PESQUISAS COM BIOMASSAS NA EMBRAPA

O QUE É NECESSÁRIO PARA UTILIZARMOS BIOMASSAS NA PRODUÇÃO DE BIOENERGIA

1) **DOMÍNIO TECNOLOGICO**
   - **Sistemas de Produção adaptados a diferentes ambientes**
   - **Disponibilidade de Processos de Conversão**

2) **ESCALA DE PRODUÇÃO**
   - **Cultivares (sementes)**
   - **Produtividade**

3) **LOGISTICA**
   - **Transporte, Proximidade do Mercado, Capacidade de Armazenamento.**

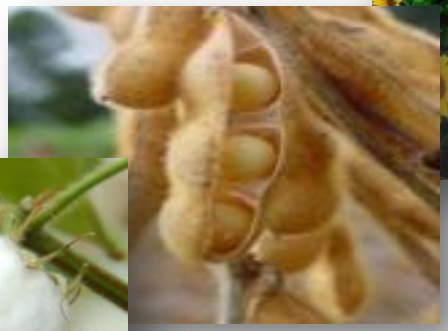
BIOMASSAS TRADICIONAIS

- **Materias Primas (requirementos):**
  - **Domínio Tecnológico**
  - **Escala de Produção**
  - **Logística**

Dendê
4.000 kg/ha

Mamona
700 kg/ha

Girassol
600 kg/ha



Soja
500 kg/ha

Algodão
450 kg/ha

Produtividade de Óleo

BIOMASSAS POTENCIAIS

In use

- Soja
- Mamona
- Girassol
- Algodão

Under evaluation

- Dendê *(Elaeis guineensis)*
- Macaúba (*Acrocomia aculeata*)
- Tucumã (*Astrocaryum sp.)*
- Babaçu *(Orbignya phalerata)*
- Inajá (*Maximiliana maripa*
- Pinhão Manso (*Jatropha curcas*)
- Amendoím
- Canola
- Buriti
- Óleos Residuais
- Wild radish
- Crambe
- Resíduos Industriais
- Pequi

Fonte: Bruno Laviola (Embrapa Agroenergia)

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Coeficientes Técnicos

- **Coeficientes técnicos de oleaginosas tradicionais**

Biomass	% Oil	Productivity (Kg/ha)	Oil Production (Kg/ha)
Soja	18	3.000	540
Algodão	20	1.900	360
Girassol	42	1.500	630
Amendoím	45	1.800	800
Mamona	47	1.500	705
Canola	40	1.300	500
Dendê	20	20.000	4.000

Fonte: Laviola e Alves (2011)

Coeficientes Técnicos

➢ Coeficientes Técnicos de Oleaginosas Potenciais

Biomassa	% Óleo	Produtividade Potencial (Kg/ha)	Produção de Óleo (Kg/ha)
Macaúba	20	20.000	4.000
Inajá	20	17.500	3.500
Tucumã	20	12.000	2.400
Babaçu*	5	10.000	500
Soja	18	3.000	540

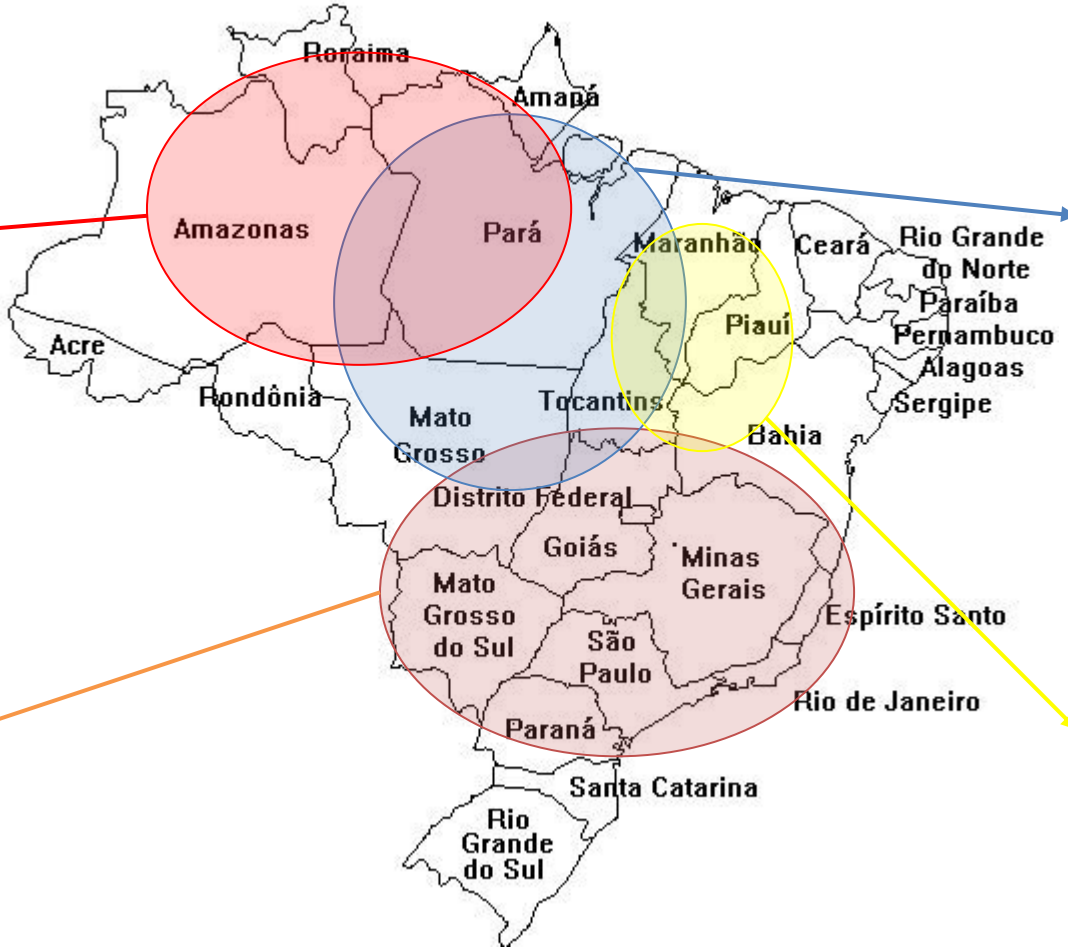



Source: Laviola e Alves (2011)

Distribuição Geográfica

Inajá

Macaúba



Tucumã

Babaçu

Source: Laviola e Alves (2011)

JATROPHA CURCAS

- **PERENIAL OIL PRODUCER PLANT WITH HIGH POTENTIAL FOR THE PRODUCTION OF AVIATION BUIOFUELS, BIODIESEL AND OTHER PRODUCTS**

Crop Potentialities

High yield of grains
(> 4.500 kg/ha – 9.000 Kg/ha)

High yield of oil
(> 2.000 kg/ha – 3.000 kg/ha)

High oil quality for Biodiesel
Palmitic 12,4%; Oleic 44,8%
Linoleic 34%; Stearic 7,8%
(C16 to C18) – (C10-C14)

Diversification of agriculture

Environment adaptation

Research Challenges

Need to broaden the genetic diversity

Lack of cultivars adapted to different areas

Lack of a production system

Uneven fruit ripening

Toxicity of the biomass residuals

Production cost

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OIL PALM

(E. guineensis; E. oleifera)

Crop Potentialities

High yield of Bunchs
(20 ton/ha/year)

High yield of oil
(4 a 6.000 kg/ha)

High oil quality
Palmitic 44%; Oleic 39%
Linoleic 11%; Stearic 4%
(C16 to C18) – (C10-C14)

Diversification of agriculture

Environment adaptation

Research Challenges

Strengthening breeding program

Resistance to Bud Rot

High efficiency cloning system

Increase seed production

Reduced production cost

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MACAÚBA
(*Acrocomia aculeata; A. intumescens*)

CROP POTENTIALITIES

- Potential for high yield of oil (4.000 kg/ha)
- Rusticity and adaptability to different climes
- Drough Tolerance (?)
- Evolution in dense areas (Resistance)
- Chance of sustainable harvesting
- Can be used in agroforestry systems
- Residues free of toxic compounds

RESEARCH CHALLENGES

- Lack of cultivars (Unknown genetic diversity)
- Lack of agronomic technology
- Germination problems
- Fruit production only after 4 to 5 years
- Tall plants (Dificulty of harvest)
- Harvest point x Uneven maturation
- Need for fast processing of fruits

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BABAÇU
Orbignya spp.

CROP POTENTIALITIES

- **Potential for high yield of oil (4.000 kg/ha)**
- **Rusticity and adaptability to different climes**
- **Drough Tolerance (?)**
- **Evolution in dense areas (Resistance)**
- **Chance of sustainable harvesting**
- **Can be used in agroforestry systems**
- **Residues free of toxic compounds**

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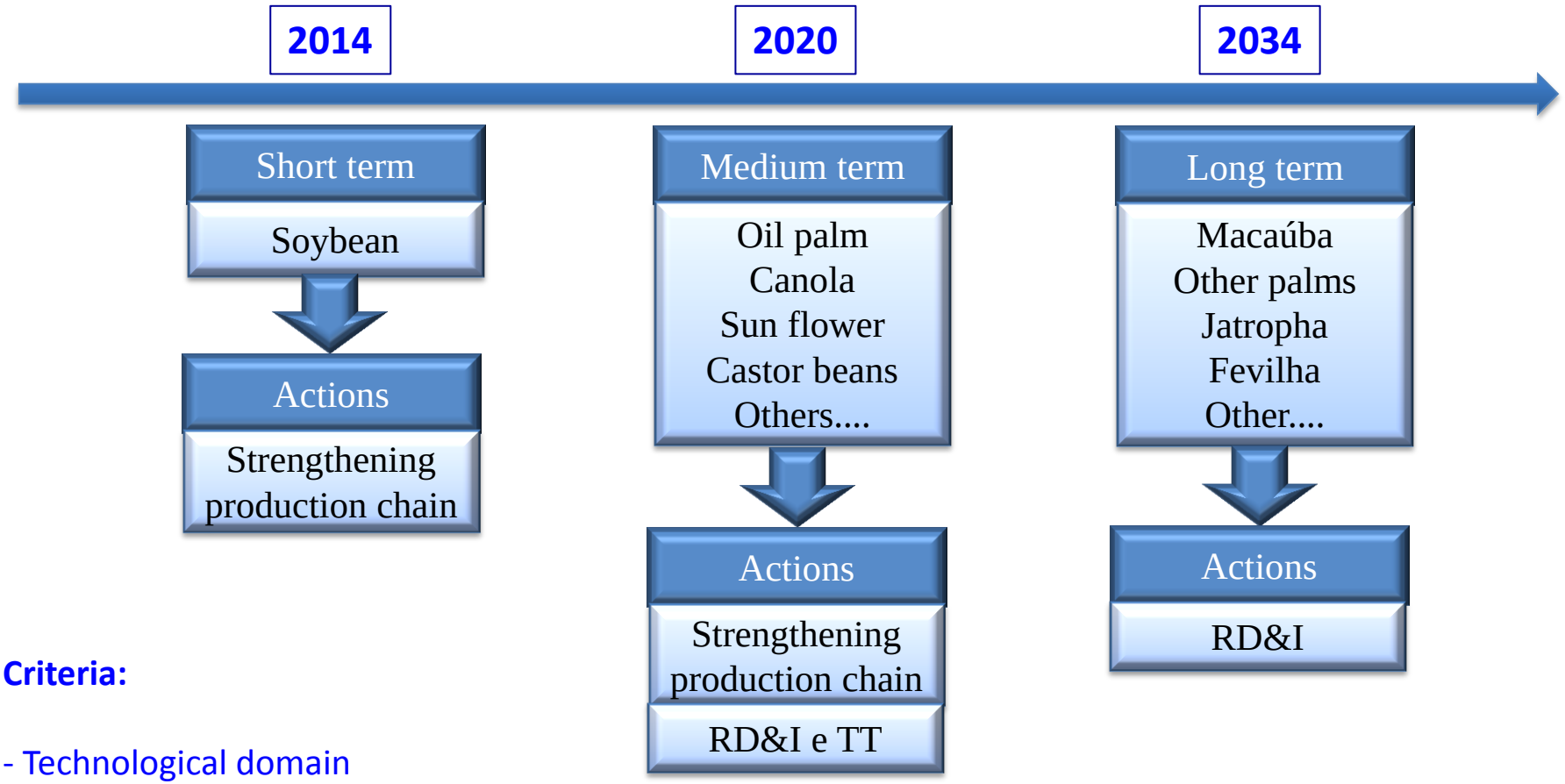
FEVILHA
Fevillea cordifolia

CROP POTENTIALITIES

- Potential for high yield of oil (4.000 kg/ha)
- Rusticity/adaptation to different climates
- Drough Tolerance (?)
- Evolution in dense areas (Resistance)
- Chance of sustainable harvesting
- Can be used in agroforestry systems
- Residues free of toxic compounds

FEEDSTOCK AVAILABILITY

INCREASE IN THE OFFER OF SUSTANABLE BIOFUELS AND BIOMASS



Criteria:

- Technological domain
- Production Scale
- Logistics

USE OF MICROALGAE FOR PRODUCTION OF BIOFUELS AND BIOPRODUCTS

MICROALGAE ARE PROMISING AND SUSTAINABLE SOURCES OF BIOFUEL

- **High growth rate and photosynthetic efficiency;**
- **Able to accumulate large amounts of reserve substances:**
  - Content of lipids and / or carbohydrates is 70% of the dry weight of the biomass;
  - Potential for the production of more than 50,000 l / ha / year of biodiesel or ethanol.
- **Efficient carbon sequestration:**
  - It is possible to couple the cultivation of microalgae with the capture of industrial emissions of CO2.
- **Can be grown on non-arable land;**
- **May use alternative sources of water:**
  - Salt or brackish water;
  - Effluents from municipal, rural and industrial sewage.

Production of microalgase in open ponds (raceways)

SINGH, A., OLSEN, S. I. **A critical review of biochemical conversion, sustainability and life cycle assessment of algal biofuels**, 2010

MARKET OPPORTUNITIES FOR PRODUCTS DERIVED FROM MICROALGAE

Nutraceuticals & Cosmetics

Price / Kg of biomass: US $ 600.00 to 4000.00
Market size: $ 100 million

Products: Beta-carotene, astaxanthin, lutein, phycobilins, etc.

Food and Animal Feed

Price / Kg of biomass: US $ 2.00 to 20.00
Market Size: $ 5 billion

Products: Animal feed and supplements containing oils rich in ω-3 and ω-6.

Chemical Industry

Price / kg biomass: US $ 1.00 to 5.00
Market Size:> $ 55 billion

Products: biopolymers, bioplastics, building blocks for fine chemicals, etc.

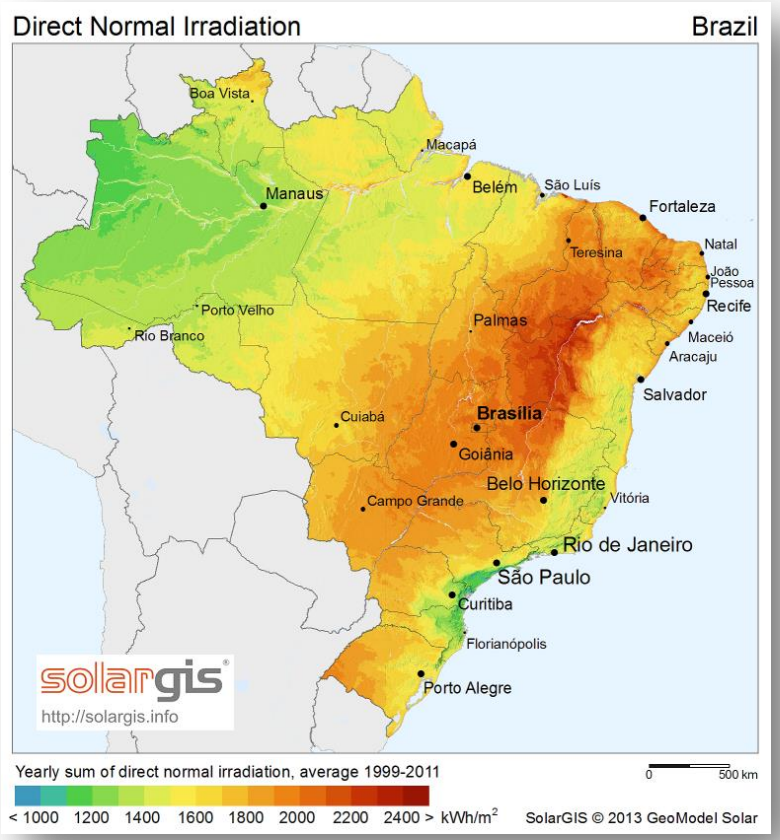
Biofuels

Price / liter: <$ 1.00
Market Size:> $ 1.1 trillion

Product: biodiesel, bio-kerosene, ethanol, butanol, etc.

BRAZILIAN POTENTIAL FOR THE PRODUCTION OF MICROALGAE

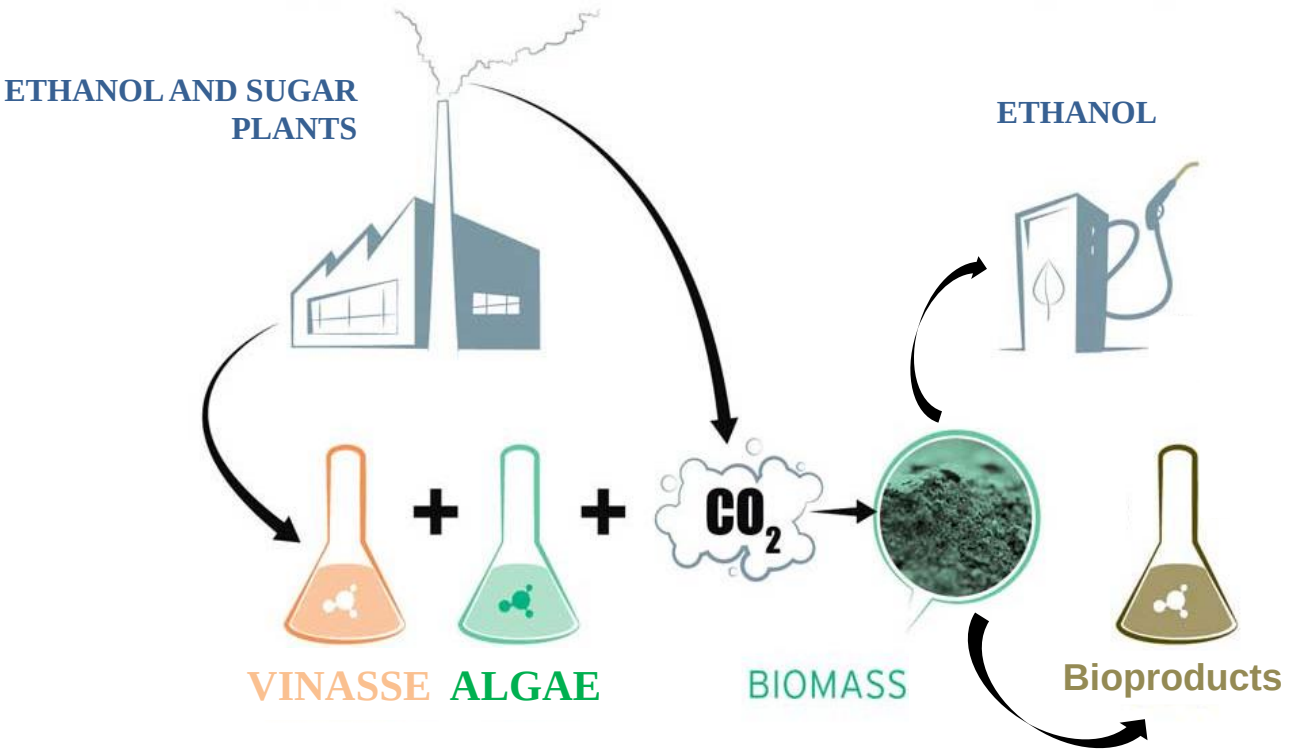
- **Brazil has an extensive tropical coast with 10,959 km;**
- **Owns approximately 12% of global freshwater reserves;**
- **Receives an average insolation 8-22 MJ / m2.dia;**
- **Has one of the richest biodiversity on the planet.**



PD & I PROGRAM OF PRODUCTION ON BIOFUELS AND BIOPRODUCTS FROM MICROALGAE IN EMBRAPA AGROENERGY

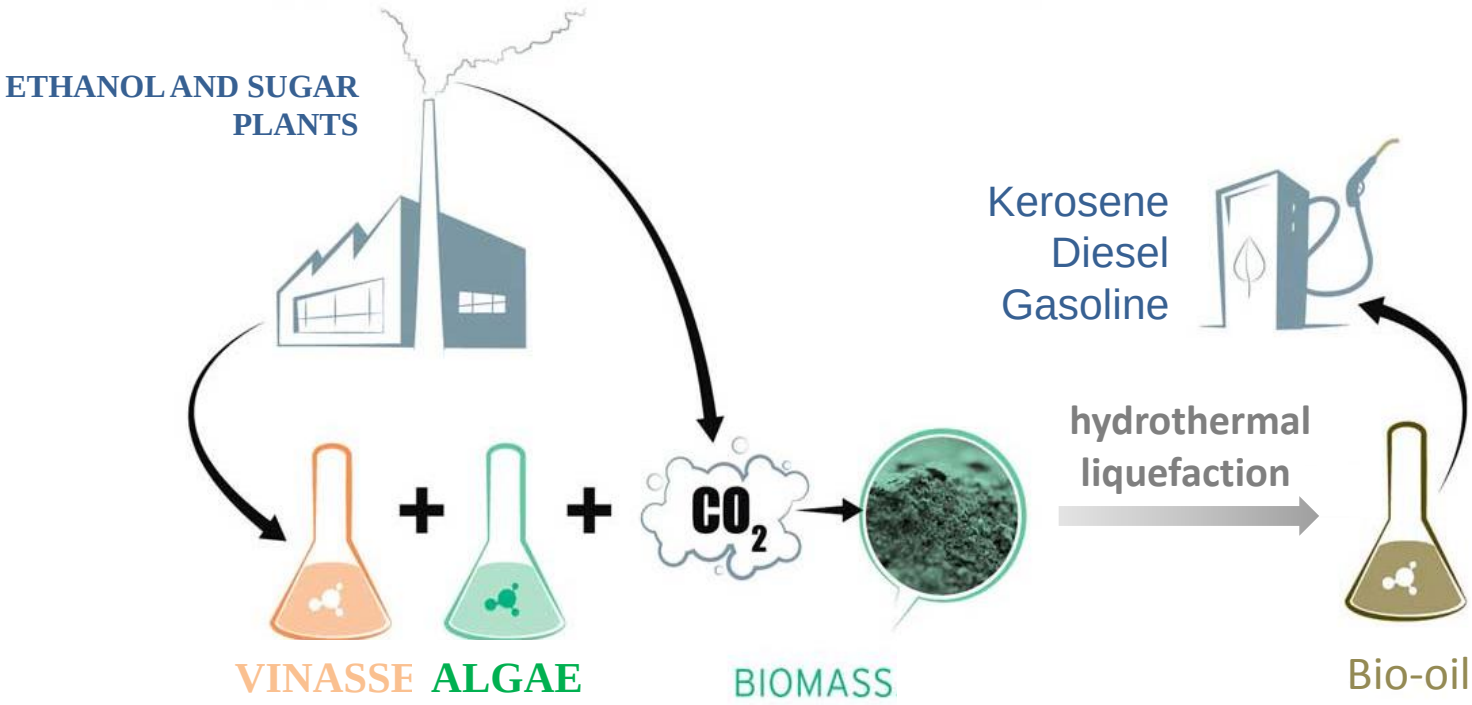
Conceptual Model I

Integrated production of ethanol and bioproducts (pigments and / or animal feed) from algal biomass grown in effluent (vinasse) produced in sugar and ethanol plants as cultivation medium.



Conceptual Model II

Production of biofuels of high energy density (kerosene, diesel and gasoline) through hydrothermal liquefaction of algal biomass grown in vinasse produced in ethanol and sugar plants.




OBRIGADO!
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CONCLUDING REMARKS

1) SOYBEAN AND SUGAR CANE ALONE WILL NOT RESPOND TO THE DEMANDS OF ALL SECTORS

2) THERE ARE MANY ALTERNATIVE FEEDSTOCKS FOR BIOENERGY

3) INDUSTRIAL PROCESSES ARE AVAILABLE FOR TRANSFORMING FEEDSTOCK AND RESIDUES

4) RESEARCH MUST CONTINUE TO ENSURE AVAILABILITY OF FEEDSTOCK WHEN DEMANDED

5) URBAN RESIDUES ARE AN ENORMOUS SOURCE OF ENERGY AND OTHER VALUE PRODUCTS

6) SUSTAINABILITY IN THE PRODUCTION OF ENERGY IS REACHED WITH DIVERSIFICATION (FOSSIL OIL, HIDROELETRIC, WIND, BIOFUELS, ETC…)

7) MORE DIVERSIFYED PRODUCTION = INCREASE IN SOCIAL INCLUSION

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