



TRANS BioDiesel Ltd.

Today's Biotechnology is Tomorrow's Biodiesel



Today's Biotechnology is

About TransBiodiesel Technology

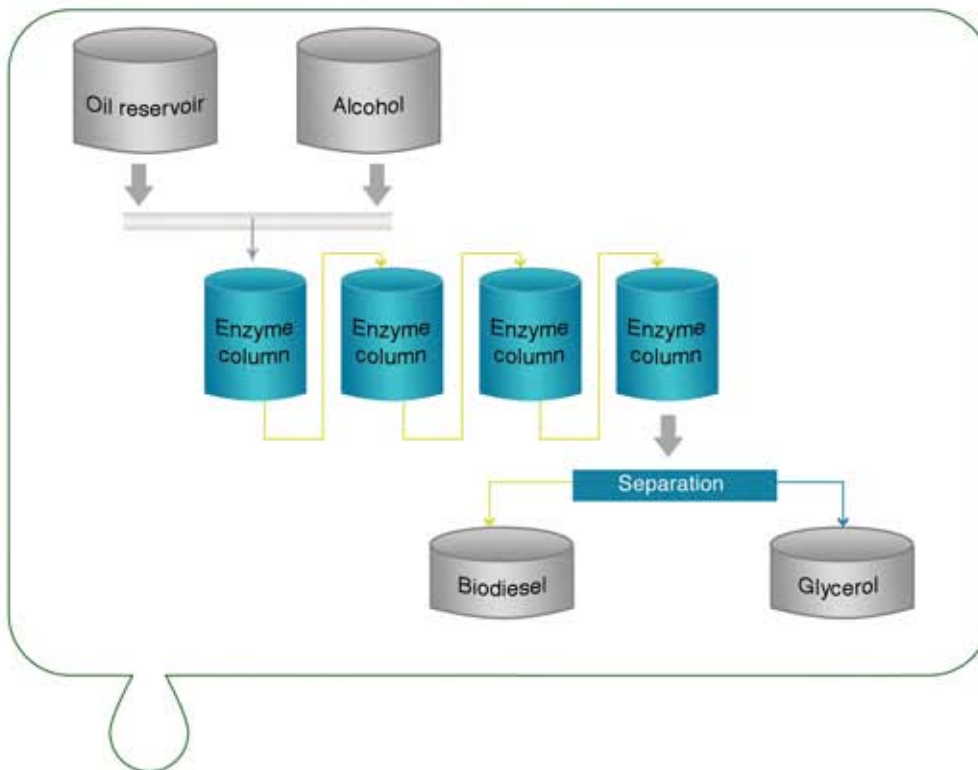
Biodiesel is a cleaner-burning, renewable, alternative fuel produced from vegetable and animal oils. It is safe for use in all diesel engines and has been registered with the U.S. Environmental Protection Agency as a fuel and a fuel additive.

Since 2007 TransBiodiesel has been forging ahead with one of a kind **Biocatalyst** (immobilized enzyme) for the production of biodiesel, implementing industrially what many companies regarded as a commercial challenge.

TransBiodiesel has developed methanol-resistant enzymes capable of esterifying / transesterifying oil components and short-chain alcohols to form biodiesel. The **Biocatalyst** has been developed as an alternative environmentally benign and cost-effective to the alkaline/acid conventional catalysts. This cutting edge technology was developed to create high quality biodiesel from vegetable oil, algal oil, waste-cooking oils, brown grease and animal fats.

TransBiodiesel has over 6 pilot plants of enzymatically catalyzed biodiesel production which are spread worldwide in Canada, USA, Holland, Japan, Israel and Singapore.

Enzymatic Process Scheme



The Advantages of the Enzymatic Biodiesel Production:

- Allows the use of low-grade feedstocks (FFA 0-100%)
- Saves energy
- Reduces waste production
- Uses a variety of lower cost feedstocks and allows existing producers to increase their biodiesel output
- Produces cleaner & very high quality Glycerol
- Utilizes both ethanol and methanol in the esterification/trans-esterification of feedstocks producing the same yield

Tomorrow's Biodiesel

Glycerol Quality from enzymatic process:

Property	Enzymatically	Chemically
Appearance	Transparent	Very brown
Glycerin content	>78%	44% - 54%
pH	6.0 – 6.2	8.9 – 10.5
Methanol content	3%	27% - 53%
Water content	7%	1% - 4%
Sulfated ash	0.1%	7%

Enzymatically produced biodiesel and glycerol from crude corn oil



Chemical process



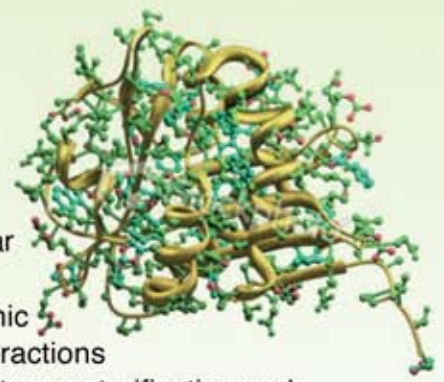
Enzymatic process



The Enzymes Behind the Technology

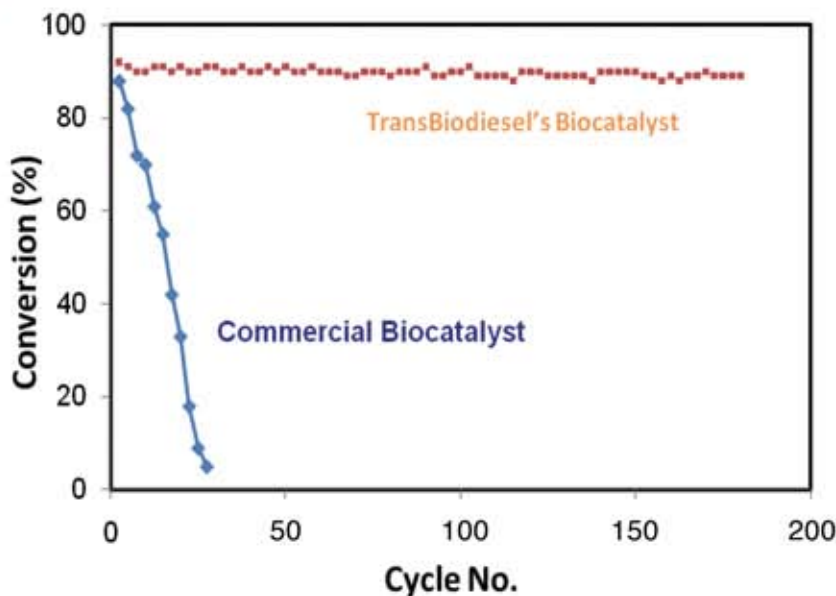
The enzyme is a lipase derived from different kind of microorganisms manufactured and marketed world-wide by various international enzyme producers. These enzymes are:

- Harmless, environmentally benign, stable upon storage for over a year
- Upon immobilization on a solid support the active enzyme is called a **Biocatalyst**. The solid supports including organic polymers or inorganic materials are capable of adsorbing enzymes by various modes of interactions
- The **Biocatalyst** through its active sites is effective in both reactions, transesterification and esterification, utilizing all types of used and fresh oil feedstocks
- The **Biocatalyst** lowers the total production costs of biodiesel fuels significantly
- One ton of enzyme can make up to 3,000 tons of biodiesel



The Biocatalyst's Recyclability

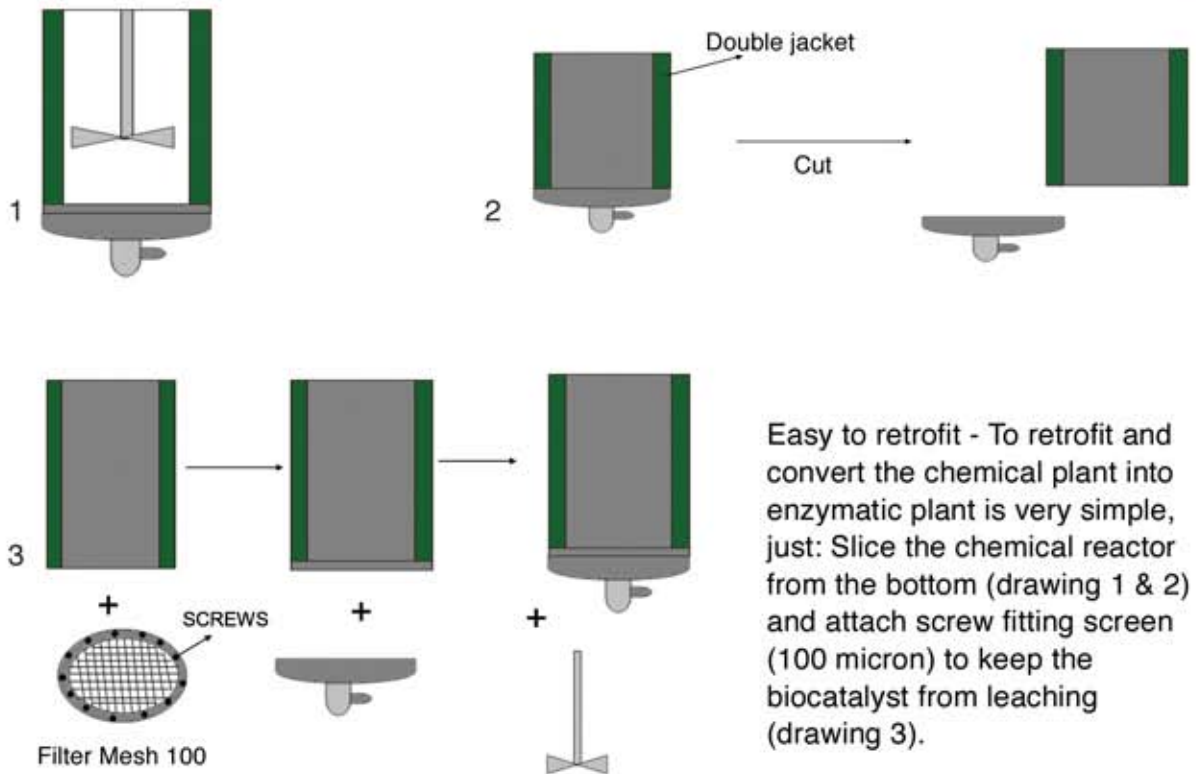
TransBiodiesel biocatalyst can be used either in batch reactors or in continuous packed column reactors. The operational life time of the biocatalyst can easily exceed 6 months.



Biodiesel: Ethanol ($\text{CH}_3\text{CH}_2\text{OH}$) vs. Methanol (CH_3OH)

TransBiodiesel biocatalyst is designed to efficiently catalyze esterification of free fatty acid and transesterification of oil glycerides with ethanol and methanol equally to form fatty acid ethyl/methyl esters.

Immediate Benefits - Retrofitting your chemical plant

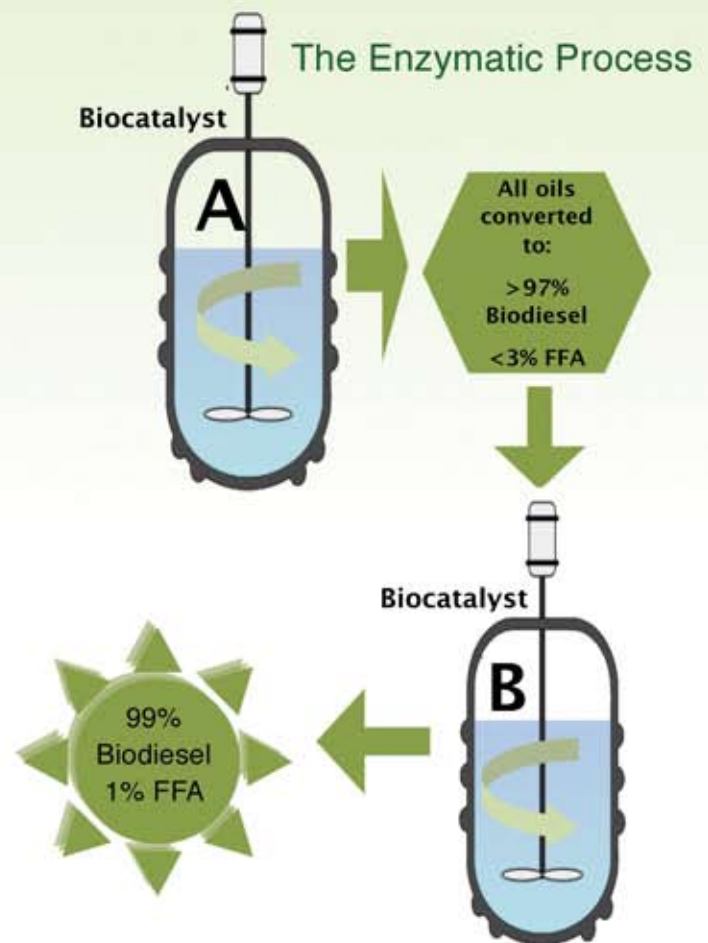


More Benefits

- Utilizes a variety of inexpensive food- and nonfood-grade feedstocks
- Produces biodiesel in only a few hours
- Does not produce any waste
- **Capital expenditure savings** - Capital expenditure savings on new facilities are significantly reduced
- **A clean process:** Biocatalyst is a non-soluble catalyst eliminating the need for the conventional chemical catalyst removal process of washing equipment or ion-exchange columns
- **Emission reduction:** Precise Methanol Consumption eliminates the need for methanol stripping machinery (distillers). The process operates at a low temperature range resulting immediately in the emission reduction

Possible Feedstocks

Feedstock	FFA
Palm oil	1.5
Rapeseed oil	1.5-2.0
Brown Grease	90
Rice oil	0.09
Soybean oil	0.35
Algae oil	0.71
Beef tallow	3.17
Lard	3.9
Swine tallow	4.02
Used cooking oil	7.26
Yellow grease	7.5
Black oil	16
Soapstock	44
Tall oil FFAs	95
Stearic acid	100



Value Proposition: Enzymatic Vs. Chemical

Parameter	Enzymatic Process	Conventional Chemical Process
Reaction Temperature (°C)	Low Energy 10 – 35	High Energy 60 -120
% FFA in Feedstock	Any grade of Feedstock FFA Transformed into BD (down to 0.8% FFA)	Only Virgin Vegetable Oil. Makes SOAP. Must be pre-treated in an acidic process for removal
Water in Feedstock	No effect on Biocatalyst (up to 5% H ₂ O)	Destroys Catalyst - Interferes with the catalyst and results in producing soaps.
Biodiesel yield	>98%	Typically 96%.
Glycerin quality	Transparent, and salt-free	Black-brownish, pH > 7 and contains salt
Catalyst removal	The biocatalyst is recyclable for one year	The final products require repeated washing for removal of the catalyst
Methanol recovery	No excess of methanol H ₂ O level (up to 5%)	Large excess methanol (% H ₂ O is prohibited) requires stripping from the final products
Waste generation	Extremely low waste	Large waste- saline/alkaline and catalyst wastewater
Catalyst cost	5-10 cents per Kg BD	9 - 11 cents per Kg BD
Capital costs	Low CAPEX / low cost for retrofitting to enzymatic reactor	High CAPEX

Who we are

TransBiodiesel Ltd. a company founded in 2007 in L.N. Technology Incubator, Haifa- Israel is the recipient of the "Best Start-up Company of the Year" award for 2010 by the ministry of Trade and Industry. The company has a patented technology on the use of unique immobilized enzymes for the production of biodiesel from different oils, including plant oils, animal fats and recycled greases. The developed immobilized lipases are characterized with their high resistance towards short-chain alcohols, typically used as substrates in the production process of biodiesel.

Team of Success - Experienced People You Can Trust

Dr. Sobhi Basheer, Founder & CEO

He is a leading expert in enzyme technology with over 23 years of enzymatic technology experience. He is the founder of Zeituna Ltd. and Enzymotec Ltd. for making OPO's and other oil derivatives. Dr. Basheer was granted many awards for his role in bringing enzymatic ideas to commercialization.

Dr Ahmed Tafesh, VP New Business Development & CTO

Dr. Tafesh is an entrepreneur with a comprehensive and profound knowledge of organic chemistry. Head of Marketing at Palindent Fine Chemicals, a subsidiary of ICL, Israel. Head of homogeneous catalysis in Hoechst AG Frankfurt/Germany. Director of NPD at Lonza Group, New Jersey USA and Director of R&D at Varcodex, Israel. Dr. Tafesh has over 30 registered patents in diverse areas of chemistry.



Awards:

TransBiodiesel received the Start-up Company of the Year Award for 2010 from the Israel Ministry of Industry and Trade.

TransBiodiesel is among the winners of The Artemis Project™ competition for excellence in key areas of the emerging advanced technologies, distinguishing TransBiodiesel as a leading company in one of the greatest high-growth industries of the 21st Century.

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