

LIGNOBIOL – Cascade use of lignocellulosic biomass to produce bioenergy | Subproject of :metabolon

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Vision

The rising worldwide energy demand leads to the depletion of fossil fuels reserves and at the same time, it increases the environmental impact caused by emissions of greenhouse gases (GHG).

Utilization of fossil fuels causes not only climate change impacts such as global warming, but also many other environmental problems such as water and soil contamination that pose potential risks to human and animal health.

Furthermore, increasing population growth leads to increased food demand and consumption. This upward trend creates competition between food and bioenergy markets. Hence, the so-called “food or fuel” discussion is back.

Challenges to counteract deciding between food and fuel that focus on the need to produce sustainable energy, while protecting environment, are the keys to replacing fossil fuels and lowering their greenhouse gas emissions. For this purpose, a completely new strategy with a proper sustainable system to supplying world’s energy demand must be found.

Motivation

- Overcome the constraints: “food vs. fuel” and global climate changes
- Use of biogenic residues and waste materials → valuable resources for the bioenergy production
- New approaches and efficient conversion technologies for “unused” biomasses
- Sustainable renewable resources → recycling of materials (nutrients and humus) into the material ecocycle
- Efficient material flow management → sustainable conversion of biomass into raw materials and energy
- Develop an innovative, efficient and environmentally friendly process to gain the maximum added value from biogenic residues and waste materials to supply energy (cascade use)

Strategies

The goals of “Lignobiol” Project are based on the cascade utilization of agricultural waste (Straw) to generate mainly bioenergy. For this purpose, the following lines will be developed in this study:

- Improve the biodegradability of lignocellulosic materials e.g. straw using suitable pretreatments (biological and thermal) to produce bioenergy
- Estimate the biogas potential of lignocellulosic biomass using thermal cogeneration
- Evaluate the proposed process (cascade utilization) as a sustainable conversion of biomasses to supply energy
- Extend the use of the proposed process to lignocellulosic materials other than straw

Scientific relevance

Within the “Lignobiol” Project, different processes and technologies are coupled in innovative integrated practices to ensure a sustainable and environmental development of bioenergy production using biogenic residues as shown in figure 1.

The process can be used to produce biogas and solid fuel (pellets, if desirable) – thus extending the efficiency for the use of the waste materials. The sustainable development of the process is based on cascade/multiple uses from wastes as an innovative and efficient use of residue conversion.

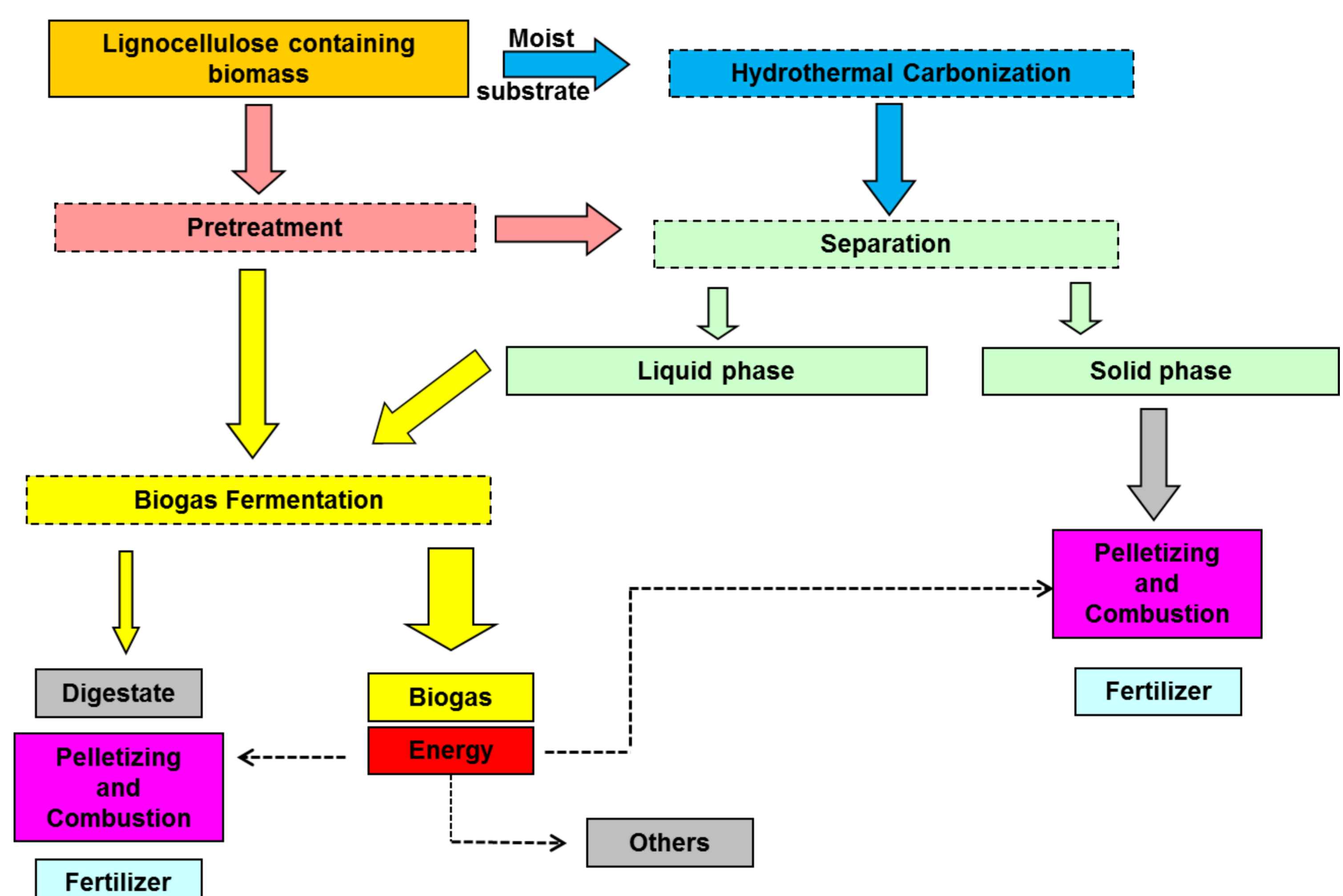


Figure 1: Proposed initial technical process of “Lignobiol” project.

1. Preparation of substrate – e.g. comminution, biological (enzyme, microorganisms)
2. Anaerobic digestion and alternatively, hydrothermal carbonization
3. The remained digestate can be used either as a fertilizer and/or for combustion of digestate fuel pellets
4. The energy produced during the process can be “recycled” in the process by drying the digestate for combustion
5. Alternatively, a separation process can take place prior to anaerobic digestion, thus resulting in a solid and liquid phase
6. The liquid fraction will be used to produce biogas (alternatively used as an innovative substrate for ethanol)

:metabolon Facilities

The labs and research hall at :metabolon Competence Center are equipped with:

- **Research Hall:** plant for biomass combustion, 2 Line -biogas plant, Process water and landfill leachate plant and hydrothermal carbonization plant
- **Chemical lab:** HPLC, IC, Spectrophotometer, TOC/TN analyzer, Fiber analyzer, etc.
- **Microbiological and molecular biological Lab:** Autoclave, Incubator, Thermo cycler PCR, DGGE, Microscope, etc.
- **Physical Lab:** Calorimeter, Sieve, Muffle furnace, Ultra Centrifugal Mill, etc.

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