Laboratório Nacional de Ciência e Tecnologia do Bioetanol

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# TECHNO-ECONOMIC FEASIBILITY STUDY OF A BTL (BIOMASS TO LIQUID) THERMOCHEMICAL ROUTE FOR PRODUCTION OF BIOJET FUEL WITH COGENERATION: A DOCTORAL PROPOSAL

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## Background

Sugarcane (*Saccharum* spp.) is one of the most important crops produced worldwide in tropical and subtropical regions. Furthermore, it is considered one of the highest productions of raw material in the world, being used for the production of sugar and ethanol. The residual lignocellulosic material from sugarcane (bagasse and straw), besides being used for electricity generation, has potential to be the most suitable feedstock for second-generation (2G) ethanol production.

Nowadays, public and private institutions are seeking new technologies regarding the sugarcane chain to raise process efficiency and sustainability. One of the possible and fast ways to solve it is through the use of mathematical and simulation models to represent process units. With this purpose, the Brazilian Bioethanol Science and Technology Laboratory (CTBE), integrated to the Brazilian Center for Research in Energy and Materials (CNPEM), has been developing a simulation platform – called Virtual Sugarcane Biorefinery (VSB) – to assess alternatives within the biorefinery concept. The VSB is capable to assess different technologies considering technical, economic, environmental and social aspects in a biorefinery. Among the advantages of using the VSB can be cited: i) Optimization of concepts and processes; ii) Assessment of different biorefinery alternatives in view of their sustainability (economic, environmental and social impacts); iii) Assessment of the stage of development of new technologies.

This work is based on a initial research doctoral project. The aim of this project is a study of techno-economic feasibility of a BTL (Biomass to Liquid) Thermochemical route for producing biojet fuel with cogeneration.

## Biomass to Liquid (BtL) Thermochemical Route

Although the BtL thermochemical route is recognized as one of the most promising, since there are several arrangements for the production of synthesis through biomass gasification developed throughout history, there are still major challenges for the development of this route (in experimental and modeling areas). One of the challenges is the production of a produced gas that should not contain tar, product undesirable for many applications. It should be considered the issues related to the design and optimal operation of the reactors, the gaseous compounds that can inhibit the catalysts and processes of produced gas applications in general, such as HCl, $NH_3$, $N_2$, fouling and heavier hydrocarbons compounds such as aromatics, phenols, and others. Another challenge concerns the technology of the production of syngas from bagasse from sugar cane, which has insufficient literature when compared with wood and coal. Table 1 shows the main characteristic or observation of a simulation process of a BTL thermochemical route obtained from of literature. Figure 1 shows a proposal of this route.

Table 1. characteristic or observation of a simulation process of a BTL thermochemical route obtained from of literature.

| Parameter or process | Characteristic or observation |
|---|---|
| Simulation platform | Aspen Plus® & Fortran code |
| Gasification | Circulating fluidized bed |
| Gasification reactor | RGibbs (Aspen Plus® reactor) |
| Gasified material | Biomass |
| Oxidant agent | Steam |
| Particulates and tar | Few pieces of information |
| Cleaning and conditioning of syngas | Few pieces of information |
| Gasification kinetic model | Few pieces of information |
| Fischer-Tropsch synthesis | Kinetic reactions & Fe-Mn & Fe-Co |
| Fischer-Tropsch reactor | Slurry |

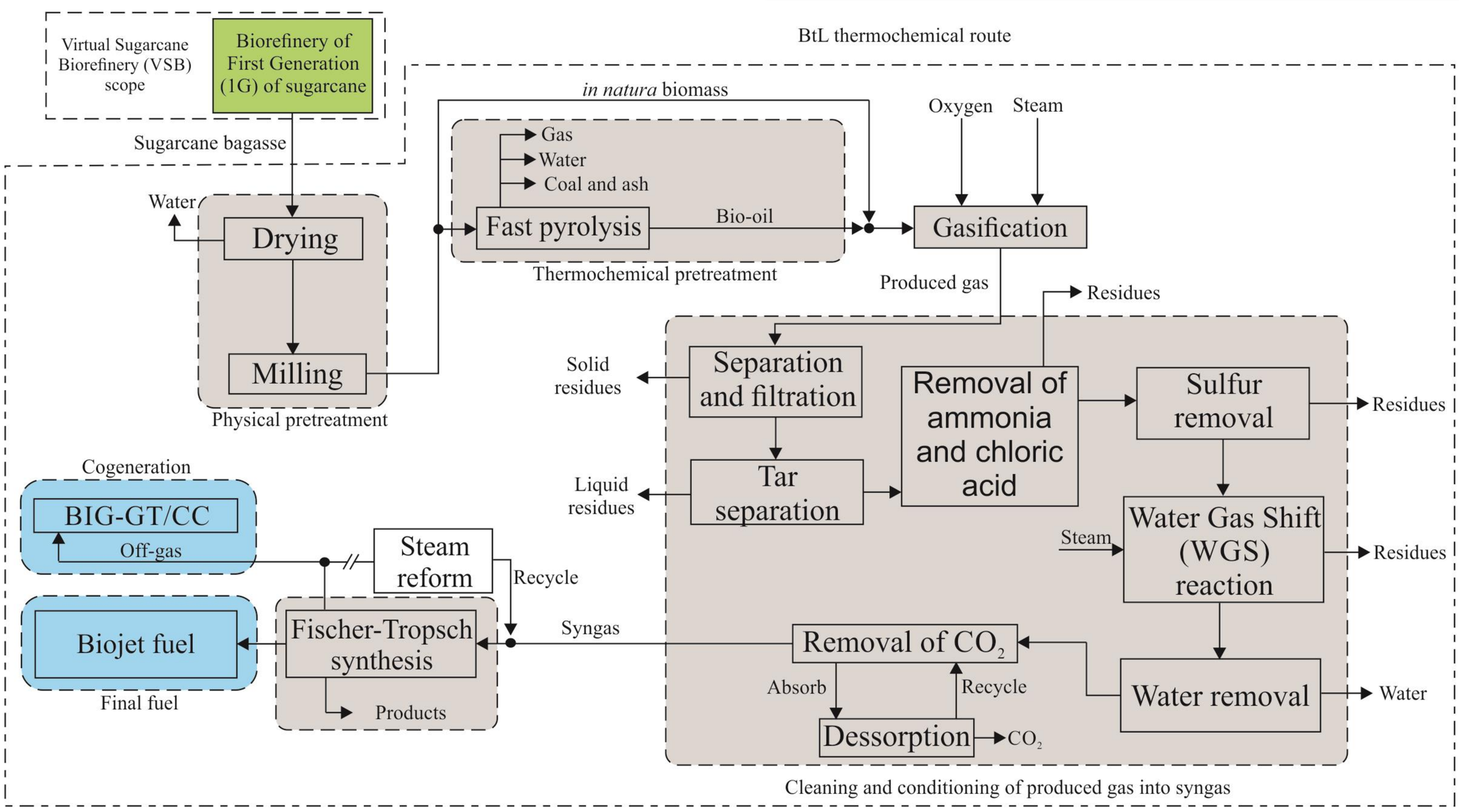


Figure 1. BTL thermochemical route proposal

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