OIL SEED CROP PLANTATION FOR BIO-DIESEL

- **PONGAMIA PINNATA**

By : **Albarakat Grpoup**

http://sites.google.com/site/biogreentech1/home

Pongamia Pinnata.....

- Pongamia pinnata is one of the few nitrogen fixing trees (NFTS) to produce seeds containing 30-40% oil. It is often planted as an ornamental and shade tree but now-a-days it is considered as alternative source for Bio- Diesel. This species is commonly called pongam or karanja in India.

Land Requirement…

- Large plots of waste land can be selected for Pongamia cultivation, thus it does not compete with cash/food crops. Larger area can be cultivated at a time as it require very little care.
- This will provide much needed employment to the rural poor. Cultivation cost is less than USD 200 to 250 per Ha for large area.

Pongamia .....

- Pongam (Leguminoceae, subfamily Papilionoideae) is a medium sized tree that generally attains a height of about 8 m and a trunk diameter of more than 50 cm.

- The trunk is generally short with thick branches spreading into a dense hemispherical crown of dark green leaves.

- The bark is thin gray to grayish- brown, and yellow on the inside. The taproot is thick and long; lateral roots are numerous and well developed.

- The alternate, compound pinnata leaves consist of 5 or 7 leaflets which are arranged in 2 or 3 pairs, and a single terminal leaflet.

- Leaflets are 5-10 cm long, 4-6 cm wide, and pointed at the tip. Flowers, borne on racemes, are pink, light purple, or white.

- Pods are elliptical, 3-6 cm long and 2-3 cm wide, thick walled, and usually contain a single seed. Seeds are 10-20 cm long, oblong, and light brown in color.

Germplasm.....

- Research conducted in India by several Agricultural Institution found that, pongam, or cvs thereof, is reported to tolerate drought, frost, heat, limestone, salinity, sand, and shade. ($2n = 22$).
- It can be grown in different types of flood free soil and matured tree withstand water lodging. Pongamia grows very well along water ways.

Distribution……..

- A species believed to be originated in India , a medium-sized sub-evergreen tree, common on alluvial and coastal situations from India to Fiji, from sea level to 1200 m.

- Now found in **Australia, Florida, Hawaii, India, Myanmar, Malaysia, Oceania, Philippines, Seychelles and Thailand**. Test plantation in African countries are proved to be successful.

Ecology…….

- It can grow from Tropical Dry to Moist through Subtropical Dry to Moist Forest Life Zones. Withstanding temperatures slightly below 0℃ to 50℃ and annual rainfall of 500–2500 mm per annuam, the tree grows wild on sandy and rocky soils, including oolitic limestone, but will grow in most soil types, even with its roots in salt water!

Propagation……

- Its propagation is by direct seedlings or by planting nursery raised seedlings. Propagation by branch cuttings and root suckers is also possible .
- Its seeds can immediately be sown after removing from matured pods and start germination after 7 days of sowing and cent percent seeds germinate.
- Seeds may be stored for an year without removing from pods and when removed they may be stored in an airtight box for delayed sowing.

Seed Germination……

- Generally seeds do not require any pretreatment before sowing. But, soaking the seeds in hot water for 15 minutes improves germination percent & vigor.
- Seeds are sown in seed beds / poly pots / sand trays with the micropyle facing downwards. Seed germinates within two weeks of sowing. Seedlings attain a height of 25-30 cm in their first growing season.
- Transplanting to the field should occur at the beginning of the next rainy season when seedlings are 60 cm in height. Seedlings have large root systems. Soil should be retained around the roots during transplanting.
- Seedling survival and growth benefit from annual weed control for the first three years after transplanting. Pits of 30 cm^3 are appropriate for planting.

Tree, roots, seeds & leaves …….

- The seeds contain pongam oil, bitter, red brown, thick, non-drying, non-edible oil, 27–36% by weight, which is used for tanning leather, soap, as a liniment to treat scabies, herpes, and rheumatism and as an illuminating oil.

- Also used for lubrication and indigenous medicine. The oil has a high content of triglycerides, and its disagreeable taste and odor are due to bitter flavor constituents, pongamin and karanjin.

- The wood is yellowish white, coarse, hard, and beautifully grained, but is not durable.

- Use of the wood is limited to small furniture making, cart wheels, posts, and fuel . Both the oil and residues are toxic. But, the pressed cake is described as a "useful poultry feed."
- It is recommended as a shade tree for pastures and windbreak for tea and coffee estates. The leaves are said to be a valuable lactagogue fodder, especially in arid regions.
- It is sometimes intercropped with pasture, the pasture grasses said to grow well in its shade.

- Dried pongama leaves are used in stored grains to repel insects. Leaves often plowed green manure, thought to reduce nematode infestations.

- Pongamia‘s spreading roots make it valuable for checking erosion and stabilizing dunes. The ash of the wood is used in dyeing.

Roots…….

- Tap roots of Pongamia are deep seated and mines water for its need even from 10 meters depth without competing other crops.

- Root nodules formation due to ***Rhizobium*** Strains in nursery and in fields is common by which nitrogen is replenished in soil. Dense network of lateral roots of Pongamia control soil erosion. It is also a drought resistant plant.

Harvesting…….

- Pods are collected and shells removed by hand.
- Mechanical Harvesting method similar to Olive seed harvesting may be implemented for faster and effective harvesting and decocting machine may be used for the shell removal.

Yield……

- Fruits setting of Pongamia starts from fifth year onwards of plantation.
- It flowers in April-May and fruits mature in January-February.
- Each pod bears single seed and average fresh weight of a matured seed is 1.2 gm. From 5th year onward of plantation it starts flowering and fruiting.
- Commercial productions of seeds start from 10 years onwards of plantation and a full-grown tree may yields up to100 kg. or even more fresh seeds per annum to 60-70 years or more.

Pongamia Cultivation per Hectare……

- Pongamia Pinnata may be cultivated in the waste land, or in any other chosen land as per the parameters given earlier in the presentation.
- Spacing differs from the soil conditions and terrain. But the best spacing for the commercial cultivations would be 5 mtr x 5 mtr to have 400 tress per Hectare.

Weeding .....

- Two or three weedings are required per year for the first 3-4 years of sowing / planting.

Diseases…….

- Commonly infected by fungi like ***Uromyces*** sp. And ***Cercospora*** sp. in winter. In some trees leaf galls are also found.
- These diseases do very les harm to the vegetative growth of Pongamia but how they affect in seeds productions are yet to be ascertained. Diseases at seedling stage are not found.
- For more info please visit http://sites.google.com/site/biogreentech1/home

Non-Edible Oil…….

- Seeds of Pongamia have about 30-35% oil and up to 27-28% oil can be expressed in crusher. By using solvent extraction method up to 35% of the oil can be extracted.
- Most of the physical and chemical properties of the oil is almost similar to those of the diesel , though ‘conardson carbon’ residue is higher incase of it and due to high viscosity preheating is needed to start a diesel engine.
- Pongamia oil in India is used in pump sets are run there with pongamia oil by the farmers for lift irrigation. Oil is also used as a lubricant, water paint binder, pesticide and in soap making and tanning industries.

Oil Cake……

- Oil cakes are good organic fertilizer and bears nitrogen 4%, phosphorous 1% and potassium 1% which is better than vermicompost or competent fertilizer compare with any other natural manure.

مجموعة البركات للتجارة واعمال البيئة

المملكة العربية السعودية جدة تليفون ٩٦٦٥٩١٠٠٨٠٣٢

قاكس ٩٦٦٢٦٦٨٧٤٢٤ بريد الكتروني

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Energy……

- Wherever it is grown, the wood (calorific value 4,600 kcal/kg) is burned for cooking fuel The thick oil from the seeds is used for illumination, as a kerosene substitute, and lubrication.
- It would seem that with upgraded germplasm one could target for 2 MT oil and 5 MT firewood per hectare per year on a renewable basis. The oil has been tried as fuel in diesel engines, showing a good thermal efficiency.

As Bio-Fuel & Flash Point……

- ***Pongamia*** seed oil as a bio- fuel has physical properties very similar to conventional diesel.
- Emission properties, however, are cleaner for Bio- fuel than for conventional diesel. It has no polyaromatic compounds and reduced toxic smoke and soot emissions. A drastic reduction in sulpher content (<350ppm) and higher cetane number (>51) will be required in the petroleum diesel produced by refineries.
- However, bio-fuel meets these two important specifications and would help in improving the lubricity of low sulpher (0.13-0.16%) diesel. The present specification of flash point for petroleum diesel is 350 C which is lower than all the countries in the world (>550C). Bio-fuel will help in raising the flash point, a requirement of safety.

THANK YOU!

ANY QUESTIONS???

نحن على اتم استعداد لتنفيذ مشارع حكومية عملاقة بتشجير مساحات شاسعة لإنتاج هذا النوع من الديزل الحيوي ولدينا خبرة كبيرة مع شركاء استراليون – ارجنتنيون – برازليون – هنود لذا نأمل عدم التردد بالإتصال بنا وسوف نكون سعداء لخدمتكم والله الموفق ،،،،،،،،،،،،،،

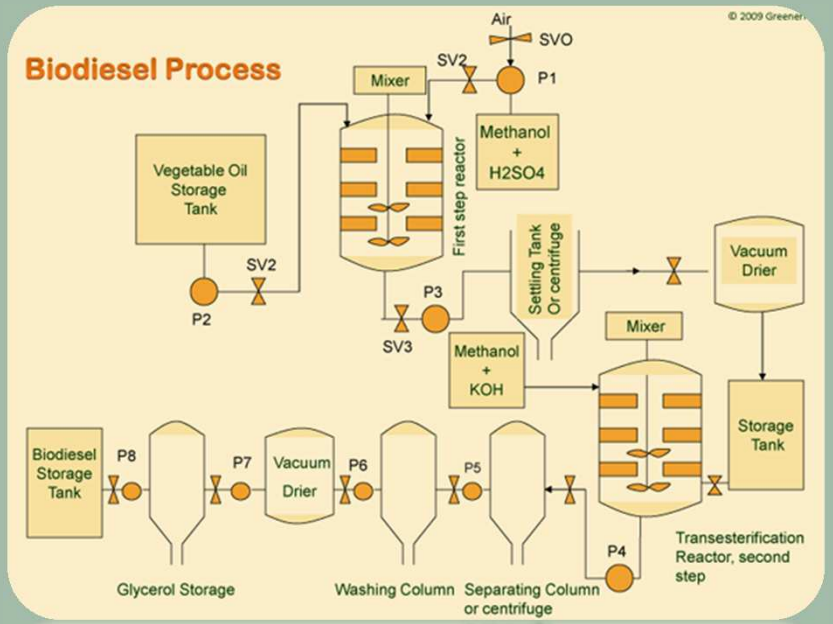
المدير العام

نبيل بن يوسف حمزة

مجموعة البركات للتجارة واعمال البيئة

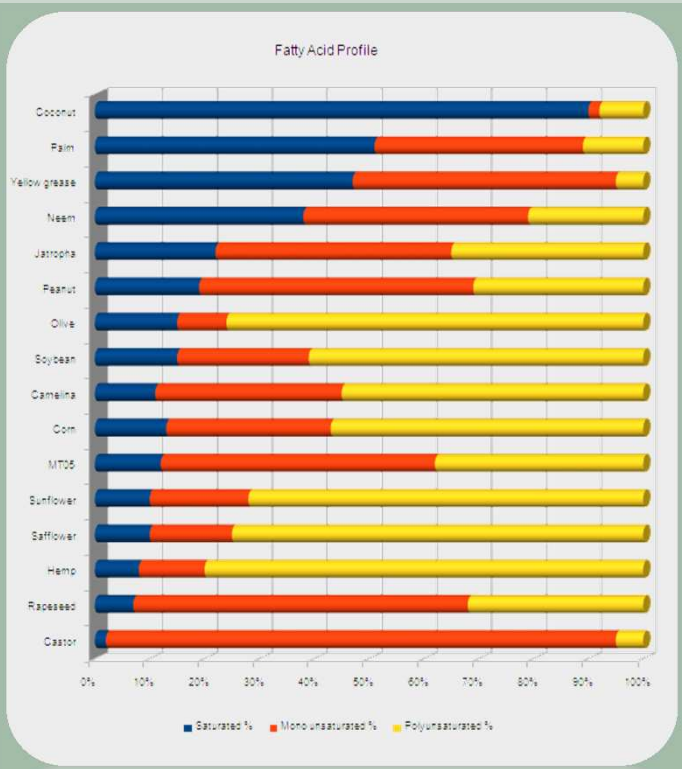
صورة الشجرة بالغة بعمر ٥ سنوات

طريقة علمية لتحضير الوقود الطبيعي



Albarakat Trading Group

علميا اثبت هذا النوع من الزيوت كفاءة عالية مقارنة بالديزل البترولي ومشتقاتة



نسبة استخدام الديزل الطبيعي في اوربا

(المانيا) اكثر الدول الأوربية استخدام له

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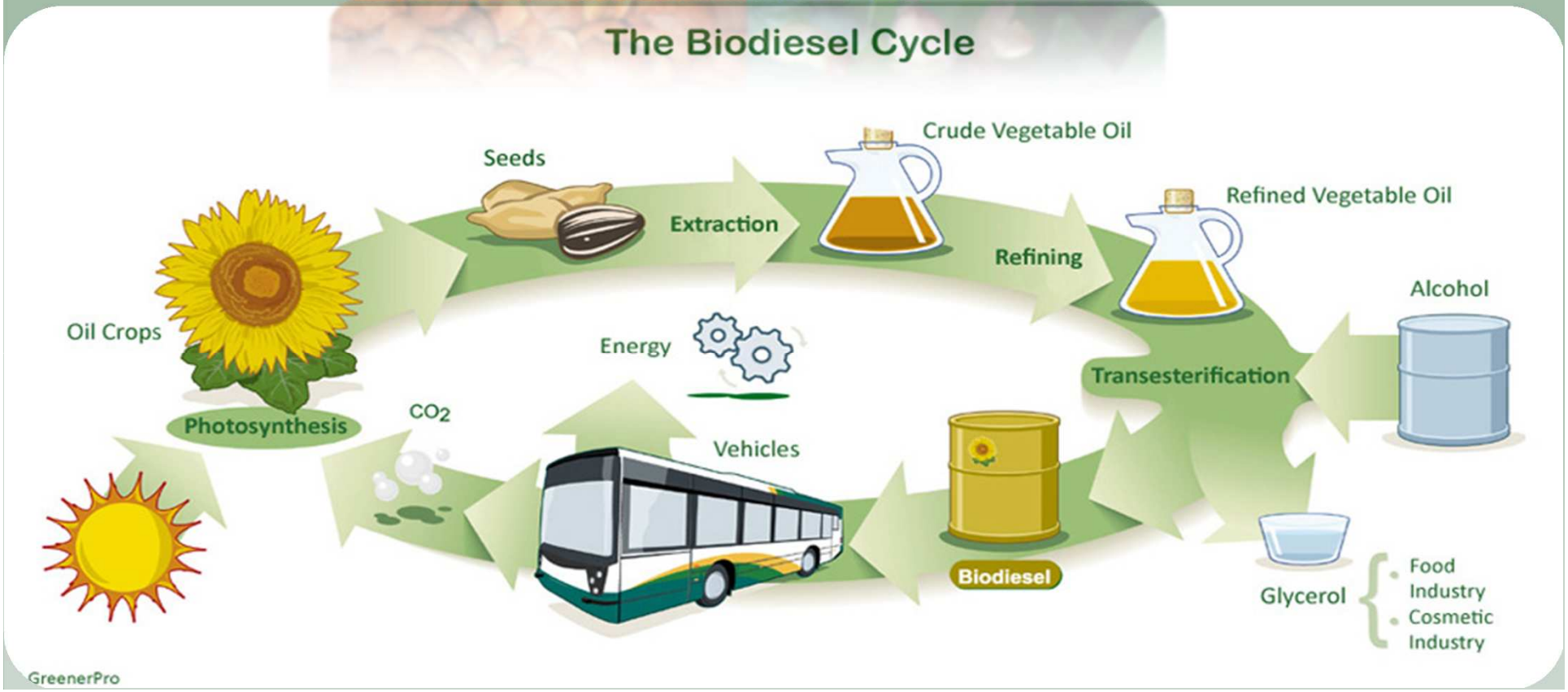
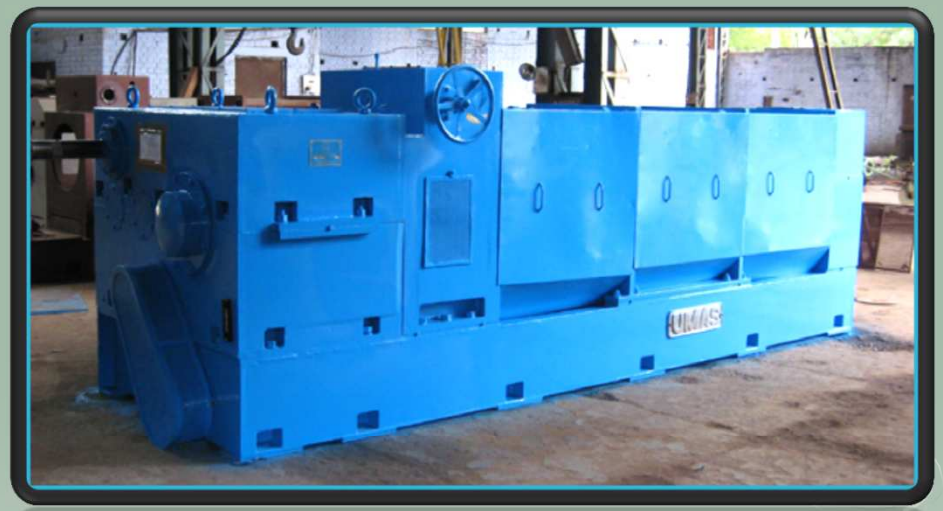
Pongamia


The Biodiesel Cycle
Seeds
Extraction
Crude Vegetable Oil
Refining
Refined Vegetable Oil
Alcohol
Transesterification
Oil Crops
Photosynthesis
Energy
CO_2
Vehicles
Biodiesel
Glycerol
Food Industry
Cosmetic Industry
GreenerPro

تجهيزات خاصة بمعصرة الزيوت بالموقع



مشروع استخراج الزيوت الطبيعية البديلة كديزل طبيعي بدون انبعاثات ضارة على الطبيعة

Green BioFuel is the future project to safe the world

- حلول جدية للمحافظة على بيئة نظيفة

Biodiesel Production

Technologies
From PONGAMIA PINNATA
– Millettia
Jatropha Seeds and any
vegetable oil & animal fat

Types of Biodiesel Production Processes

Definition and standards

Transesterification

Fatty acid chains

Standard recipes

Competing reactions

Process issues

Definition of “Biodiesel”

Biodiesel – a fuel comprised of mono-alkyl esters of long chain fatty acids derived from vegetable oils or animal fats, designated B 100.

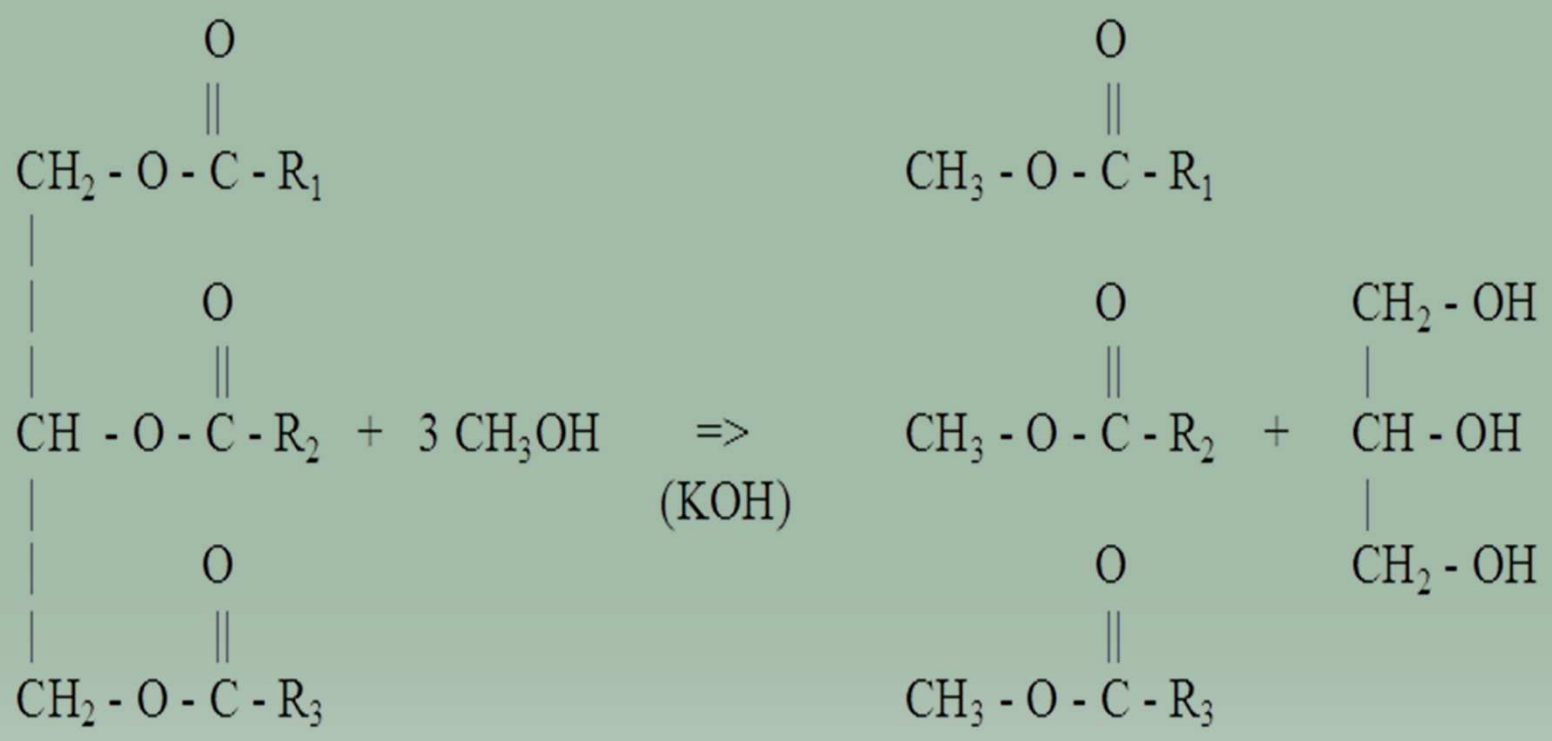
Biodiesel must meet the specifications of ASTM D 6751

A “mono-alkyl ester” is the product of the reaction of a straight chain alcohol, such as methanol or ethanol, with a fat or oil (triglyceride) to form glycerol (glycerin) and the esters of long chain fatty acids. Biodiesel can be used as B 100 (neat) or in a blend with petroleum diesel. A blend of 20 % biodiesel with 80 % petrodiesel, by volume, is termed “B 20”. A blend of 2 % biodiesel with 98 % petrodiesel is “ B 2”, and so on.

ASTM D 6751-02

Property	Method	Limits	Units
Flash point, closed cup	D 93	130 min	° C
Water and sediment	D 2709	0.050 max	% volume
Kinematic viscosity, 40 ° C	D 445	1.9 – 6.0	mm^2/s
Sulfated ash	D 874	0.020 max	wt. %
Total Sulfur	D 5453	0.05 max	wt. %
Copper strip corrosion	D 130	No. 3 max	
Cetane number	D 613	47 min	
Cloud point	D 2500	Report to customer	° C
Carbon residue	D 4530	0.050 max	wt. %
Acid number	D 664	0.80 max	mg KOH/g
Free glycerin	D 6584	0.020	wt. %
Total glycerin	D 6584	0.240	wt. %
Phosphorus	D 4951	0.0010	wt. %
Vacuum distillation end point	D 1160	360 °C max, at T-90	% distilled

Transesterification



Triglyceride methanol mixture of fatty esters glycerin

Triglyceride Sources

Rendered animal fats: beef tallow, lard
Vegetable oils: soybean, canola, palm, etc.
Chicken fat
Rendered greases: yellow grease (multiple sources)
Recovered materials: brown grease, soapstock, etc.

Standard Recipe

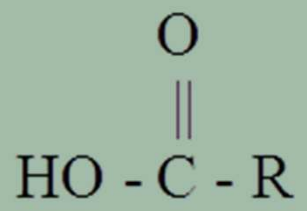
100 lb oil + 21.71 lb methanol

→ 100.45 lb biodiesel + 10.40 lb glycerol
+ 10.86 lb XS methanol

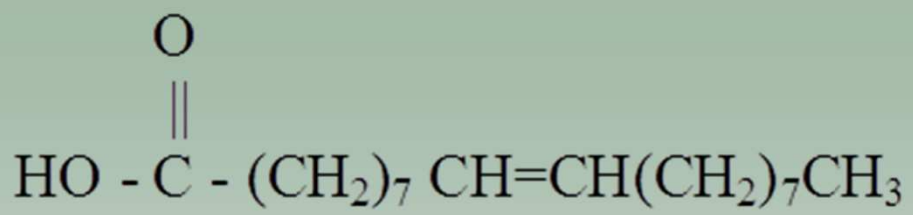
Plus 1 lb of NaOH catalyst

Competing Reactions

Free fatty acids are a potential contaminant of oils and fats.



Carboxylic Acid (R is a carbon chain)



Oleic Acid

Fatty acids react with alkali catalyst to form soap.

KOH + HO - C(=O) - (CH2)7 CH=CH(CH2)7CH3

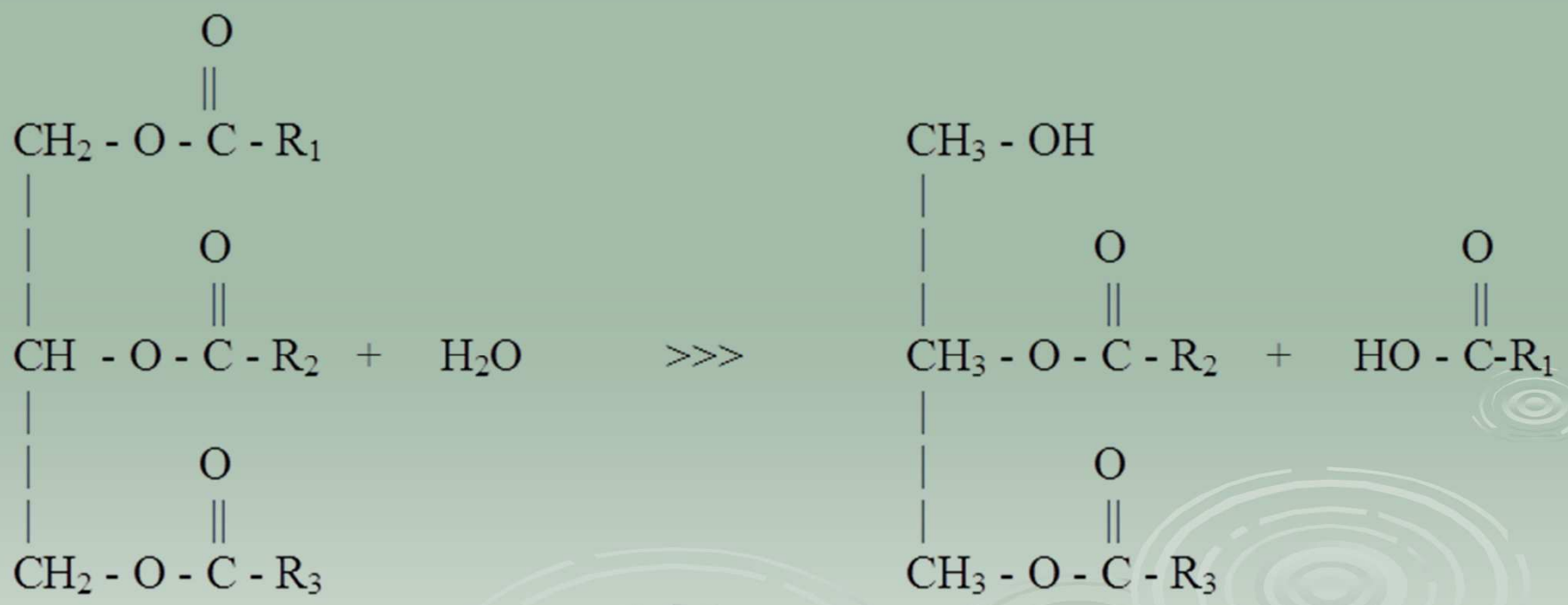
Potassium Hydroxide Oleic Acid

C - (CH2)7 CH=CH(CH2)7CH3 + H2O C(=O) K+ -O - →

Water Potassium oleate (soap)

Water is also a problem

Water hydrolyzes fats to form free fatty acids, which then form soap.



Triglyceride **Water** **Diglyceride** **Fatty acid**

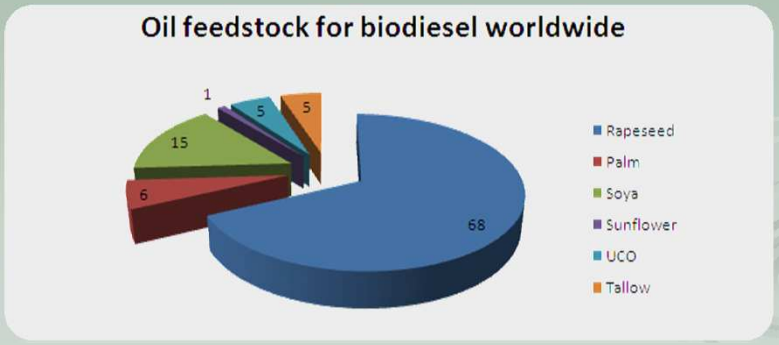
Soap

Soaps can gel at ambient temperature causing the entire product mixture to form a semi-solid mass.

- **Soaps can cause problems with glycerol separation and washing.**

Feedstocks Used in Biodiesel Production

Triglygeride or fats and oils (e.g. 100 kg soybean oil) vegetable oils, animal fats, greases, soapstock, etc.
Primary alcohol (e.g. 10 kg methanol) – methanol or ethanol (44% more ethanol is required for reaction)
Catalyst (e.g. 0.3–1.0 kg sodium hydroxide)
Neutralizer (e.g. 0.25 kg sulfuric or hydrochloric acid)



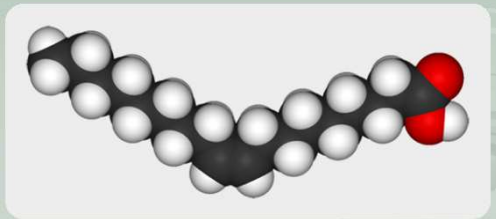
Reaction time

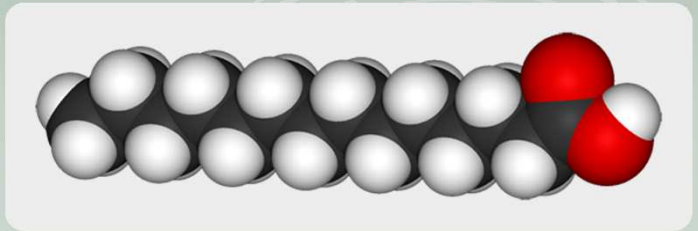
Transesterification reaction will proceed at ambient (70°F) temperatures but needs 4-8 hours to reach completion.

Reaction time can be shortened to 2-4 hours at 105°F and 1-2 hours at 140°F.

Higher temperatures will decrease reaction times but require pressure vessels because methanol boils at 148°F (65°C).

High shear mixing and use of cosolvents have been proposed to accelerate reaction.

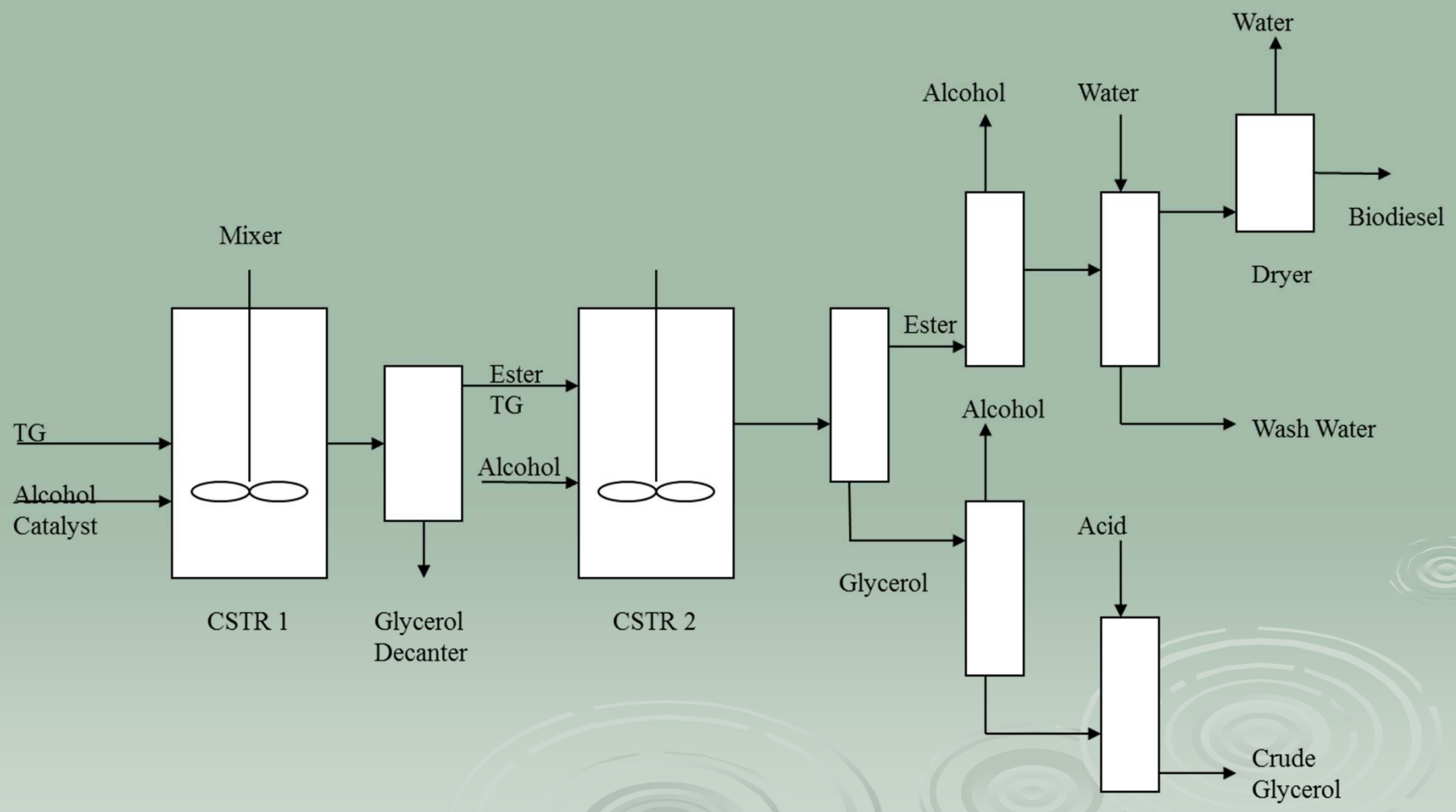




Batch vs Continuous Flow

Batch is better suited to smaller plants (<1 million gallons/yr).
Batch does not require 24/7 operation.
Batch provides greater flexibility to tune process to feedstock variations.
Continuous allows use of high-volume separation systems (centrifuges) which greatly increase throughput.
Hybrid systems are possible.

Hybrid Batch/Continuous Base Catalyzed Process



Processing Lower Quality Feedstocks

Biodiesel feedstocks vary in the amount of free fatty acids they contain:

< 0.05% Refined vegetable oils

0.3-0.7% **Crude soybean oil**

2-7% Restaurant waste grease

5-30% Animal fat

75-100% Trap grease

Price decreases as FFAs increase but processing demands increase, also.

Not suitable for high FFA feeds because of soap formation

Preferred method for High FFA feeds: Acid catalysis followed by base catalysis

Use acid catalysis for conversion of FFAs to methyl esters, until FFA < 0.5%.

Acid esterification of FFA is fast (1 hour) but acid-catalyzed transesterification is slow (2 days at 60℃).

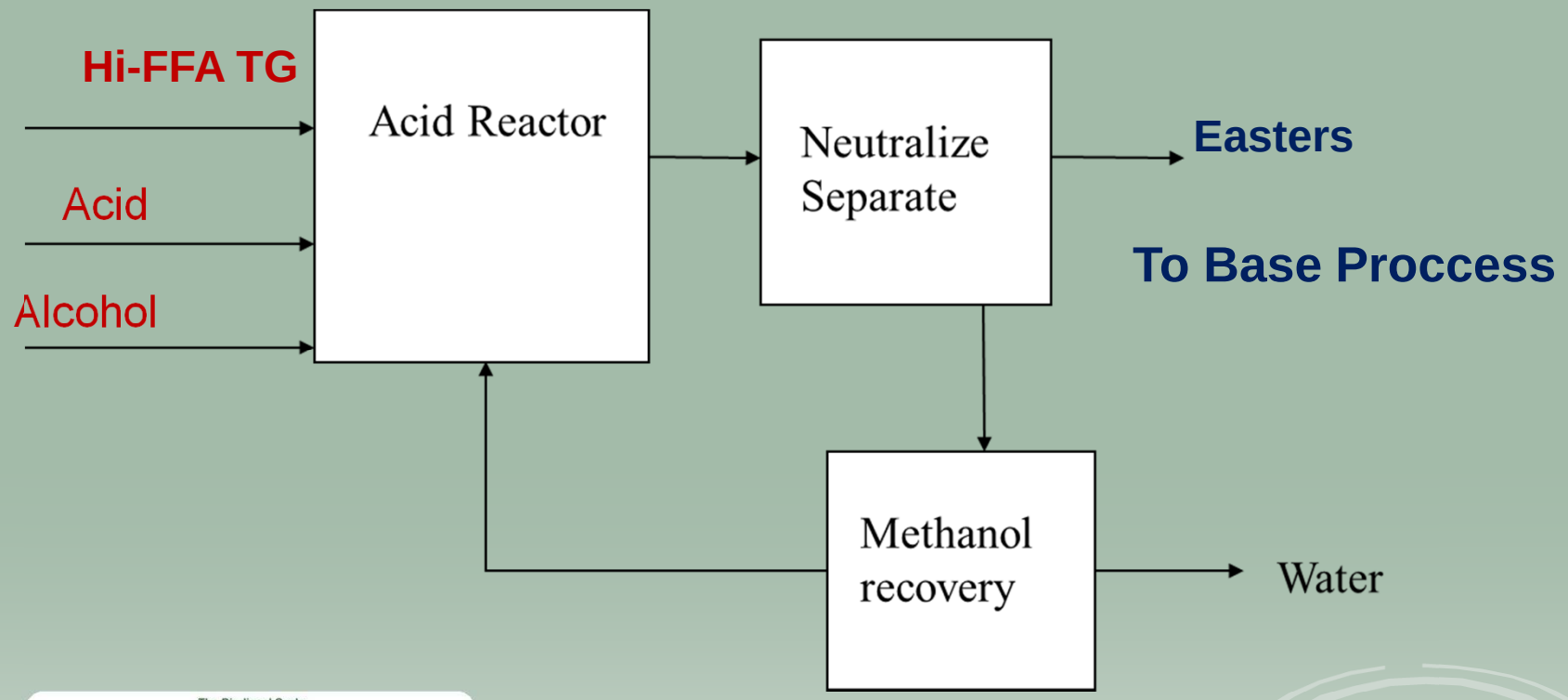
Water formation by

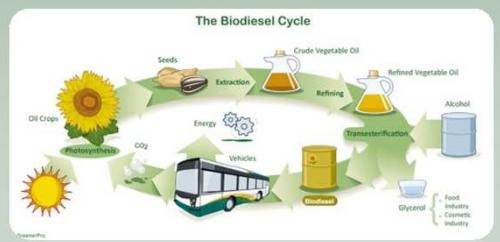
FFA + methanol ==> methyl ester + water

can be a problem.

Then, add additional methanol and base catalyst to transesterify the triglycerides.

Acid Catalyzed FFA Pretreat System





Product Quality

Product quality is important – modern diesel engines are very sensitive to fuel. It is not biodiesel until it meets ASTM D6751.

Critical properties are total glycerol (completeness of reaction) and acid value (fuel deterioration).

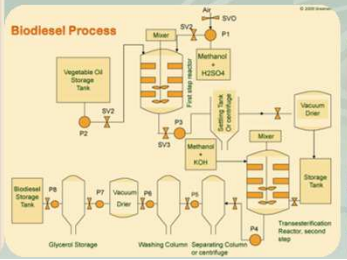
Reaction must be >98% complete.

Developing Process Options

Schemes for accelerating the reaction
Supercritical methanol
High shear mixing
Cosolvents (Biox)
Solid (heterogeneous) catalysts
Catalyst reuse
Easier glycerol clean-up

Summary

- Biodiesel is an alternative fuel for diesel engines that can be made from virtually any oil or fat feedstock.
- The technology choice is a function of desired capacity, feedstock type and quality, alcohol recovery, and catalyst recovery.
- Maintaining product quality is essential for the growth of the biodiesel industry.



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لنعمل لأجيال المستقبل