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Title : Use of Life Cycle Assessment to determine the environmental impact of thermochemical conversion routes of lignocellulosic biomass: state of the art

Authors : S. Gerbinet, A. Léonard

Authors affiliation : Génie chimique - Procédés et développement durable - Faculté des Sciences Appliquées - Université de Liège

Corresponding email address: Saicha.Gerbinet@ulg.ac.be

Abstract : The lignocellulosic biomass valorisation is part of second generation technologies in opposition to first generation technologies. They are very interesting because they allow less competition for land and water used for food. Indeed, they permit the use of the entire plant. Moreover, lignocellulose is abundant in cheap and non-food materials available from plants such as wood and energy crops (miscanthus, etc.). In light of the high interest of the use of lignocellulosic biomass, the study of its environmental impact seems very important.

The thermo-chemical route is being considered more extensively, especially the gasification process. This process converts carbonaceous biomass into combustible gas (CO, H₂, CO₂, CH₄ and impurities) called syngas in the presence of a suitable oxidant such as air, oxygen or steam. The syngas can be converted into a large range of products. Diesel can be produced via a Fischer-Tropsch process, whereas hydrogen can be obtained with a purification process. Methanol can also be obtained, and used for producing DME (dimethyl ether). DME and diesel can serve as fuels in traditional motors. Syngas can also be used to produce ethylene and propylene, two building blocks for the chemical industry. Production of these four compounds (ethylene, propylene, diesel and DME) are specifically investigated.

In this PhD work, life Cycle Assessment (LCA) methodology will be used to determine the environmental impact of lignocellulosic biomass gasification. LCA deals with the environmental aspects and potential impacts associated with all the stages of a product's life from raw material extraction to end of life by disposal or recycling.

The first step consists in realizing an extensive bibliography research concerning gasification processes as well as identifying the key methodology points to be improved during the LCA analysis. The poster will describe different possibilities for gasification but also for biomass preprocessing and syngas purification. It will also show the need to take into account the impact of change in land use (for example, the change in organic content of land, the CO₂ emissions from deforestation, etc.) which is an essential factor when considering the large scale valorisation of lignocellulosic biomass.