BIODIESEL PRODUCTION

First Generation in Brazil

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Laboratório Greentec

Escola Nacional de Química

UFRJ

Rio de Janeiro

June, 2005

Brazilian Biodiesel First Steps

Prodiesel – 80´s (Biodiesel and other Vegetable Oil Experiences as Fuel), Prof. Expedito Parente.

Probiodiesel – October/02:
Minister for Science & Technology

Brazilian Biodiesel Program – December/04

Brazilian Biodiesel Program

2005: B2 starts. Mandatory at 2008 – All the country

2013: B5 mandatory – All the country

LOW FEDERAL TAXES FOR SOCIAL PROJECTS AND POOR REGIONS

First Official Biodiesel Plant

Soyminas (March/2005)

Small Batch Plant

Minas Gerais State

Agropalma, Belém-PA, April/2005

Patent: D. A. G. Aranda and O. A. C. Antunes; PI0301103-8, 2003.
D. A. G. Aranda and O. A. C. Antunes, WO2004096962, 2004.

BUILT BY DEDINI INDÚSTRIAS DE BASE

Agropalma, Belém-PA, April/2005

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Agropalma´s Process

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[Continued on next page]

(54) Title: CATALYTIC PROCESS TO THE ESTERIFICATION OF FATTY ACIDS PRESENT IN THE ACID GROUNDS OF THE PALM USING ACID SOLID CATALYSTS

Patented by Federal University of Rio de Janeiro

Esterification (Free Fatty Acids)

$$H_3C\text{-}(CH_2)_{16}\text{-}COOH + C_2H_5OH \xrightarrow{Cat} \Rightarrow H_3C\text{-}(CH_2)_{16} - \underset{\displaystyle O}{\overset{\displaystyle \|}{C}} - OCH_2CH_3 + H_2O$$

100 kg FFA + 16 kg ethanol → 110 kg biodiesel + 6 kg water

acid — alcohol — ester — water

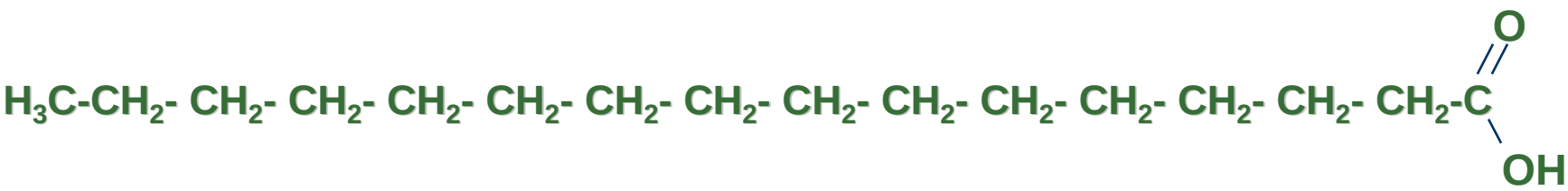
Catalyst = Strong acids

Palm Fatty Acid Distilatte

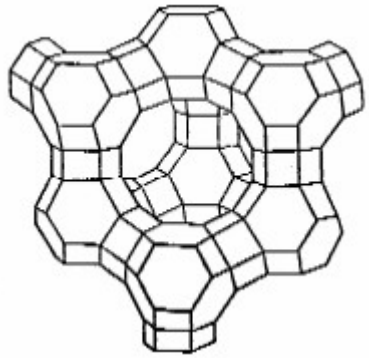
Fatty Acids extracted in Vegetable Oil Refining

Soybean FFA in Brazil (Soapstock):

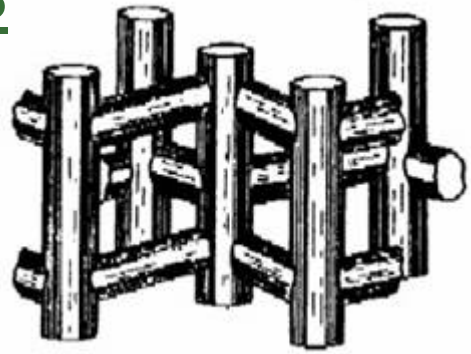
More than 150.000 ton/y



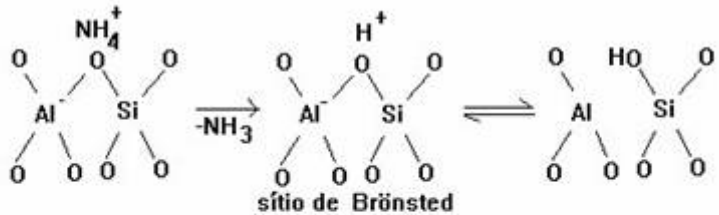
The Best Catalyst



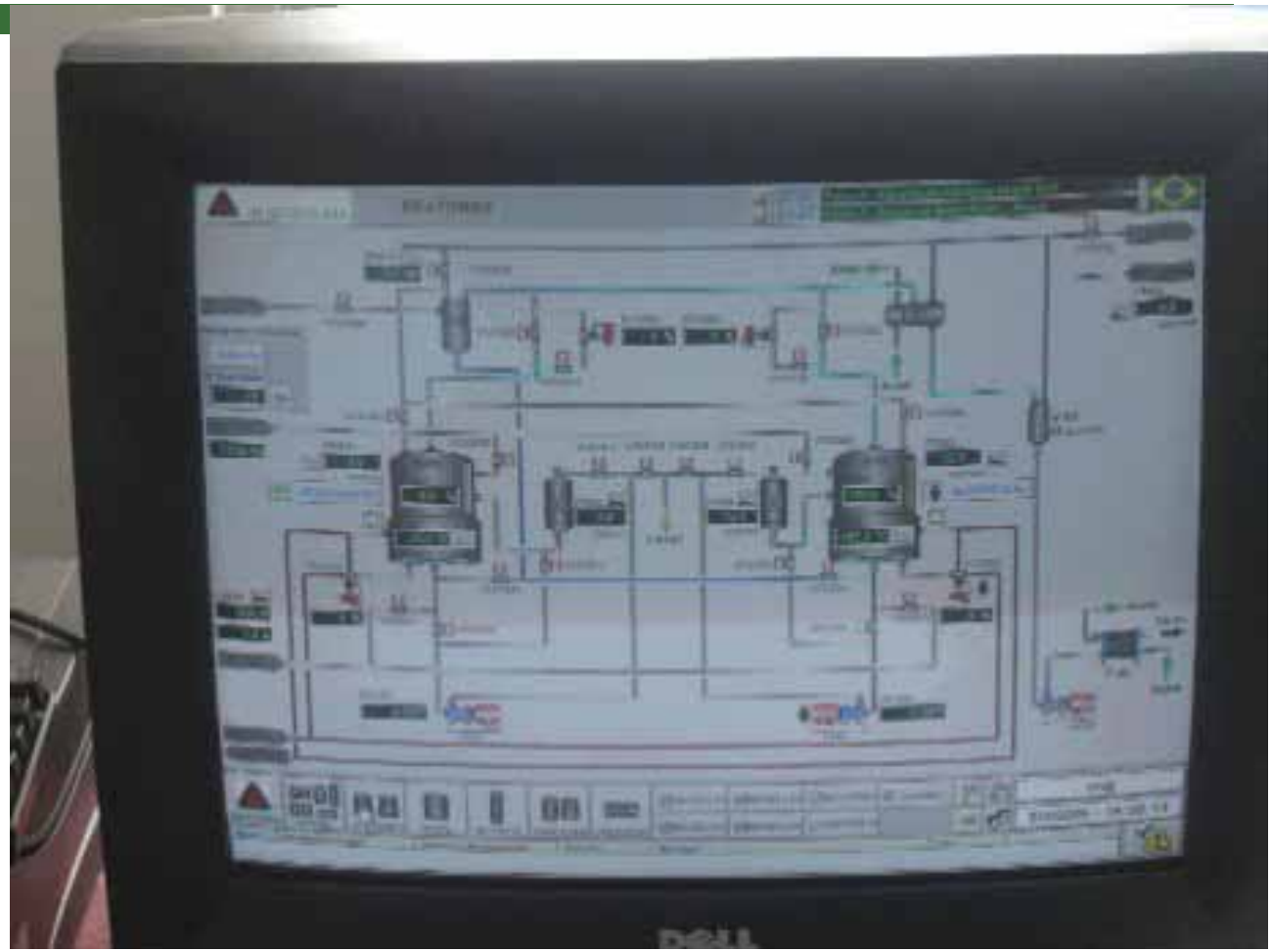
- Heterogeneous Catalyst
  - No soap
  - Reusable
  - Easier separation
  - No neutralizer



Niobic Acid (CBMM)



Agropalma, Belém-PA, April/2005



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Diesel X Biodiesel

Diesel - Hydrocarbon

$H_3C\text{-}CH_2\text{-}\ CH_2\text{-}\ CH_2\text{-}\ CH_2\text{-}\ CH_2\text{-}\ CH_2\text{-}\ CH_2\text{-}\ CH_2\text{-}\ CH_2\text{-}\ CH_2\text{-}\ CH_2\text{-}\ CH_2\text{-}\ CH_2\text{-}CH_3$

Biodiesel – FAME or FAEE

Biodiesel Ethyl Ester

$H_3C\text{-}CH_2\text{-}\ CH_2\text{-}\ CH_2\text{-}\ CH_2\text{-}\ CH_2\text{-}\ CH_2\text{-}\ CH_2\text{-}\ CH_2\text{-}\ CH_2\text{-}\ CH_2\text{-}\ CH_2\text{-}\ CH_2\text{-}\ CH_2\text{-}C(=O)OC_2H_5$

Biodiesel Methyl Ester

$H_3C\text{-}CH_2\text{-}\ CH_2\text{-}\ CH_2\text{-}\ CH_2\text{-}\ CH_2\text{-}\ CH_2\text{-}\ CH_2\text{-}\ CH_2\text{-}\ CH_2\text{-}\ CH_2\text{-}\ CH_2\text{-}\ CH_2\text{-}\ CH_2\text{-}C(=O)OCH_3$

FAEE – Idaho, USA

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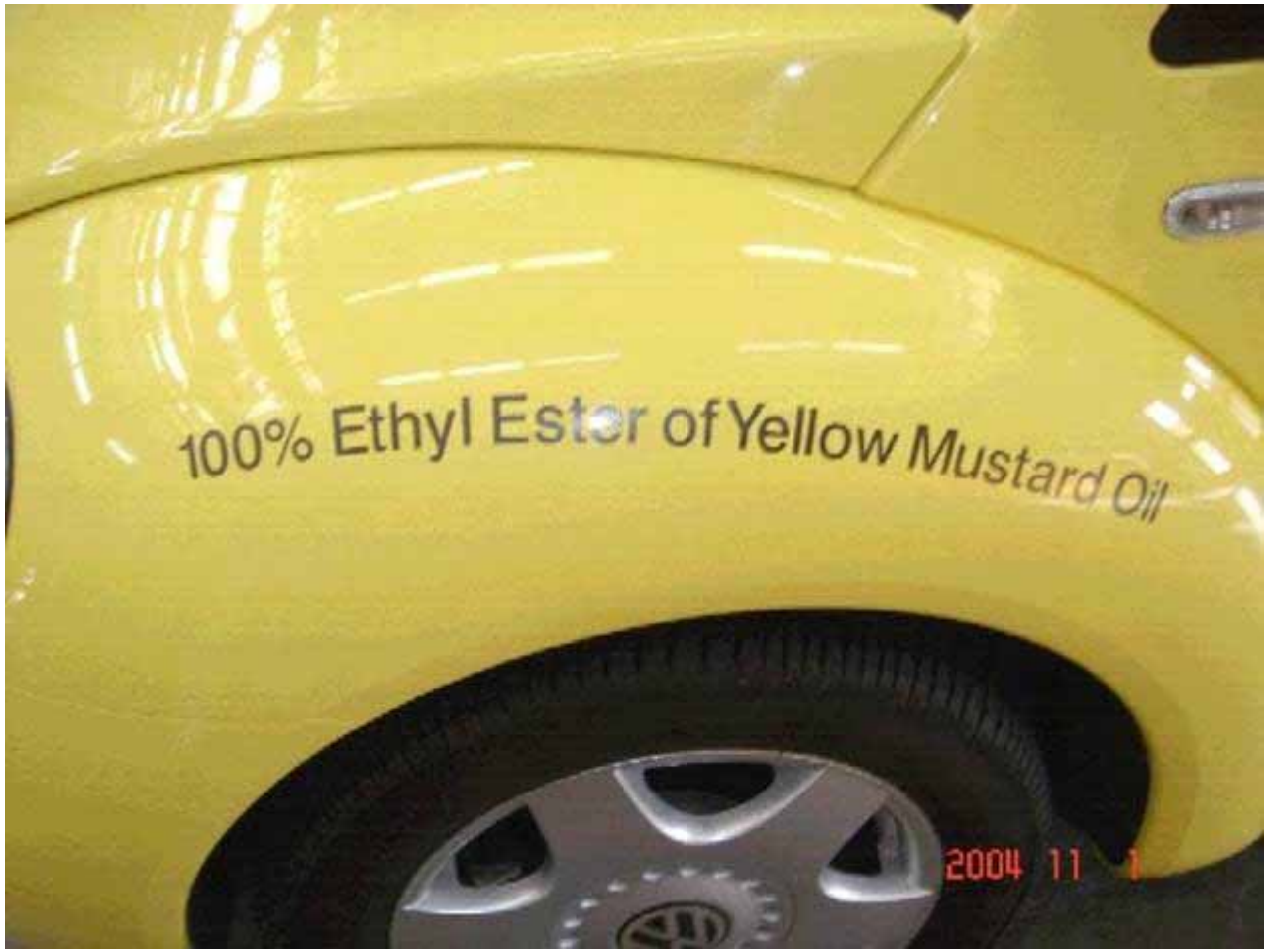

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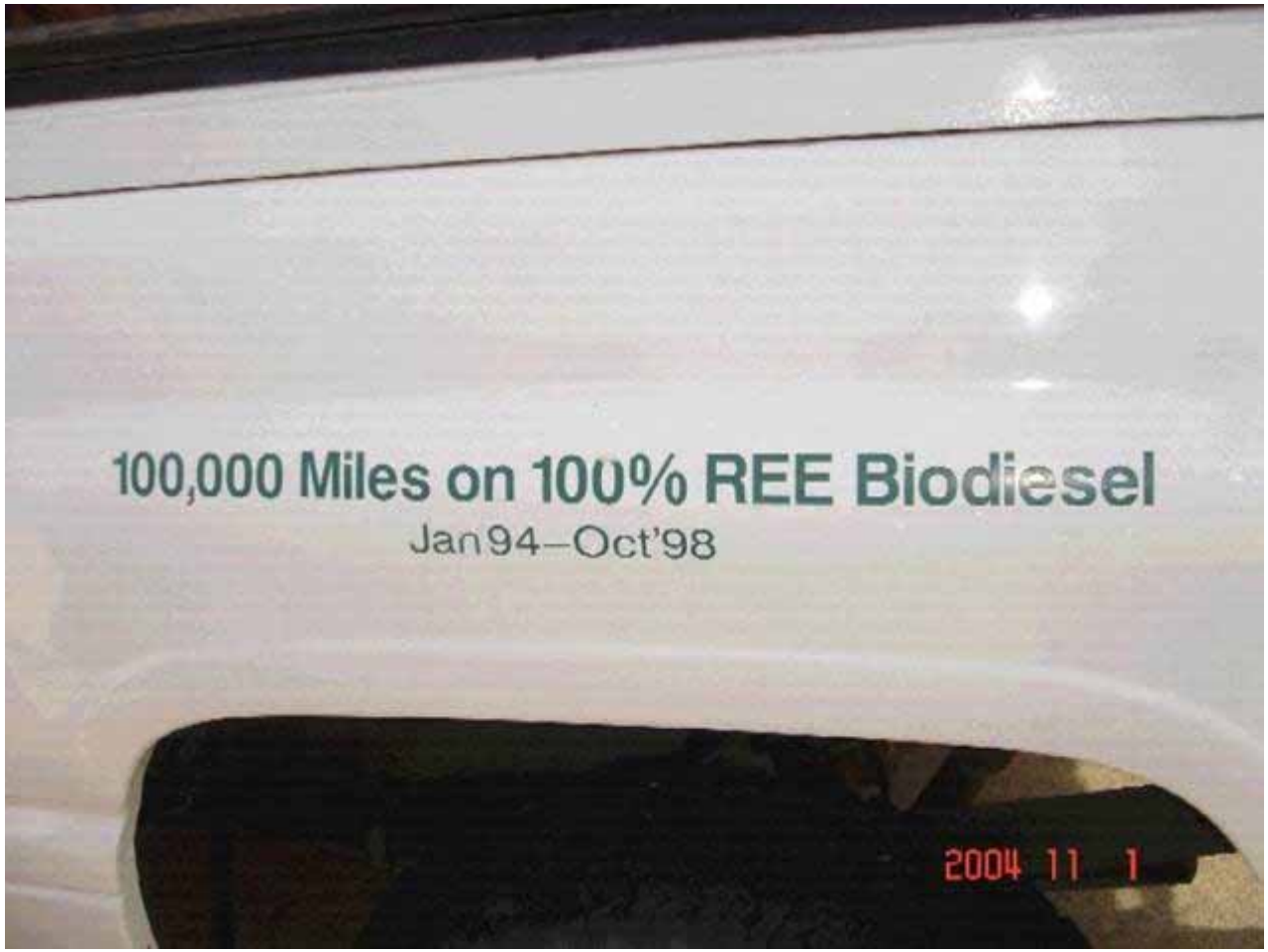


Biodiesel Standard

PROPERTIES	UNITY	EN 14214	AGROPALMA
DENSITY, 20ºC	kg/m³	0.86-0.90	0,87
VISCOSITY, 40°C,	mm²/s	3.5-5.0	4-4.5
WATER, MAX.	% vol.	0,05	0,000
CONTAMINATION	mg/kg	24	15
FLASH POINT, MIN.	°C	100,0	177
ESTER	%	96,5	99,5
DISTILATION; 90% VOL.	°C	--	350
CARBON RESIDUE.	%	0,30	0,01
ASHES, MX.	%	0,020	0,001
SULPHUR (*)	%	0,001	0,001
Na + K, MAX.	mg/kg	5	2
Ca + Mg	mg/kg	5	2
P	mg/kg	10	1
CORROSION, 3 H, 50 °C, MAX.	- - -	1	1
CETANE	- - -	51	69
ASPECT		---	CLEAN
ACIDITY, MAX.	mg KOH / g	0,50	0,50
FREE GLYCEROL, MAX.	%	0,02	0,001
TOTAL GLYCEROL, MAX.	%	0,25	0,00
MONOGLYCERIDES	%	0,8	0,01
DIGLYCERIDES	%	0,2	0,0
TRIGLYCERIDES	%	0,2	0,O
METHANOL OR ETHANOL, MAX.	%	0,2	0,01
IODINE		120	50
OXIDATION STABILITY 110°C, MIN	h	6	72

GreenTec

Palm

Babassu

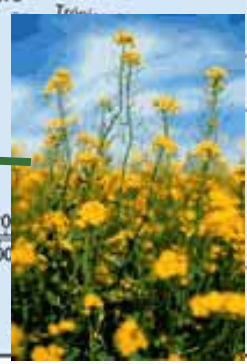
Castor

Sunflower

Soybean,
Tallow,
Cotton

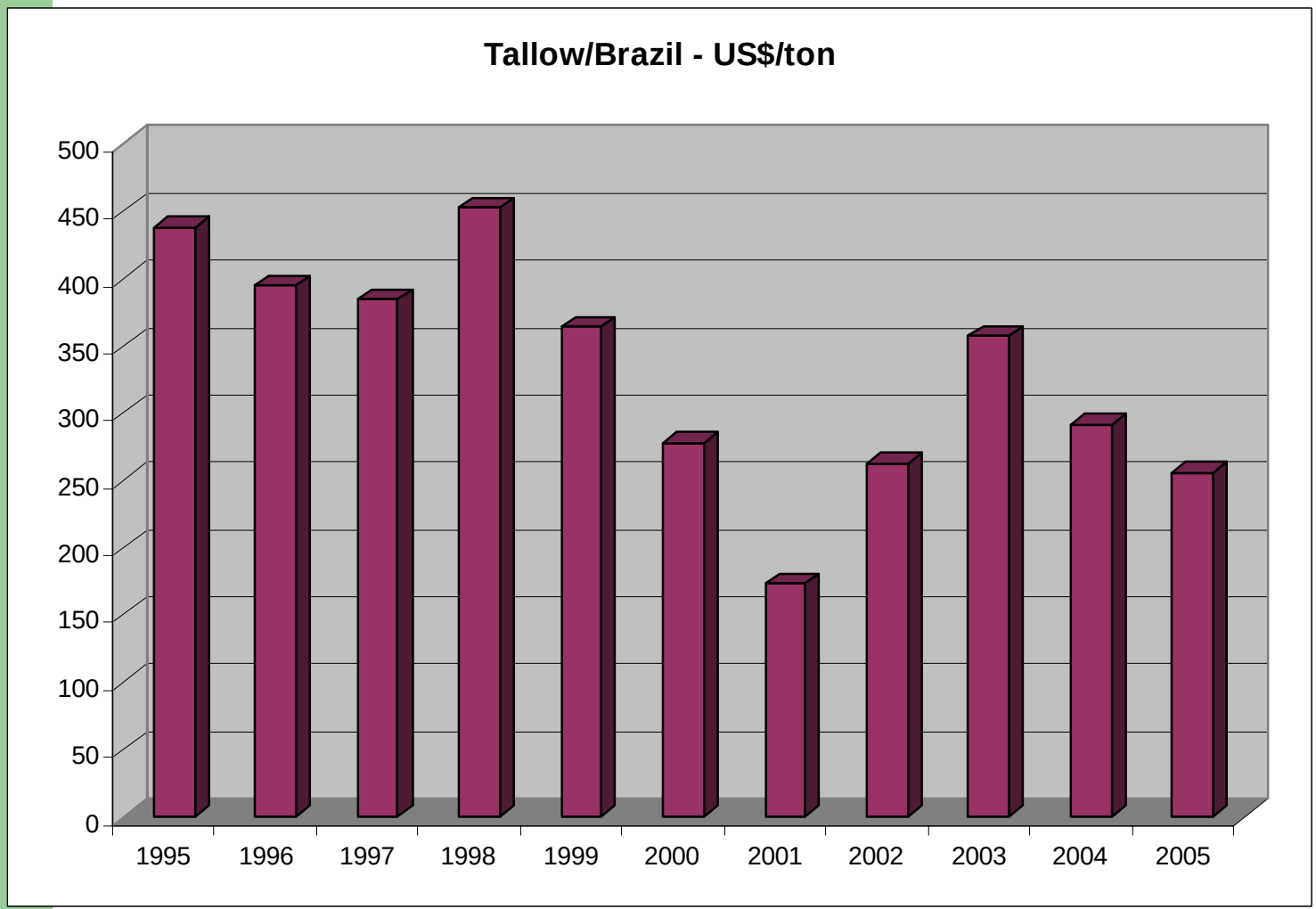
Jatropha

Peanut



Canola

Tallow



750.000
Ton/year

Conclusions

- Brazilian Biodiesel Program starts with Residues. Very Cheap Feedstocks.
- FFA and Tallow are the main residues.
- Technology Provides Premium Quality Biodiesel from Residues.
- Cotton, Sunflower and Castor will probably be the first seeds to produce biodiesel

GreenTec

“ The use of vegetable oils for engine fuels may seem insignificant today, but such oils may become, in the course of time, as important as petroleum and the coal-tar products of the present time. ”

Rudolf Diesel, 1912


Obrigado !