



**LADETEL – LABORATORY FOR CLEAN TECHNOLOGIES  
DEVELOPMENT**

**BiodieselBrasil**  
[www.biodieselbrasil.com.br](http://www.biodieselbrasil.com.br)

***Biodiesel: Brazilian Perspective.  
New and Future Feedstocks for its Production.  
The Official Brazilian Biodiesel Test Program.***

***Prof. Dr. Miguel J. Dabdoub***

***President of the São Paulo State Government Biodiesel Chamber  
and Head of the “Biodiesel Brasil” Program***

***University of São Paulo - Campus of Ribeirão Preto  
Department of Chemistry***

***“USDA Global Conference on Agricultural Biofuels:  
Research and Economics”***

***Minneapolis, Minnesota, USA. August 20-22, 2007***



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*Ethanol and Biodiesel are (USA and BRAZIL) and will be used worldwide blended to fossil fuels as no changes on the logistics and economical structures of other countries are need.*



*However, is it going to happen just because enviromental issues?*

THE BEST WAY TO PREDICT THE FUTURE IS  
BUILDING IT

*Peter Drucker*



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**Brazil 1973**

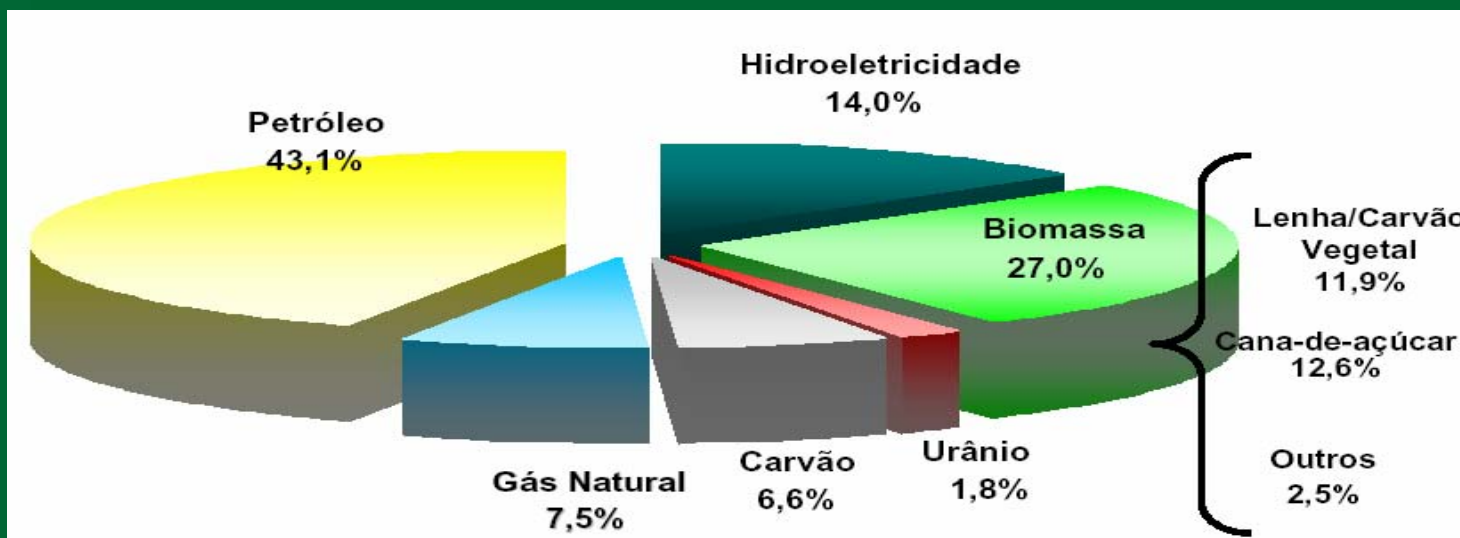
**Oil Crises**



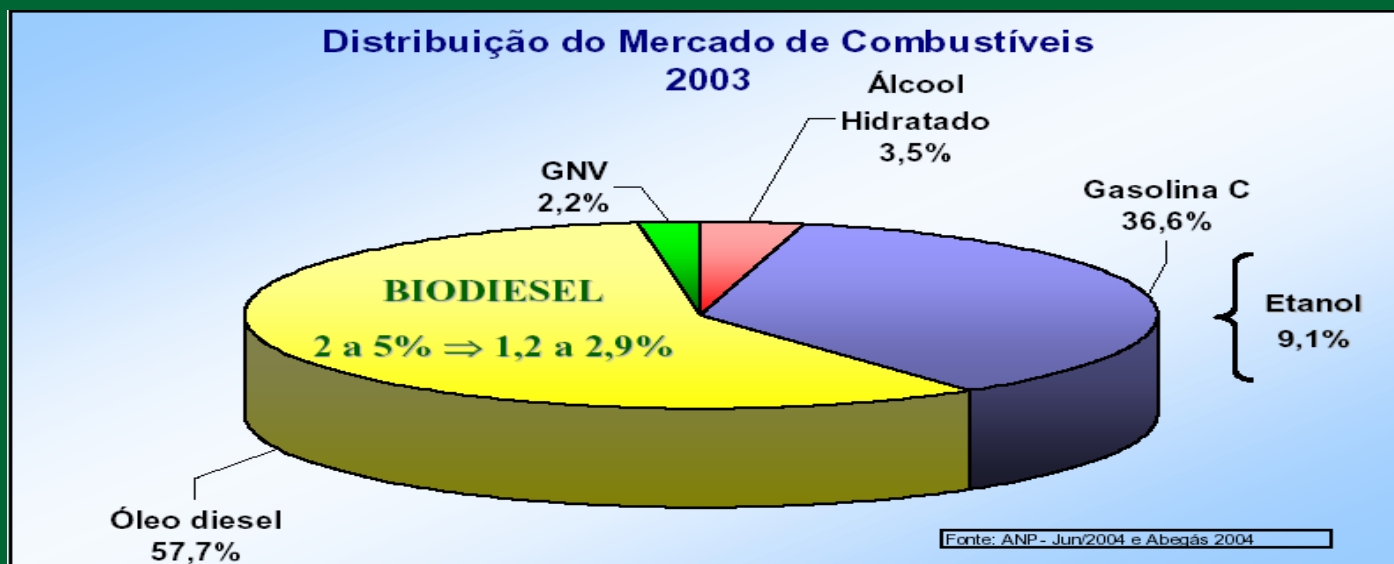
**“Proalcohol” 1975**



## BRAZILIAN ENERGETIC MATRIX



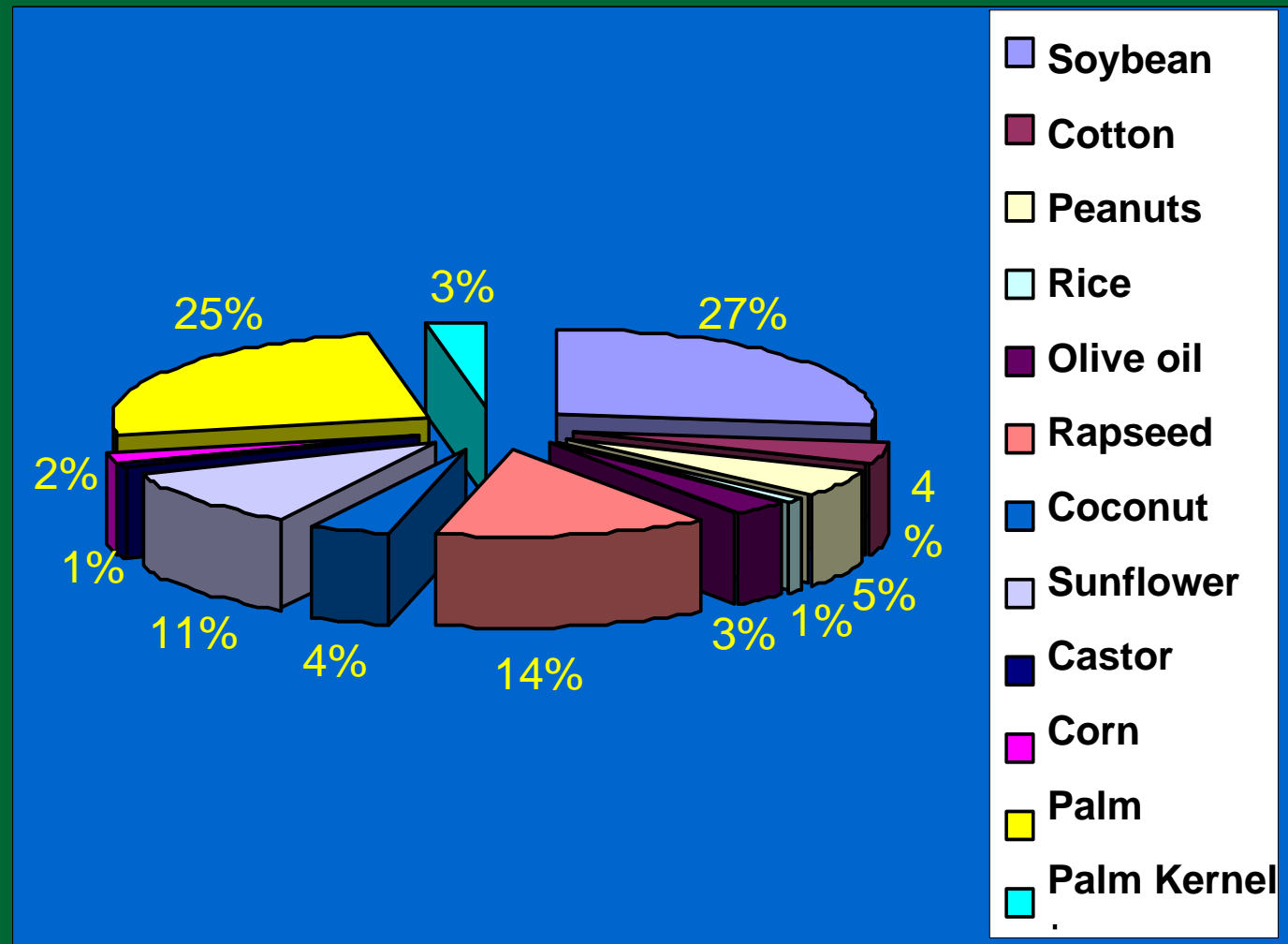
## BRAZILIAN LIQUID FUELS AND OIL DERIVATIVES DEMAND





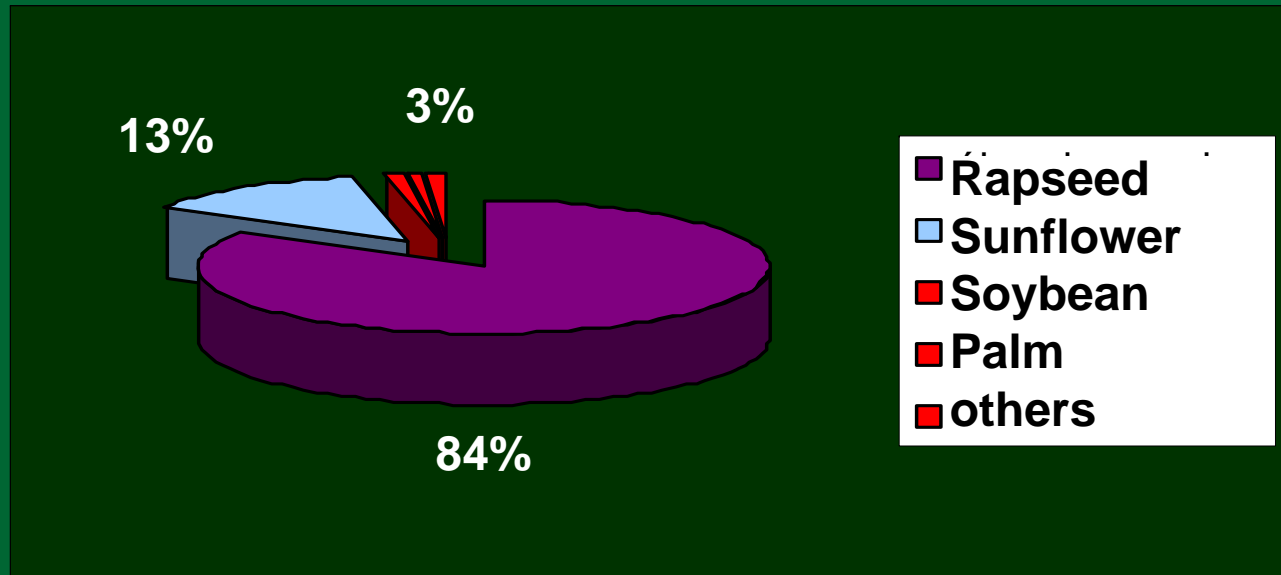


## WORLDWIDE VEGETABLE OIL PRODUCTION

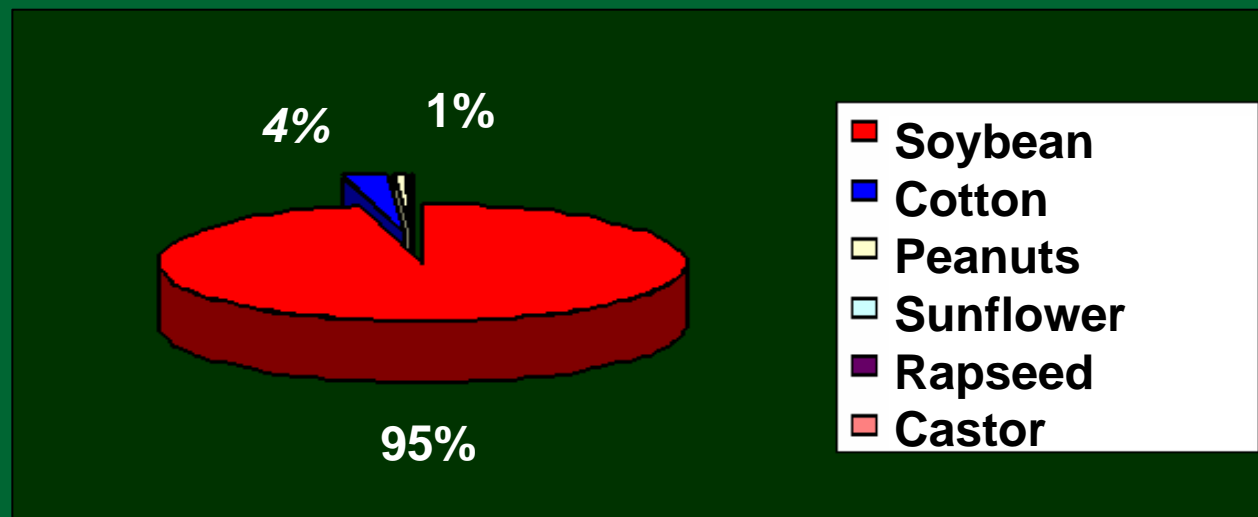




## SEEDS FOR VEGETABLE OIL PRODUCTION IN EUROPE



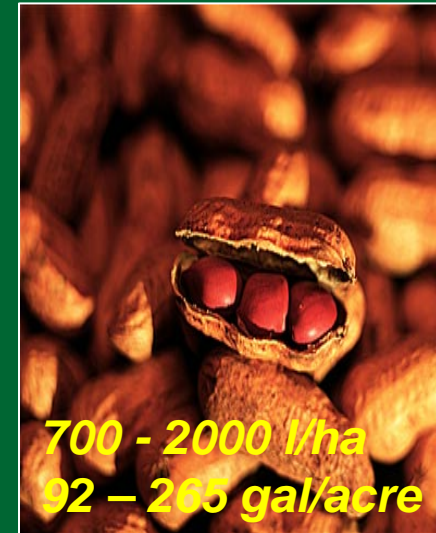
## SEEDS FOR VEGETABLE OIL PRODUCTION IN BRAZIL





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## BRAZILIAN BIODIESEL – LADETEL EXPERIENCE







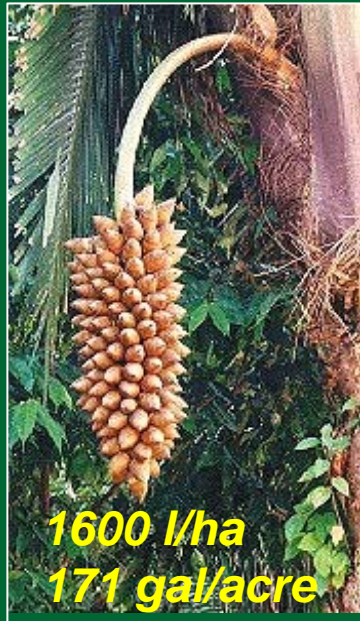
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## BRAZILIAN BIODIESEL – LADETEL EXPERIENCE



3200 l/ha  
 342 gal/acre

*Caryocar brasiliensis*  
*Caryocar coriaceo*



1600 l/ha  
 171 gal/acre

*Orbignia palerata*



4500 l/ha  
 481 gal/acre

*Syagrus coronata*



4000 l/ha  
 427 gal/acre

*Acrocomia aculeata*



*Jatropha curcas*



5900 l/ha  
 630 gal/acre

*Elaeis guinensis*





# Operational issues

- Low energy content
  - Not harmful, but may cause power loss and increased fuel consumption
- Cold flow – fuel filter plugging
- Incomplete reaction – fuel filter plugging
- Fuel oxidation – fuel filter plugging

**Fuel filter plugging is the most common operational issue**





- Cetane numbers (cf. diesel fuel = 42-46)
  - From soybean oil: 48-52
  - Lauric derivatives or from used cooking oil: >60
  - Level of saturation is important

<u>Methyl esters with 18 carbons</u>		<u>Cetane number</u>
No double bonds	Methyl stearate	79
One double bonds	Methyl oleate	55
Two double bonds	Methyl linoleate	42
Three double bonds	Methyl linolenate	23

- Effect of shorter ignition delay
  - Less HC emission (Less time to prepare overmixed fuel)
  - Less NO<sub>x</sub> (higher cetane number usually means less NO<sub>x</sub>)
  - Quieter operation



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## ***BIODIESEL IN BRAZIL***



***METHANOL AND ETHANOL !***





## **INTERNATIONAL COLLABORATIONS: Exchanging Technologies**

- USA : INCOBRASA – Exporting equipments NG Met. (Piracicaba, São Paulo)
- Europe – Brasil: Renk Zanini (Cravinhos, São Paulo)





**- United States: Earth Biofuels ([www.earthbiofuels.net](http://www.earthbiofuels.net))**





**- USA: Earth Biofuels ([www.earthbiofuels.net](http://www.earthbiofuels.net))**



**15.000.000 gal/yr  
Durant, City  
Oklahoma  
2007**



- **United States: Earth Biofuels** ([www.earthbiofuels.net](http://www.earthbiofuels.net))



**- United States:  
Incobrasa  
(Gilman, Illinois - 2007)**



**31.000.000 gal/year  
Gilman, Illinois**



# INCOBRASA: 31.000.000 gal/year Gilman, Illinois



OCT 13 2006



**31,000,000 gal/year: Incobrasa (Gilman, Illinois - 2007)**





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**Brazilian Law: n<sup>o</sup> 11.097  
(January 13th, 2005)**

**B5 (5%)**

**of biodiesel blended with petroleum diesel will  
be mandatory after 8 years (by January, 2013)**

**B2 (2%)**

**of biodiesel blended with petroleum diesel will  
be mandatory after 8 years (by January, 2008)**







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## **Brazilian Diesel Consumption: 40 million TPY (2005)**

**B5 : 2 million TPY**

**B2 : 800.000 TPY**

**Taxes reduction incentives:**

**100% for familiar agriculture  
(Palm and Castor oil  
in North and Northeast regions)**

**68% for familiar agriculture**

**32% for intensive commercial agriculture**







## **BRAZILIAN CURRENT DEMAND**

- *Brazilian Federal Government is creating the demand : Aprox. Price is US\$ 3,45 per gallon*
- *PETROBRAS is acquiring all the biodiesel produced to be blended as a B2.*
  - *Nov. 2005 : 18,494,000 gallons*
  - *April 2006 : 124,000,000 gallons*
  - *2008 : 224,500,000 gallons*
  - *2013 : 581,000,000 gallons*

**PRODUCTION CAPACITY: ~ 200,000,000 gallons/year**





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# Reaction Conditions Optimization







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# PARTNERSHIPS



Até B100





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# PARTNERSHIPS



B30



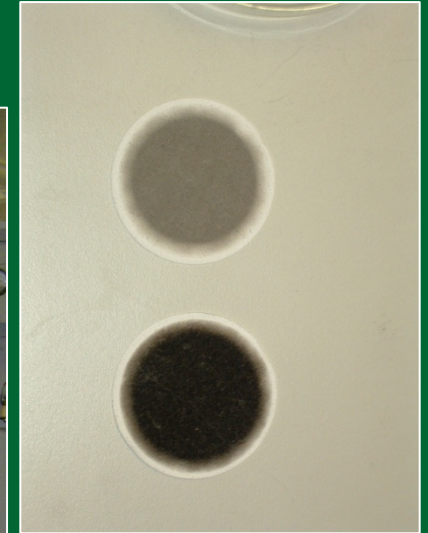


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# PARTNERSHIPS



PSA PEUGEOT CITROËN



B30





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# PARTNERSHIPS



B30

LACTEC

PSA PEUGEOT CITROËN





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# PARTNERSHIPS

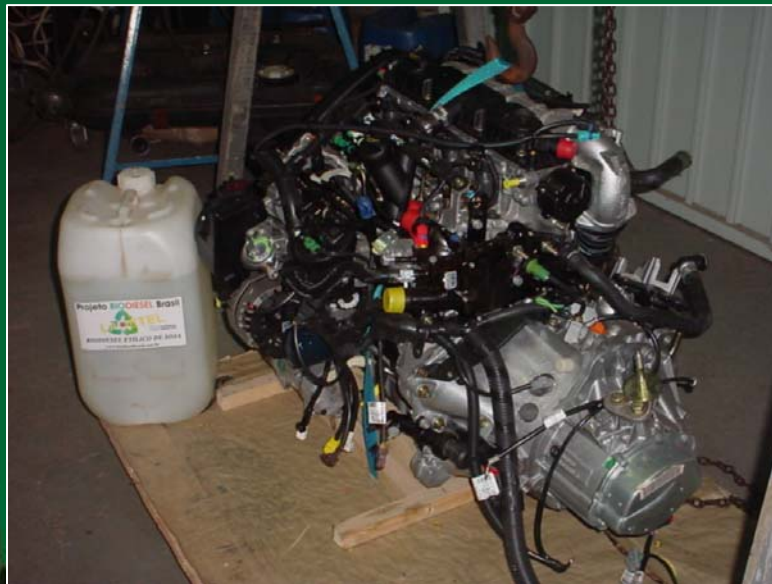




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# PARTNERSHIPS

PSA PEUGEOT CITROËN



B10 – B100







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**INTERNATIONAL**  
*Engines*



**Major  
Latin America  
diesel engines  
producer and  
exporter**

- FORD (Ranger)
- LAND ROVER (Defender)
- Massey Ferguson



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**INTERNATIONAL**  
*Engines*



HS 2.8L





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## *PARTNERSHIPS*



*New materials and Compatibility*



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# PARTNERSHIPS







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# PARTNERSHIPS



**B5**



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# DELPHI FILTERS: B20 MONITORED USE DURING 18 MONTHS



**NEW FILTER (OPEN)**



**OPEN FILTER**



**INTERNAL CUP OPEN**



**CLEAN SIDE**



**DIRTY SIDE**

**BIODIESEL QUALITY SPECS FULLFILLED**





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## BIODIESEL QUALITY SPECS FULLFILLED

### SOYBEAN BIODIESEL B20



CLEAN SIDE



DIRTY SIDE



### CASTORBEAN BIODIESEL B05





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Biodiesel may cause slimy deposits to form on the surface of the filter media resulting in rapid filter plugging.

**OUT OF SPECS QUALITY BIODIESEL**







## OUT OF SPECS QUALITY BIODIESEL

Biodiesel may form a slimy deposit on the surface of fuel filter media resulting in premature filter plugging. This problem gets worse as the concentration of biodiesel increases.



Leopard spots on the filter surface is a clear sign of microbiological growth



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# BIODIESEL QUALITY SPECS FULLFILLED



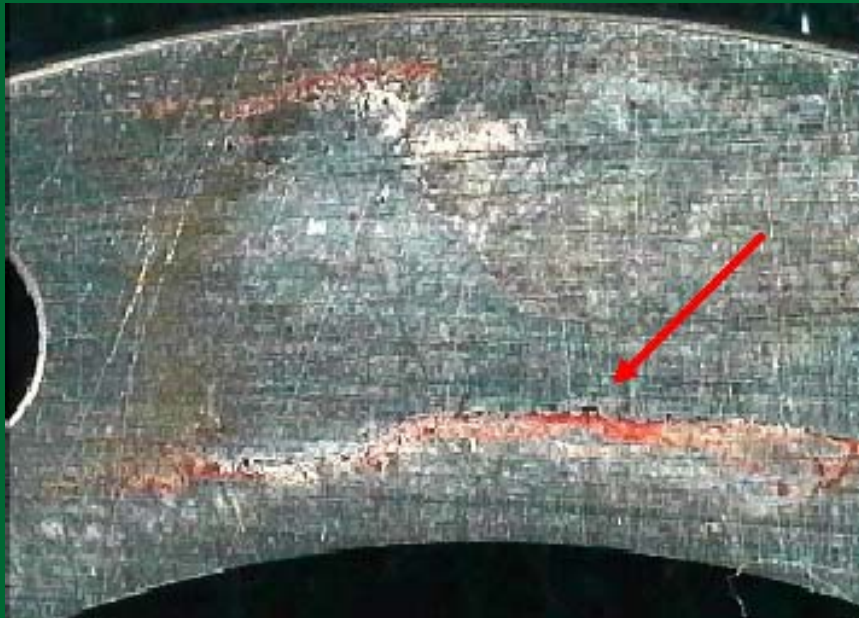




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## BIODIESEL QUALITY SPECS FULLFILLED

**AFTER 18 MONTHS  
WITH SOYA BIODIESEL:**



**CARBON DEPOSITS:**

**AFTER 18 MONTHS  
WITH MINERAL DIESEL:**



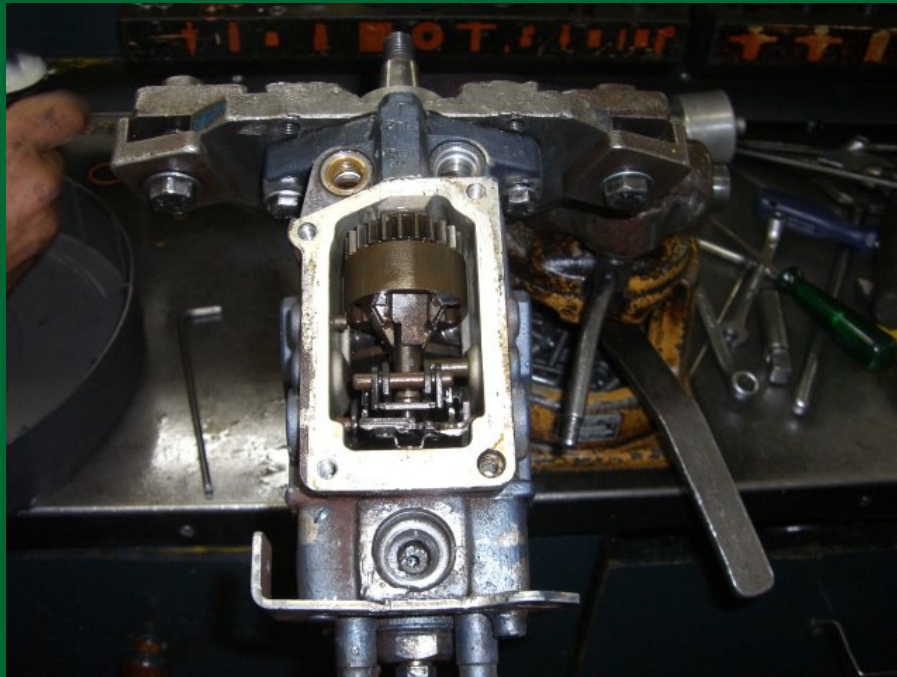
**RESULTS WITH BOSCH AND ANFAVEA**



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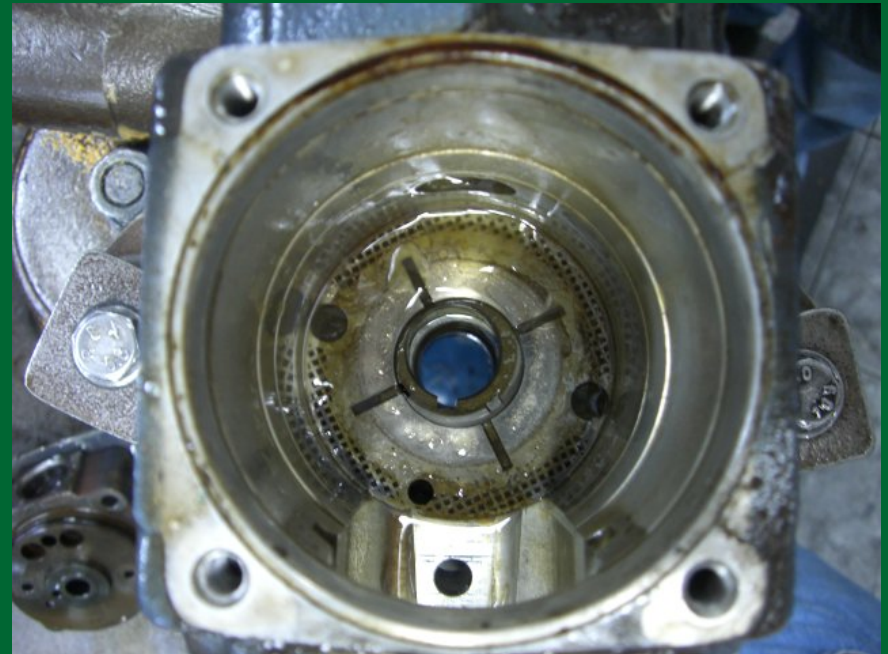
## BIODIESEL QUALITY SPECS FULLFILLED

**AFTER 18 MONTHS  
WITH B100 SOYA BIODIESEL:**



**INDEPENDENT RESULTS**

**NO CARBON DEPOSITS:**

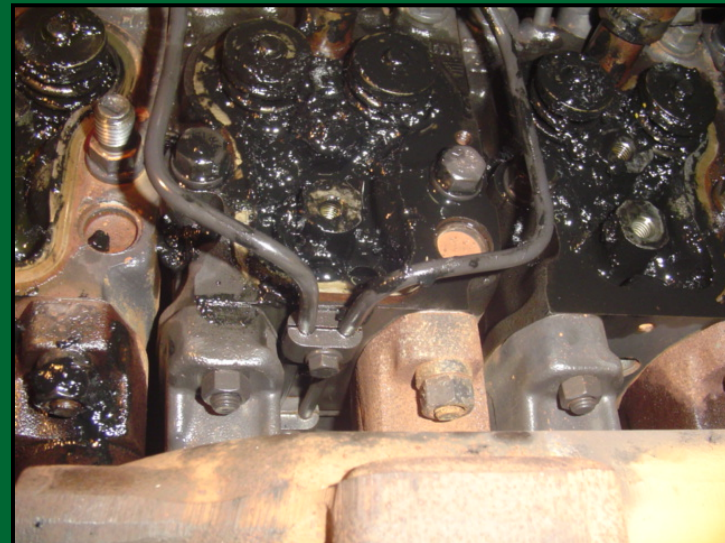






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# USE OF CRUDE VEGETABLE OIL = TO USE OUT OF SPECS QUALITY BIODIESEL





## OUTLOOK FOR THE FUTURE :

“Considering the large oleaginous seeds diversity and the regional characteristics for the vegetable oils production, different conditions of refining, storage and transportation and even different climate conditions for the biodiesel usage, there are a lot of scientific work to be done. **Promoting bilateral and multilateral research collaboration.**”





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THE BEST WAY TO PREDICT THE FUTURE  
IS BUILDING IT

*Peter Drucker*

THANKS FOR YOUR ATTENTION

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