

ARPEL-IICA Biofuels Guide - Downstream Aspects

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Round Table "Biofuels and the energy sector"

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ARPEL-IICA Biofuels Guide

- Reasons to promote or not to promote biofuels
- Technical aspects
- Logistical aspects
- Environment, Health and Safety aspects
- Economic aspects
- Regulatory aspects
- Lessons learned, case study, field trials on vehicle performance, unsuccessful events and reasons for them.
- Agricultural activity (upstream)

Chapter 1 (Reasons to promote or not to promote biofuels)

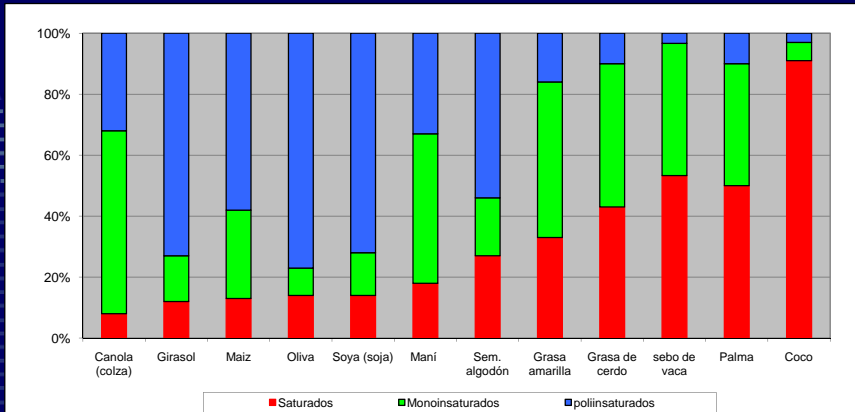
EACH COUNTRY (REGION) IS A PARTICULAR SITUACION....



Chapter 1 (Reasons to promote or not to promote biofuels) - cont.

- The scientific information available does not clearly state whether the energy balance of biofuels is neutral or positive, but does show the **advantages and disadvantages** of different energy sources and the best productive techniques to raise such energy balance.
- As regards food safety, in spite of the repeated association of biofuels to the current relative scarcity of food and certain basic agricultural commodities, **it is not definitely conclusive** that the main cause of this scarcity is the commercial appearance of biofuels, or that the inevitable tendency will be to confront biofuels and food safety.
- The foreseeable production of **biofuels of second generation** based on cellulose would be partially left aside just when it began, with a risk of competition between food and biofuels.

Chapter 2 (Composition of commodities for biodiesel)



	Saturados	Monoinsaturados	poliinsaturados
ácidos grasos	12:0 14:0 16:0 18:0 20:0 22:0	16:1 18:1 20:1 22:1	18:2 20:2
# cetano	alto	medio	bajo
Punto de niebla	alto	medio	bajo
Estabilidad	alto	medio	bajo

SOME CHARACTERISTICS OF THE OILS / FATTY ACIDS (COMMODITIES) AND THE BIODIESEL PRODUCED FROM THEM

Propiedades de aceites y biodiesel

Aceite	Punto Fusión			# yodo	# cetano
	aceite	metil ester	etiles		
Colza	-5	-10	-12	110-115	55
girasol	-18	-12	-14	125-135	52
soya	-12	-10	-12	125-140	51
algodon	0	-5	-8	100-115	55
maiz	-5	-10	-12	115-124	53
oliva	-12	-6	-8	77-94	60
coco	20-24	-9	-6	8-10	70
nuez de palma	20-26	-8	-8	12-18	70
palma	30-38	14	10	44-58	69
oleina palma	20-25	5	3	85-95	65
estearina palma	35-40	21	18	20-45	85
higuerilla	-10	-16	-18	81-97	38
grasa de cerdo	32-36	14	10	60-70	65
grasa de vaca	35-40	16	12	50-60	75
diesel EPA					40
Diesel California					50

Performances - commodities for biofuels

CULTIVO	L/HA /AÑO	TIPO
Palma	5500	biodiesel
Cocotero	4200	biodiesel
Higuerilla	2600	biodiesel
Aguacate	2460	biodiesel
Jatropha	1559	biodiesel
Colza	1100	biodiesel
Soja	840	biodiesel

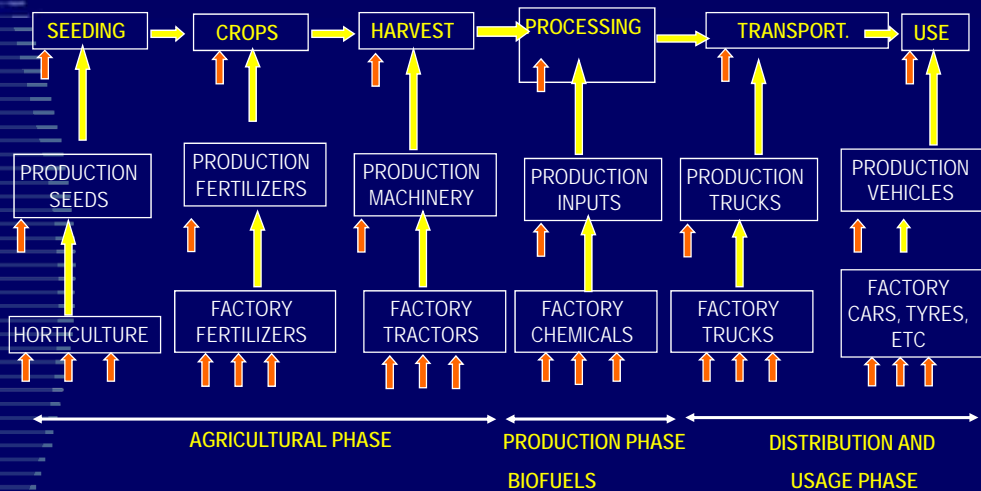
CULTIVO	L/HA /AÑO	TIPO
Caña azucar	9000	bioetanol
Remolacha	5000	bioetanol
Yuca	4500	bioetanol
Sorgo dulce	4400	bioetanol
Maiz	3200	bioetanol

Source: ICP - Ecopetrol

LIFE-CYCLE ANALYSIS

According to ISO 14040, Life-Cycle Analysis is a technique to assess the environmental aspects and product potential through:
 The compilation of an inventory of inputs and outputs as regards matter, energy and emissions
 The evaluation of the related potential environmental impacts
 The interpretation of the results

→ MASS FLOW
 → ENERGY FLOW



THREE GENERATIONS OF BIODIESEL

	First generation 2000	Second generation 2007	Third generation 2015
INPUT	Rape oil	Vegetable oils and animal greases	Biomass
TECHNOLOGY	Esterification FAME	Hydrotreating	Fischer - Tropsch Gasification BTL
OUTPUT	Methylester or ethylester $R-O-CO-CH_3$	Renewable Diesel C_nH_{2n+2}	Renewable Diesel C_nH_{2n+2}

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Chapter 3 (logistic aspects of the biodiesel production line)

•Storage recommendations

- Avoid exposure of the fuel to heat, light and even oxygen
- Storage diesel-biodiesel mixtures instead of B100
- Monitor the acidity rate and the viscosity of the B100 at the moment of its reception and then along time
- Store B100 in carbon steel tanks:
- Store B100 for not longer than six months unless additives are used to stabilize it
- Avoid pollution with water
- Store at a temperature higher than the pour point

Chapter 4 (Environment, health and safety aspects of biodiesel handling)

- Biodiesel does not contain hazardous materials and is generally safe. Many studies have found that it biodegrades faster than diesel. Users in sensitive environmental areas, such as wetlands, marine environments and national parks, have taken advantage of this property to replace diesel by biodiesel.
- In the US no warning sign is required for the transportation of B100, but a warning sign is required for transportation of its blends if its flash point is lower than 93°C, as shown in the following figure:



Flash point lower than 60°C

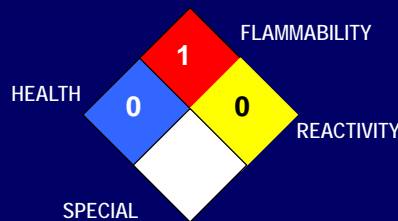
- ADR (European Agreement concerning the International Carriage of Dangerous Goods by Road : Non-dangerous goods
- ADNR (Regulation for the Carriage of Dangerous Substances on the Rhine) Non-dangerous substances
- RID (International Rule for Transport of Dangerous Substances by Railway): Non-dangerous substances
- IATA (International Air Transport association): Non-dangerous goods
- IMDG (*International Maritime Dangerous Goods*):



Flash point between 60° and 93°C

Chapter 4 (Environment, health and safety aspects of biodiesel handling)

RISK RATE:
 4 VERY HIGH
 3 HIGH
 2 MODERATE
 1 MILD
 0 MINIMUM



IGNITION AND EXPLOSION HAZARDS

FLASH POINT: > 130°C

LOWER FLAMMABILITY LIMIT IN AIR: Unknown

UPPER FLAMMABILITY LIMIT IN AIR: Unknown

FIRE EXTINGUISHMENT METHOD: dry chemical dust, Halon, foam, CO₂, water vapor

Chapter 4 (Environment, health and safety aspects of biodiesel handling)

ENVIRONMENTAL PROTECTION

ENVIRONMENTAL PRECAUTIONS: Avoid uncontrolled leaks

SPILLS: Although the product is not considered polluting (98% biodegradable in 21 days), make product tight avoiding its penetration in sewage, water courses, permeable soil and wells. Transfer the spilled material to security containers. Where necessary, collect the spilled material using absorbent media. In the case of uncontrolled spill of this product, determine if this must be communicated to the pertinent authorities according to the applicable law

METHODS OF CLEANING / SPILLED PRODUCT COLLECTION: In case of small spills, remove the remaining product from the ground using absorbent materials (e.g. soil, sand, etc.)

In case of large spills, remove the product through pumping.

Introduce the waste in duly labeled containers

CONSIDERATIONS RELATED TO DISPOSAL: The product surplus and the polluted containers must be disposed of according to the applicable law, in facilities duly authorized for such purpose

•Comparison of the levels of emission between biodiesel (B100) and diesel

Average biodiesel emissions ⁽¹⁾

Type of emission	100% biodiesel
Total HC without burning	-67%
Carbon monoxide	-48%
Particulate matter	-47%
NOx	+/-2%

(1) compared with those of traditional diesel according to EPA (US)

Chapter 5 (Economic Aspects of biodiesel)

- The introduction of biofuels in the business of oil companies, as a consequence of legal regulations that required or will require companies to blend a percentage of them with fossil fuel, have forced these companies to position themselves in this new scenario.

- In each country where regulations on the use of biofuels are implemented, particularly biodiesel, the refiners will have the possibility to integrate in the entire biofuels value chain or just participate in its last link.

Chapter 6 (Regulatory aspects of biofuels)

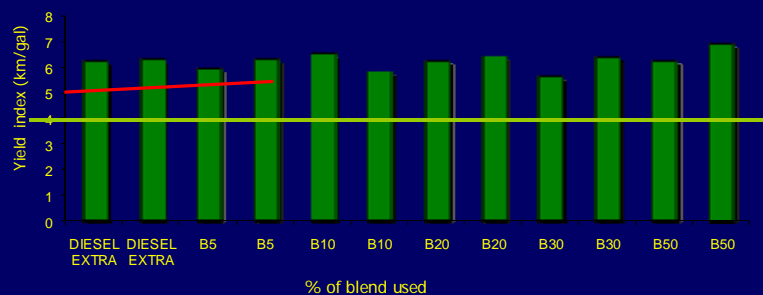
- In April 2007, OLADE published the report "*Analysis of legislation on biofuels in Latin America*". This document does not reflect the position of ARPEL or any of its members, but greatly contributes to the objectives of this chapter. This chapter complements part of the information contained in such document for the following countries:
 - Argentina
 - Brazil
 - Colombia
 - Peru

Chapter 7 (Experiences with biofuels in the region)

- AGROPALMA Project: Biodiesel production process developed by Professor Donato Aranda, School of Chemistry of the Federal University of Rio de Janeiro – UFRJ, consisting in the esterification of fatty acids in palms
- Long-term tests of diesel-biodiesel blends in Colombia: Carried out in Bogotá, at a height of 2,600 meters above sea level, which permitted to evaluate the effect of height in the performance and emissions of diesel engines, when palm diesel-biodiesel blends are used from 5 to the 50%. With this purpose, 12 buses of the capital transportation system were used to evaluate two buses with each of the following blends: 0, 5, 10, 20, 30 and 50% of biodiesel.

• Fuel yield

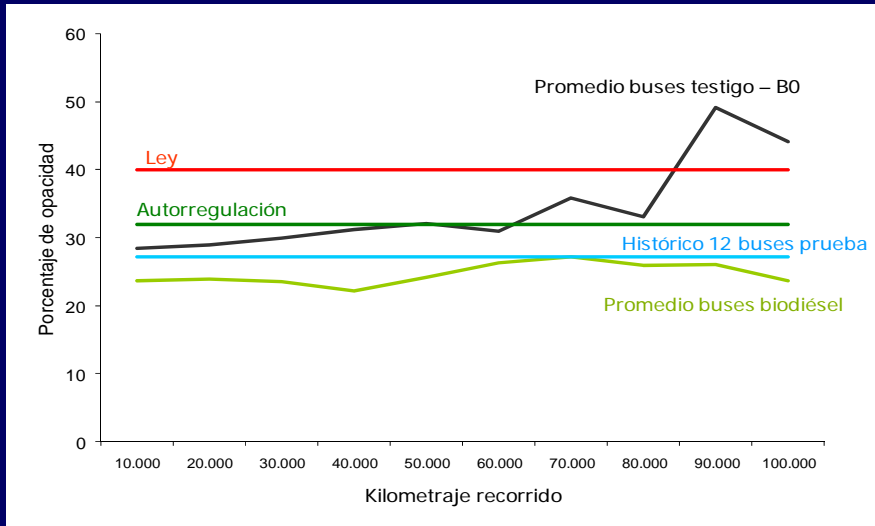
Testing Period



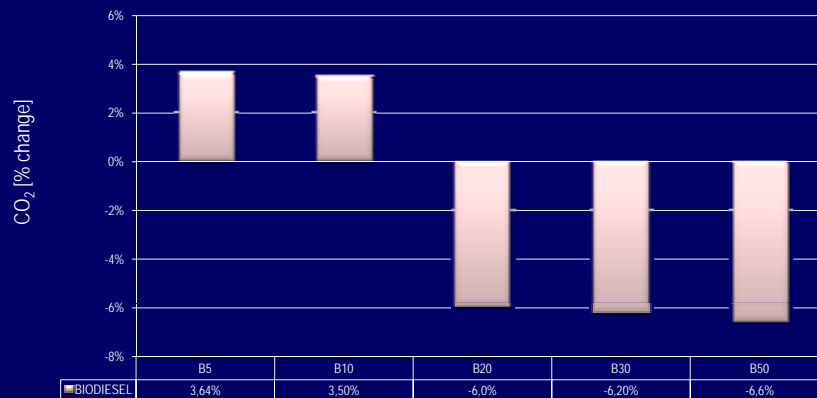
The fuel yield is not affected by the use of palm biodiesel.

•Source: Ecopetrol, SI99, Fedepalma, Cenipalma

Consolidated opacities registered

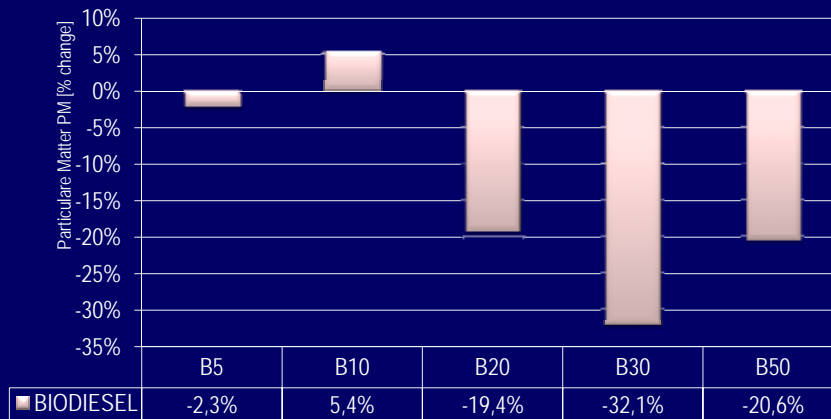


Results of the tests of emissions on the road - CO₂



• There is a CO₂ lowering tendency with the use of these blends. This analysis should be carried out jointly with the consumption of fuel and analysis of CHN of fuel.

Results of the tests of emissions on the road – Particulate matter



There is a particulate matter lowering tendency with the use of these blends.

CONCLUSION OF ARPEL

- In ARPEL we confirm our position that **we are the greater suppliers of fuels** for the region in the transportation sector, therefore, we should contribute to reduce as much as possible the environmental impact that our activities generate. **We consider that biofuels are integrated to the oil chain**, so we foster the sustainable production of biofuels. In this regard, it is necessary to consider:
 - **Good Practices:** Farming and technological knowledge for sustainable production, harvest and production of commodities.
 - **Sustainability criteria and compliance:** better knowledge about the effects of food safety, environmental effects (excessive use of fertilizers, acidification, loss of biodiversity, toxicity of pesticides)
 - **Intensification and yield:** In the last 5 decades the highest global production of food has been the result of the increase in production yield, and of a 20% increase in cultivated area, but the growth rate of the demand of biofuels surpasses the historical values, so new technologies, such as cellulose conversion and improvements in production chain management, must be should in the medium term.

THANK
YOU!

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