATS AND FATTY OILS
Filed March 30, 1943



INVENTORS
HAROLD DWAIN ALLEN
WILLIAM ASHLEY KLINE
BY *[Signature]*
ATTORNEY

Producing Biodiesel



Mass (kg)	995	108	1000	103
Unit Price (RMB/1000 kg)	3400	2300	6650*	15,000
Cost (RMB)	3383	248.40	6650	1545

***2009 August Xiamen City Sino-Pec pump price, varies from city to city and much 'off-spec' and smuggled black market diesel available on the market**

Gross Profit RMB 4563.60

But Biodiesel is not Diesel

Diesel

Biodiesel

Mass (kg) 1000

1000

Unit Price (RMB/L) 5.52

5.52

Density 0.83

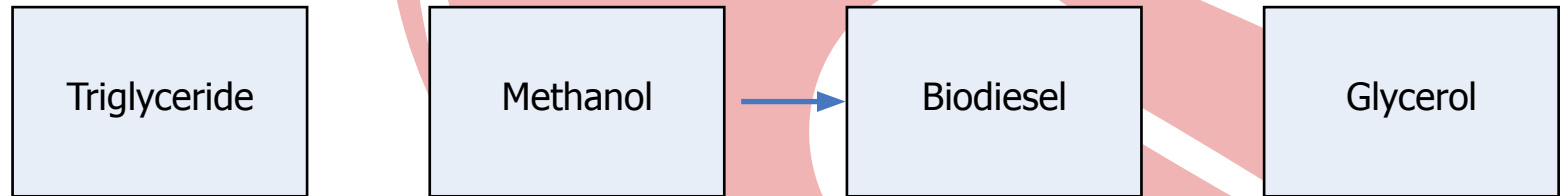
0.87

Volume (L) 1205

1149

RMB 6342.48/T at the pump

and the reality is cruel

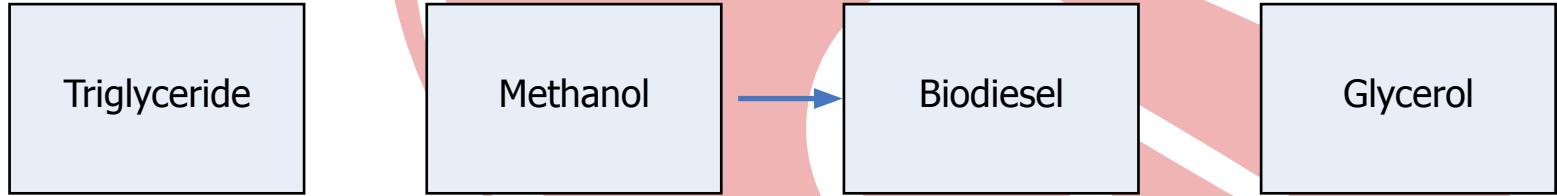


Mass (kg)	1111	216	1000	327
Unit Price (RMB/1000 kg)	3400	2300	5708.23*	0
Cost (RMB)	3777.40	496.80	5708.23*	0

***10% discount on RMB 5708.23 to compensate for extra mileage caused by lower heat value**

Gross Profit RMB 1434.03

Taxation without Representation



	Triglyceride	Methanol	Biodiesel	Glycerol
Mass (kg)	1111*	216	1000	327
Unit Price (RMB/1000 kg)	3400	2300	5708.23	0
Cost (RMB)	3777.40	496.80	5708.23	0
VAT (17%)	0	84.46	970.34	0

After Tax RMB 548.15

Not all Feedstock is Equal



Not all Feedstock is Equal



All kinds of Feedstock

COBRA Feedstock Library



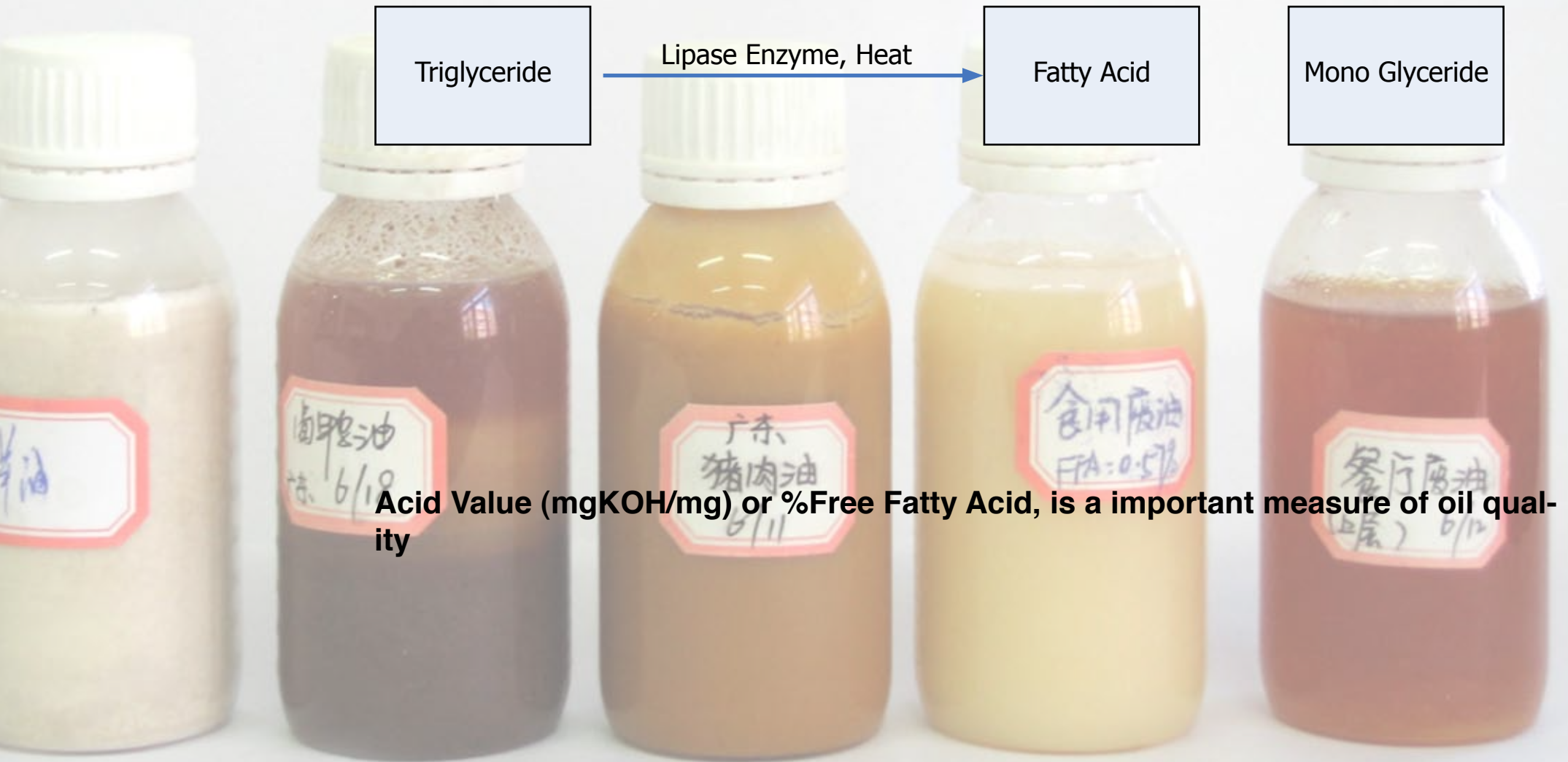
All kinds of Feedstock



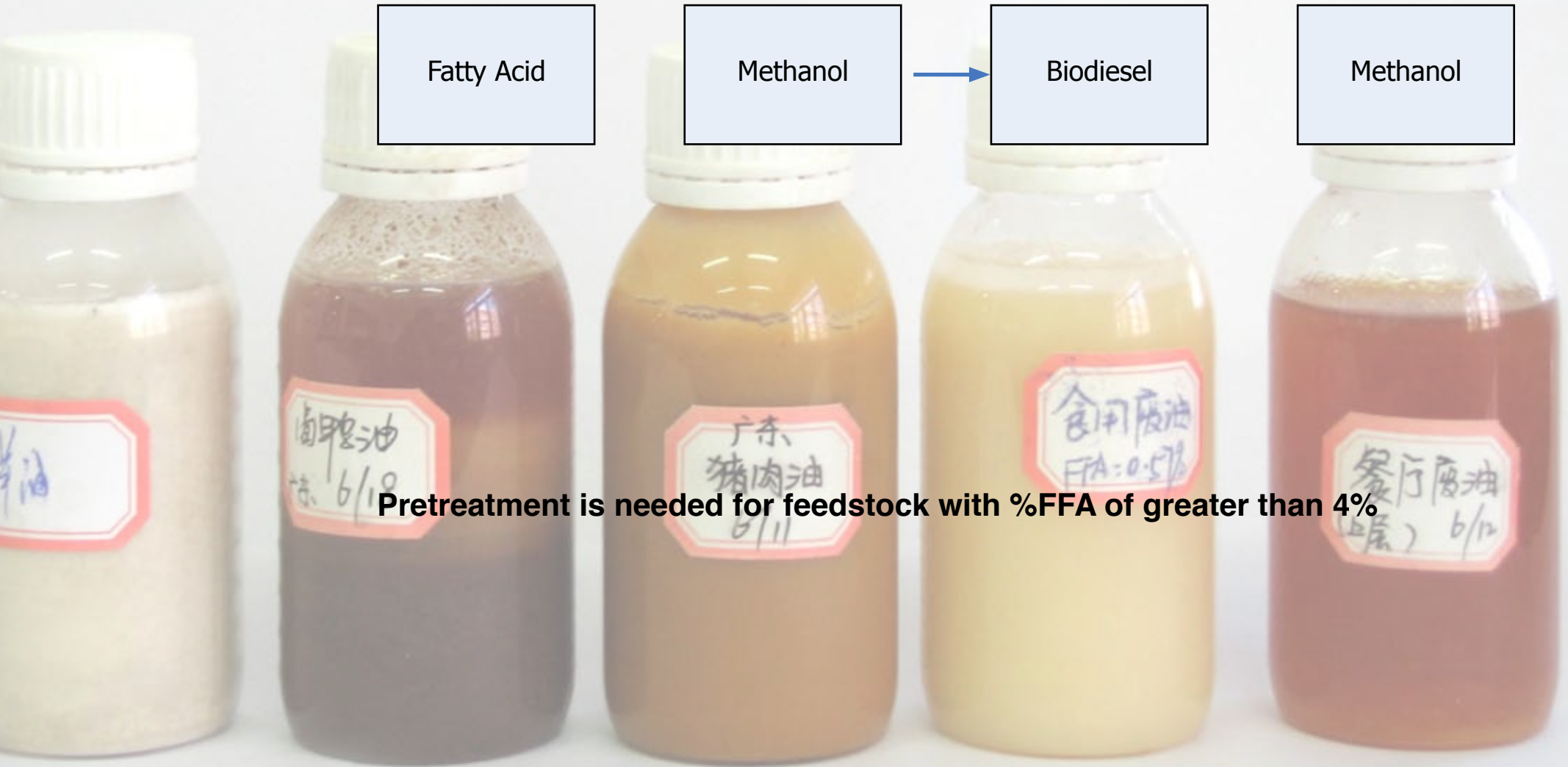
All kinds of Feedstock



What happens to old oil

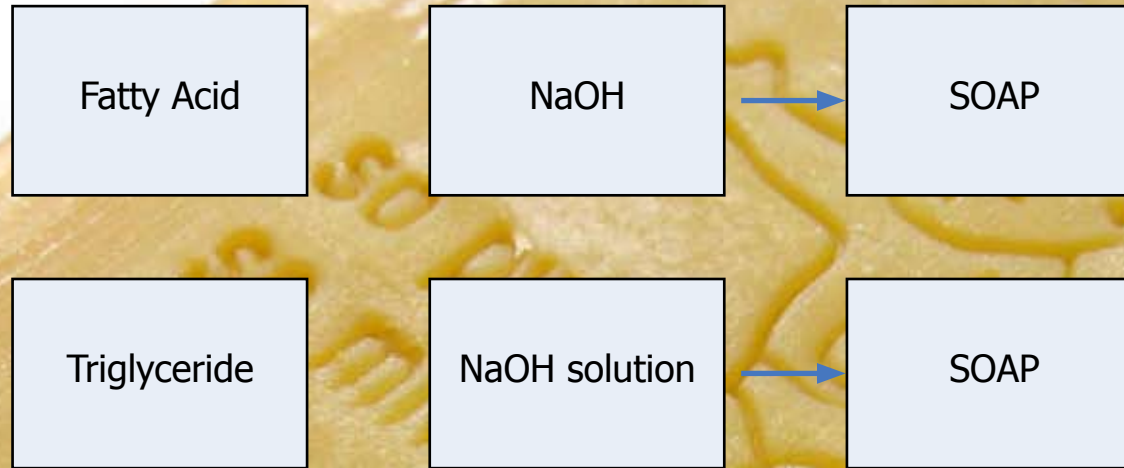


Pretreatment



Pretreatment is needed for feedstock with %FFA of greater than 4%

Counter Reactions



Soap is not fuel

All kinds of Biodiesel



Mr. Cai Biodiesel





清大科码科技有限公司



生物柴油 复合柴油

清华技术领先全国

全球石油资源已近枯竭
开发可再生资源迫在眉睫!
生物液体燃料的出现
带来了石油市场璀璨的新曙光!

详情点击进入

废塑料 废轮胎 废机油

废物堆里炼出的黄金万两

旋转炼油机采用全新结构360°整体旋转中轴线出油气，逆向自动排渣，滑动翻料等有一系列独到设计。进出料系统采用高强度无泄露装置，密封性、安全性极佳。

详情点击进入

To scale up

TAX FREE ! or as low as possible (VAT, Consumer Tax, Fuel Tax, Income Tax ...etc)

Secure Steady Supply of Feedstock

Reduce Price of Feedstock, establish commodity market

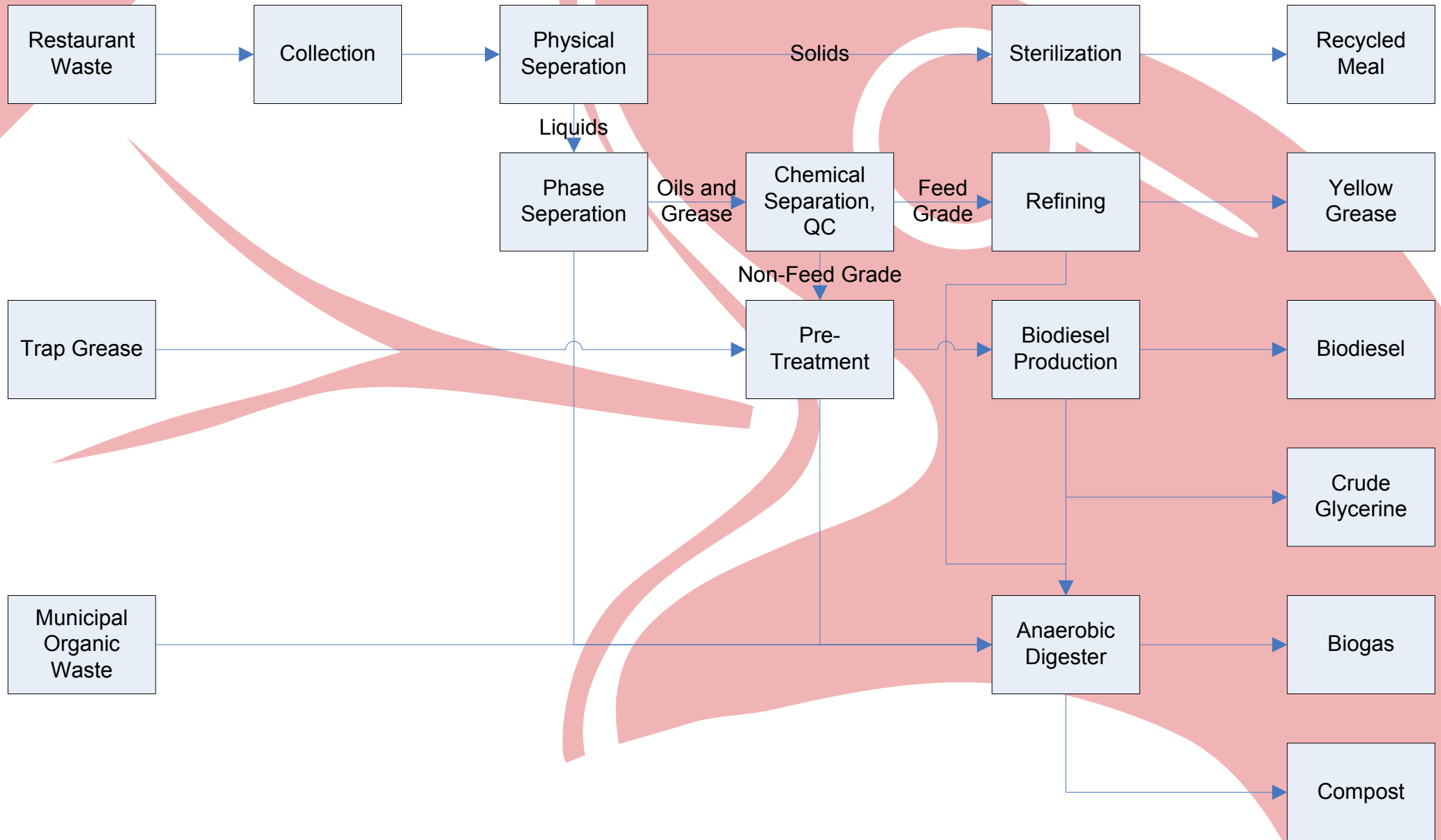
Reduce Transportation cost

Increase Biodiesel Price, emphasis of environmental value

Need Biodiesel Industry Material, Production and Application standards and best practices

VERTICAL INTEGRATION

The COBRA Process



ASTM Certified



CERTIFICATE OF ANALYSIS

NO.: 2008022227

SAMPLE NO. : 2008-MIS-051004-002
JOB NO. : SG100-0004192
DATE RECEIVED : 10-Dec-2008
REPRESENTING : COBRA BIODIESEL
ADDRESS : PRO-TEK (XIAMEN) ELECTROPLATING DEVELOPMENT LTD, GUANNAN INDUSTRY ZONE, GUANKOU, XIAMEN, CHINA

SAMPLE DESCRIPTION :
 PRODUCT : BIODIESEL FUEL
 SAMPLE NO: 2008111202
 SAMPLE DATE : 10/12/2008

The above sample was tested on 10-Dec-2008 in accordance with the test method(s) stipulated, with the result(s) as follows:-

TEST	METHOD	UNIT	SPECIFICATION	RESULT
Flash Point, PMCC	ASTM D93-07	°C	93.0 Min	177.0
Methanol Content (Alcohol Control)	EN 14110-03	Vol %	0.2 Max	<0.01
Flash Point, PMCC (Alcohol Control)	ASTM D93-07 ..	°C	130.0 Min	177.0
Water and Sediment	ASTM D2709-96(06)	Vol %	0.050 Max	<0.005
Kinematic Viscosity @ 40°C	ASTM D445-06	mm ² /s	1.9-6.0	4.633
Sulfated Ash	ASTM D874-06	wt %	0.020 Max	<0.005
Sulphur	ASTM D5453-06	wt %	0.0015 Max (Grade S15), 0.05 Max (Grade S500)	0.0027
Copper Corrosion @ 100°C for 3 hrs	ASTM D130-04e1		No.3 Max	1a
Cetane Number	ASTM D613-01		47 Min	67.3
Cloud Point	ASTM D2500-05	°C	Report	+6
Micro Carbon Residue	ASTM D4530-07	wt %	0.050 Max	0.06
Total Acid Number	ASTM D664-07	mg KOH/g	0.50 Max	0.109
Free Glycerin	ASTM D6584-07	wt %	0.020	<0.010
Total Glycerin	ASTM D6584-07	wt %	0.240	0.140
Phosphorus	ASTM D4951-02	wt %	0.001 Max	<0.0001
90% Recovered	ASTM D1160-02a	°C	360 Max	352.0
Calcium + Magnesium	EN 14538	ppm	5 Max	<1
Sodium + Potassium	EN 14538	ppm	5 Max	<1
Oxidation Stability @ 110 °C	EN 14112-03	hr	3 Min	<3.0
Cold Filter Plugging Point	EN 116	°C	Report	+4
Cold Soak Filtration Test	ASTM D6751-Annex A1			
Filtration Time > 720 sec volume filtered	ASTM D6751-Annex A1	mL	Report	160



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Date Printed : 24-Dec-2008

Revision : 4
 Issued : Dec 2008

Intertek Testing Services (Singapore) Pte Ltd
 Business Reg No.: 197401138D
 Laboratory: Singapore Technical Centre
 Laboratory: Intertek Universal Laboratory

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B20 passes GB 252-2000 standard



第1页共4页

检测报告

TEST REPORT


编号 No.	262565
样品名称 Sample Description	B20
型号规格 Type, Specification	0号
受检单位 Inspected Entity	先锋(厦门)电镀开发有限公司
委托单位 Applicant	先锋(厦门)电镀开发有限公司
检验类别 Test Type	委托检验

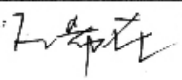
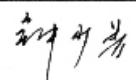
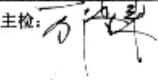
广东(惠州)石油产品质量监督检验中心
广东省惠州市石油产品质量监督检验中心
Guangdong Huizhou Testing Centre for Petroleum Products Quality

2006年11月11日 (Y/M/D)

检测报告

No. 262565
第3页 共4页

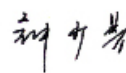
样品名称	B20	型号、规格、等级	0号		
受检单位	先锋(厦门)电镀开发有限公司		检验类别	委托检验	
委托单位	先锋(厦门)电镀开发有限公司		邮政编码/电话	361023 0592-6380558	
委托单位地址	厦门市集美区灌口镇灌南工业区		抽样基数	—	
供货单位	先锋(厦门)电镀开发有限公司		样品数量	2.5L	
来样日期	2006-10-12	来样方式	寄送	来样/接样单号	0001501
检验依据	GB 252-2000《轻柴油》、GB/T 384-1981(88)等。				
检验结论:	<p>该样品检验项目: 色度、氧化安定性、硫含量、酸度、10%蒸余物残炭、灰分、铜片腐蚀、水分、机械杂质、运动粘度、凝点、冷滤点、闪点、馏程、十六烷指数、密度、热值。 所检项目符合0号轻柴油质量指标要求。</p>				
					
			检验日期: 2006年10月14日		
未经本中心书面批准, 不得复制本报告(完整复制除外)。					
附注: 1. 样品状态: 样品塑料瓶装。 2. 检测仪器: 闪点测定器、硫含量测定器等。 3. 检测环境条件: 27~30 °C, 70~76 %RH 4. 检测结果的不确定度(必要时填写): 5. 偏离情况(必要时填写): 6. 抽样情况(必要时填写): 7. 其他:					

授权签字人:  审核:  主检: 

检测报告

No. 262565
第4页 共4页

序号	检验项目	检验依据	质量指标	检验结果	单项结论
1	色度, 号	GB/T 6540	≤3.5	2.5	合格
2	氧化安定性, 总不溶物 mg/100mL	SH/T 0175	≤2.5	0.6	合格
3	硫含量, % (m/m)	GB/T 17040	≤0.2	0.13	合格
4	酸度, mgKOH/100mL	GB/T 258	≤7	6.6	合格
5	10%蒸余物残炭, % (m/m)	GB/T 268	≤0.3	0.058	合格
6	灰分, % (m/m)	GB/T 508	≤0.01	0.001	合格
7	铜片腐蚀(50°C, 3h), 级	GB/T 5096	≤1	1a	合格
8	水分, % (V/V)	目测	≤痕迹	无	合格
9	机械杂质	目测	A:	无	合格
10	运动粘度(20°C), mm ² /s	GB/T 265	3.0~8.0	4.994	合格
11	凝点, °C	GB/T 510	≤0	<-2	合格
12	冷滤点, °C	SH/T 0248	≤4	-4	合格
13	闪点(闭口), °C	GB/T 261	≥35	67	合格
14	馏程	GB/T 6536			
	50%回收温度, °C		≤300	295.5	合格
	90%回收温度, °C		≤355	344.0	合格
	95%回收温度, °C		≤365	356.5	合格
15	十六烷指数	GB/T 11139	≥45	50	合格
16	密度(20°C), kg/m ³	GB/T 1884 GB/T 1885	实测	853.0	—
备注	热值, Cal/g, 总热值 净热值	GB/T 384	—	9370 9070	—

审核: 

主检: 

Marine Application

Table 1 — Requirements for marine distillate fuels

Characteristic	Limit	Category ISO-F-				Test method reference
		DMX	DMA	DMB	DMC	
Appearance		Visual		—	—	See 6.2
Density at 15 °C, kg/m ³	max.	1) ¹	890,0	900,0	920,0	ISO 3675 or ISO 12185 (see also 6.3)
Viscosity at 40 °C, mm ² /s ²⁾	min. max.	1,40 5,50	1,50 6,00	— 11,0	— 14,0	ISO 3104 ISO 3104
Flash point, °C	min.	43	60	60	60	ISO 2719 (see also 6.4)
Pour point (upper), °C ³⁾	max.	—	—6	0	0	ISO 3016 ISO 3016
— winter quality	max.	—	0	6	6	
— summer quality	max.	—	—	—	—	ISO 3015 (see also 6.5)
Cloud point, °C	max.	—16 ⁴⁾	—	—	—	ISO 3015 (see also 6.5)
Sulfur, % (m/m)	max.	1,0	1,5	2,0	2,0	ISO 8754 (see also 6.6)
Cetane number	min.	45	40	35	—	ISO 5165 (see also 6.7)
Carbon residue (micro method, 10 % (V/V) distillation bottoms), % (m/m)	max.	0,30	0,30	—	—	ISO 10370
Carbon residue (micro method), % (m/m)	max.	—	—	0,30	2,50	ISO 10370
Ash, % (m/m)	max.	0,01	0,01	0,01	0,05	ISO 6245
Sediment, % (m/m)	max.	—	—	0,07	—	ISO 3735
Total existent sediment, % (m/m)	max.	—	—	—	0,10	ISO 10307-1
Water, % (V/V)	max.	—	—	0,3	0,3	ISO 3733
Vanadium, mg/kg	max.	—	—	—	100	ISO 14597
Aluminium plus silicon, mg/kg	max.	—	—	—	25	ISO 10478 (see also 6.8)

1) In some geographical areas, there may be a maximum limit.
2) 1 mm²/s = 1 cSt.
3) Purchasers should ensure that this pour point is suitable for the equipment on board, especially if the vessel operates in both the northern and southern hemispheres.
4) This fuel is suitable for use without heating at ambient temperatures down to -15 °C.

CERTIFICATE OF ANALYSIS

NO.: 2009005688

SAMPLE NO. : 2009-MIS-010891-001
JOB NO. : SG100-0005110
DATE RECEIVED : 18-Mar-2009
REPRESENTING : COBRA BIODIESEL
ADDRESS : PRO-TEK (XIAMEN) ELECTROPLATING DEVELOPMENT LTD, GUANNAN INDUSTRY ZONE, GUANKOU, XIAMEN, CHINA

SAMPLE DESCRIPTION :
PRODUCT : BIODIESEL
SOURCE : DMB
SAMPLE DATE : 18/03/2009

The above sample was tested on 18-Mar-2009 in accordance with the test method(s) stipulated, with the result(s) as follows:-

TEST	METHOD	UNIT	SPECIFICATION	RESULT
Density @ 15 °C	ISO 12185-96	kg / L	Report	0.8842
Kinematic Viscosity @ 40°C	ISO 3104-94	cSt	Report	5.677
Flash Point	ISO 2719-02	°C	Report	168.0
Pour Point	ISO 3016-94	°C	Report	+3
Sulphur	ISO 8754-03	wt %	Report	<0.02
Calculated Cetane Index	ISO 4264-07		Report	60.0
Micro Carbon Residue	ISO 10370-93	wt %	Report	0.08
Ash	ISO 6245-01	%m/m	Report	0.003
Appearance	Visual		Report	Bright and Clear
Total Sediment Existent	ISO 10307-1(93)	wt %	Report	<0.01
Water by Distillation	ISO 3733-99	Vol %	Report	<0.05

REMARKS :



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Date Printed: 25-Mar-2009

Revision: 4
 Issued: Dec 2005

CERTIFICATE OF ANALYSIS

NO.: 2009005690

SAMPLE NO. : 2009-MIS-010895-001
JOB NO. : SG100-0005110
DATE RECEIVED : 18-Mar-2009
REPRESENTING : COBRA BIODIESEL
ADDRESS : PRO-TEK (XIAMEN) ELECTROPLATING DEVELOPMENT LTD, GUANNAN INDUSTRY ZONE, GUANKOU, XIAMEN, CHINA

SAMPLE DESCRIPTION :
PRODUCT : BIODIESEL
SOURCE : DMC
SAMPLE DATE : 18/03/2009

The above sample was tested on 18-Mar-2009 in accordance with the test method(s) stipulated, with the result(s) as follows:-

TEST	METHOD	UNIT	SPECIFICATION	RESULT
Density @ 15 °C	ISO 12185-96	kg / L	Report	0.9001
Kinematic Viscosity @ 40°C	ISO 3104-94	cSt	Report	12.86
Flash Point	ISO 2719-02 --	°C	Report	168.0
Pour Point	ISO 3016-94	°C	Report	+3
Sulphur	ISO 8754-03	wt %	Report	<0.015
Micro Carbon Residue	ISO 10370-93	wt %	Report	0.19
Ash	ISO 6245-01	%m/m	Report	0.009
Total Sediment Existent	ISO 10307-1(93)	wt %	Report	<0.01
Water by Distillation	ISO 3733-99	Vol %	Report	<0.05
Vanadium	IP 501-05	mg / kg	Report	<1
Aluminium	IP 501-05	mg / kg	Report	2
Silicon	IP 501-05	mg / kg	Report	2
Calcium	IP 501-05	mg / kg	Report	<1
Zinc	IP 501-05	mg / kg	Report	<1
Phosphorus	IP 501-05	mg / kg	Report	<1

REMARKS :



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Date Printed: 25-Mar-2009


Revision: 4
 Issued: Dec 2005

COBRA Grease Monkey 1



COBRA Grease Monkey 1





COBRA Grease Monkey 1

COBRA Grease Monkey 1

Begin operations in May 2007

Privately funded, 15 million RMB spent to date

30 T per day capacity

Developing Crude Glycerine applications

**On site waste water treatment available and developing
Biodiesel specific Biogas digester and Biogas applications**

Biodiesel Research Platform



Shenyang Kitchen Waste Recycling



Recycled Meal



Shenyang Kitchen Waste Recycling



Shenyang Kitchen Waste Recycling

Began trial operation December 2006, ended June 2008

30 T per day of Kitchen Waste Treatment Capacity

Biogas potential is 52 cubic meter of Biogas per 1 T of waste water*. Kitchen waste is 70% liquid

Shenyang city generates 200 T of Kitchen Waste per day

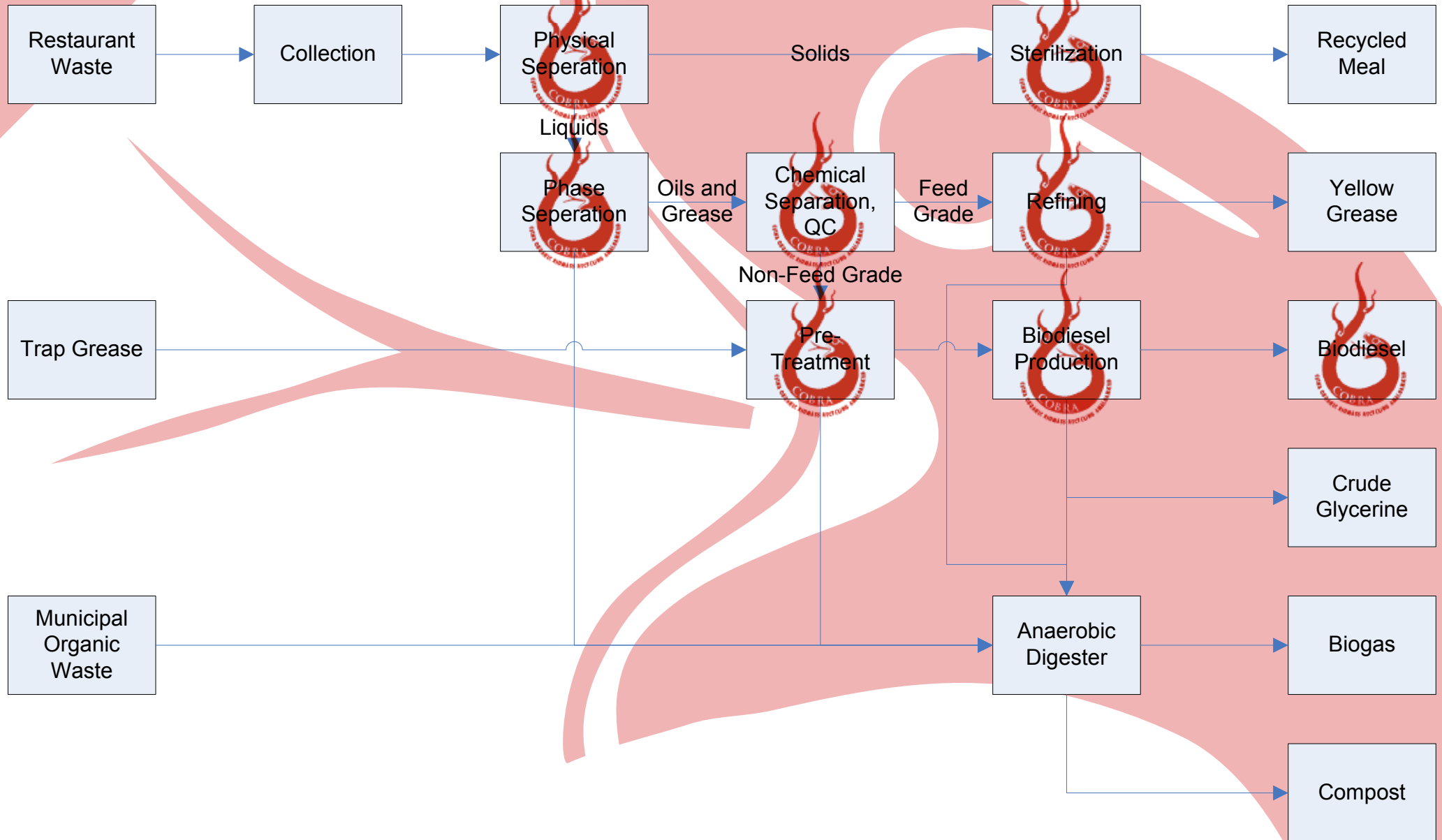
Project terminated and equipment dismantled due to poor or no local government cooperation, long management distances.

Key project data gathered, next generation leftover treatment plant is designed and project costs estimated

Government, management and operational details are planned based on experience learned at Shenyang plant

***Institute of Clean Energy and Environmental Engineering & Liaoning Key Lab of Clean Energy**

Half way there



Tough Road ahead

Tax issues, subsidies issues

Who is in-charge ? and too many people in-charge

Vertical Integration is an uphill struggle

Conclusion

Needs to be sustainable