BIO DIESEL
SAVING ENVIRONMENT

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The success story of "ENERGEA" Austria, is now brought to India by SPEC Engineers & Consultants Pvt Ltd, New Delhi, India , in Technical Collaboration with ENERGEA Licensee Mr Camillo Holecek – now operating as ECODUNA S.R.O.,Bratislava – a company also engaged in another alternative fuel patented technology to produce Algae which will have bio engineered triglyceride contents as high as 60% by weight.

SAVING ENVIRONMENT

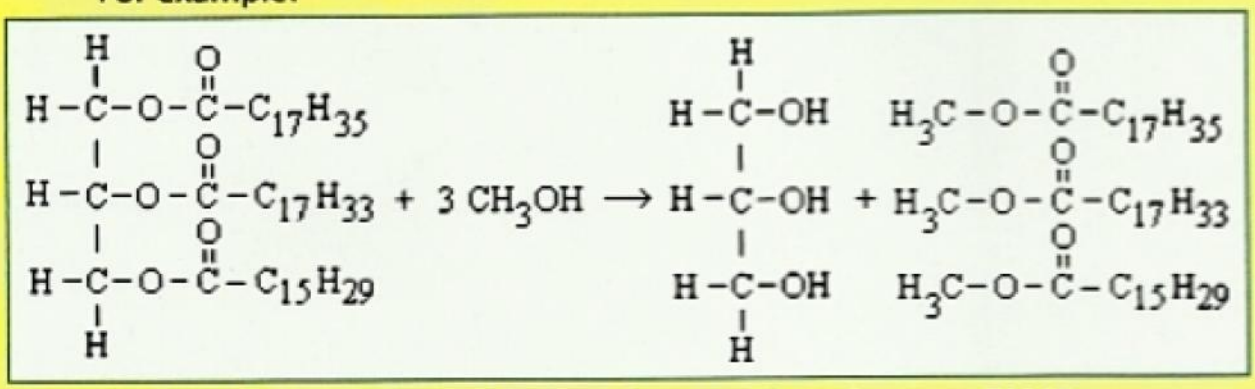
BIODIESEL PRODUCTION PROCESS

INTRODUCTION & DESCRIPTION

All plant oils and recycled cooking oils are esters of a trivalent alcohol (Glycerin) and 3 fatty acid chains.

In a chemical process called trans-esterification the Glycerin in the oil is changed against a monovalent alcohol Methanol. The result is Fatty Acid Methyl Ester (FAME) and Glycerin.

For example:



Some oils and fats may contain higher levels of FFAs (Free Fatty Acids). This applies specially to tropical, indigenous and tree born oil seeds. ENERGEA's Technology is dedicated to deliver virtually 100% yield and best economy from these feedstocks.

We offer one process route where we deal very efficiently with those FFAs, converting them also completely into Biodiesel. Alternatively, there are equally efficient process layouts where the same features are archived during state of the art pre-treatment (means when it features also an esterification step).

Bio Diesel has obtained worldwide recognition as an alternative and renewable energy source for the transport sector because of its many product advantages and applications benefits.

Bio Diesel is also finding tremendous advantages in Industrial application as replacement of LDO & FO saving the environment.

Bio Diesel molecules are very simple hydrocarbon chains, containing no sulfur and no toxic cyclic or polycyclic aromatic compounds as contained in fossil fuels.

Bio Diesel reduces risks as produced by locally harmful emission such as soot, particulate matter, carbon monoxide, hydrocarbons, etc., when compared to conventional fossil fuel, Biodiesel contributes to reduce greenhouse gases and resulting climate change and has superior lubrication properties.

Bio Diesel can be used as a 100% substitute to mineral diesel, or it can be blended in any ratio, without any changes on the engine.

CHRONOLOGY

ENERGEA, an Austrian based company, has done thorough research and development programm culminating in its CTER - "Continuous Trans Esterification Reactor". With this patented reactor design, **ENERGEA** was successful in optimizing the conversion of biogenic fats and oils. The significant advantage being the acceleration of the trans esterification process :- within a few minutes high-quality standardized Biodiesel is produced from biogenic fats and oils using methanol and catalyst.

The new Biodiesel technology was tested successfully in a pilot set-up in 1999 and the first commercial installation - **a 40,000 TPA continuous flow refinery at Zistersdorf,** Austria started production in autumn 2002- based on used frying oils followed by 250,000 TPA biodiesel and glycerin plant for Biofuels Corporation Plc at Teesside, UK, commissioned in Nov 05 – based on rape seed oil and another 40,000 TPA biodiesel plant for Australian Renewable Fuels PTY LTD in Adelaide, Australia, commissioned in Dec 05 based on tallow.

The successful commissioning of biodiesel plant for Australian Renewable Fuels PTY LTD in Adelaide resulted in repeat order of 40,000 TPA plant for them at Picton, Australia, which was commissioned in Jan 06.

SPEC / ECODUNA are building first ENERGEA Plant in India and the construction work started in July 2009 and commercial production expected in May 2010.

ENERGEA CTER TECHNOLOGY

The main advantages of ENERGEA CTER technology are:

1. The continuous conversion process saves space.
2. The **CTER** installation is optionally made up of several industry container sized frames.
3. The cost of investment decreases considerably for large capacity.
4. Feedstock with high FFA is converted efficiently without having to separate them first.
5. The oil for the Biodiesel process must only be degummed, but not neutralized.
6. Multi-feed-stock technology: Able to process even used cooking oil , animal fat, acid oils and oil sludges besides all edible and non edible oils.
7. Problematic waste (UCO, animal fat) can be turned into precious diesel fuel.
8. Less energy is required due to our continuous process design.
9. Uses Plug Flow Tubular Reactors in which reaction is accelerated using high pressure and is over within few seconds. This avoids all unwanted side reactions thus avoids losses and maximizes yeild.
10. Produces potassium sulphate paste as by product which can be readily dried and used as fertilizer thus increasing the profitability of the process.

11. Our second generation CTER technology makes it possible first time to offer true "multi feedstock" capability **WITHOUT** the need of **any additional equipment** or process steps (as required by all competition) thus avoiding any loss in yield or economy.

12. ENERGEA's technology is truly **Multi-feed stock** (One can use any kind of blending of different raw material with different FFAs) which can even process **85% and above FFA**; producing more than 100% yield and EN standard biodiesel.

13. **Option of Ethanol instead of Methanol** is also available in our technology. In future India may also look Ethanol as a better option to methanol truly, bearing in mind concept of Green fuel. We have our excellence centre in Brazil. Ethanol would be political choice for Biodiesel productions in some part of the world including India, Brazil and several others.

Investment opportunity with ENERGEA's Tech is purely based **on "OPEX Vs CAPEX" factors. The strength of ENERGEA's tech would be based on "OPEX".** Proven track record of ours, knowing "TIGHT productions margin" for biodiesel production in India, also variations in feed stock scenario qualifies our tech for Asian countries as a better proposals compared to others in many ways.

1. PLANT DESCRIPTION

The Biodiesel production plant by direct trans esterification of oils obtained from Edible / Non Edible Crude oils and designed to produce biodiesel meeting the European quality standards EN14214 needs the following steps used alternatively for different feed stock depending on composition.

Pretreatment

- Degumming & Washing
- Bleaching
- Deacidification - Optional
- Esterification - Optional

Biodiesel Production

- KOH –Methanol Mixing
- Neutralisation/ Acid Pre esterification
- Transesterification
- Methylester/glycerine separation
- Methylester purification – flash of methanol
- Raw glycerine purification – soap splitting

- Methanol rectification
- Vents condensation
- Methyl Ester Distillation

The proposed process use standard pretreatment sections to process crude oils and used fried oils and glycerolysis of fatty acids. The purification of Glycerine to Pharma grade and Dynamite grade is the last optional step.

The Biodiesel plant converts most vegetable oils or fats into FAME (Biodiesel). FAME is the main product, which after synthesis is washed in several steps. The quality of the FAME is in accordance with the CEN standard EN 14214. Some of the fuel parameters in that standard, such as CFPP, oxidation stability, phosphorus and sulfur content, iodine number and distribution of Fatty Acids are depending only on the raw material and cannot be influenced by the production process.

1.1. Process description

KOH Mixing Stage

KOH flakes are weighed and fed into the mixing tank along with methanol. Nitrogen blanket applied for safety. The Methanol-KOH-mixture is then kept ready in an intermediate tank.

Pre Esterification Stage

Feed oil with high ffa is esterified with methanol under acidic catalyst to convert into FAME. Oil & FAME mixture is treated with basic glycerine phase to neutralize the acidic catalyst and separated out in static phase separator.

Feed oil with low ffa is neutralized with basic glycerine phase and soap removed in static phase separator.

Two stage Trans-Esterification

The oil mixture from Pre esterification stage is mixed with the appropriate Methanol-KOH-Mixture according to the recipe and fed to the ENERGEA CTER reactor stages. On the way, glycerin phase is separated from the FAME using static phase seperator.

Polishing & Drying Stages

This is followed by two washing stages where the necessary polishing of the FAME product is performed. Finally, the last traces of methanol and water are separated from the product in an evaporator. After heat recovery and fine filtration the product has reached the prescribed EN quality. At that point, optional equipment can add winter additives or oxidation stabilizers to the final product, according to season and clients specifications. (These are usually supplied by or leased from additive suppliers.)

FAME Distillation

SPEC – ECODUNA has developed techniques for purifying FAME to EN standards when made from the most difficult raw materials i.e. acid oils and oil sludge. FAME can also be fractional distilled for producing value added products i.e. single chain fatty acid Methyl Esters.

Glycerin Phase Recycling Stage

The glycerin phase and wash-waters from the separators are stored in an intermediate storage tank. By adding H_2SO_4 this mixture is split and the resulting FFA phase, raw glycerin and K_2SO_4 are separated. The FFA phase ("fatty matter") is fed to the esterification unit, increasing the total biodiesel yield.

Glycerin Drying Stage

After initial neutralization and methanol recovery, the raw glycerin is partly dried. The end product is crude glycerin of min. 80 % glycerine content, ready to be handled by any pharma glycerin plant.

Methanol Rectification (integrated in Glycerine drying Stage)

Excess methanol collected from the various purification stages, both from the FAME as well as from glycerin stream is completely recycled for optimum consumption figures. A rectification column serves as distillation device. Both, the purified methanol and also water are cycled back for use in the main process. Thus the plant is minimum water discharge plant – minimizing effluent loads.

Plant Staff & Automation

Due to the high automation standard of the Bio Diesel plant, 1 person per shift can theoretically operate it, plus administration and logistic staff. But local regulations may require the use of 2-3 people per shift for safety reasons.

A minimum of two PC based work stations serve for the process visualization and interaction with operation staff.The plant is designed to operate automatically via PLC .

RAW MATERIALS, AUXILIARY MATERIALS

Vegetable oils, edible or non-edible, also used or recycled.

Methanol (CH3OH)

Potassium Hydroxide (KOH) Flakes

Sulfuric acid (H2SO4)

Nitrogen (N2)

Saturated Steam

Demineralised Water,Cooling Water,Chilled Water

Compressed Air

Electric Power

PRODUCTS

Biodiesel . in accordance with the EN 14214 standard.

Only the following parameters given in the EN14214 can be influenced by the process:

- Ester-Content
- Ash-Content (Sulfate-Ash)
- Water-Content
- Total Contamination
- Copper-Corrosion
- Acid-Value
- Methanol-Content
- Mono-Glyceride-Content
- Di-Glyceride-Content
- Tri-Glyceride-Content
- Content of free Glyceride
- Total Content of Glyceride
- Content of Alkali-Metals

This means that the product will meet the requirements as specified in EN14214 only if :

- the feedstock meets respectively is suitable to meet the other parameters as required by the standard EN14214 which can not be influenced by the process e.g. CFPP, content of linolenic acid, and the feedstock meets the requirements set out in the offer.
- The quality of chemicals and utilities meet the requirements set out in the offer and the plant is operated, services and maintained acc. to the requirements set out in the operation respectively servicing / maintenance manuals Glycerine - 80% purity

PRELIMINARY MASS BALANCE

Quantities based on 1,000 kg absolute pure oil INPUT (with FFA) having a saponification number of **205**.

Raw materials and Auxiliary materials:

	1%FFA		Units
Oils and fats	1,000.0		Kg
Methanol (CH3OH)	122.0		Kg
KOH 88%	15.0		Kg
H2SO4 96%	14.0		Kg
Nitrogen (N2)	20.0		Nm^3
Saturated Steam1	500		Kg
Compressed Air	10.0		Nm^3
Demineralised Water	25		Liter
Electricity	45		kWh
Chilled water (in circulation)	7.5		m^3
Cooling load (Cooling water)	135		KWhth

[1]The exact quantity of steam & cooling for your climatic condition can only be given after the design engineering.

Products

	1%FFA	Units
Bio Diesel	min. 998 including processing of FFA phase	Kg
(Pharma) Glycerin Content	95.3 but also depending on saponification number and impurities	Kg

SPEC

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