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Strategic situation, design and simulation of a biorefinery in Andalusia

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Abstract

Biorefinery have been promoted in the last decades. In a lignocellulosic feedstock based biorefinery, biomass can be transformed in several products, with different chemical and/or agro-industrial applications, and energy (biofuels). The use of biomass waste is strongly advocated under European Union (EU) legislation in order to help achieve the climate and energy targets of the EU for 2020 and beyond. In this context, this study was focussed on the design and simulation of a biorefinery to mainly obtain ethanol and DME. These biofuels were obtained from waste forestry and agricultural waste biomass collected near the area where the biorefinery plant was proposed to be installed, to minimize the transportation costs and to promote the valorization of the biomass waste generated in this region. Moreover, the industrial applications of the possible obtained by-products were evaluated to minimize the environmental impacts and to make the biorefinery more sustainable. Fig.1 shows the block diagram of the global biorefinery processes.

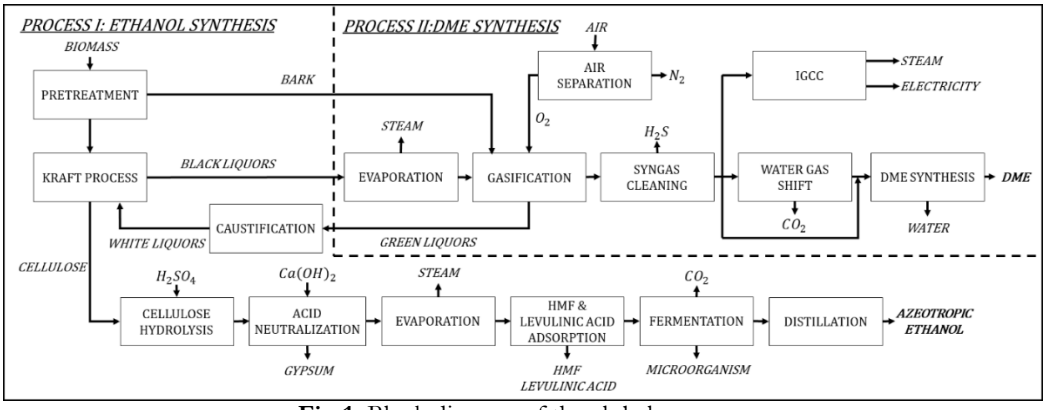

Fig.1. Block diagram of the global process.

The central area of Andalusia, specifically the municipalities of Lucena and Antequera, was selected as the most adequate area to develop the installation of the biorefinery plant

Two commercial simulation software, such as Aspen HYSYS® and UniSim®, were used to design and size the equipments and to simulate both production lines.

One of the most important achievements of this biorefinery is the possibility of obtaining 42,700 T y^{-1} of ethanol with a purity of 96%, which supposes a 16.5% of the Spanish national production in 2016, and 137,850 T y^{-1} of DME, with a purity of 99.99%. from these biomass waste Both compounds can be used as alternative fuels or energy sources. A techno-economic analysis was performed, obtaining a minimum selling price of 0.58 $/L for bioethanol, 1.15 $/kg for DME and 0.65 $/kg for HMF and LA, respectively. These prices are comparable to those found in the literature [1].

Furthermore, the implementation of the biorefinery in this strategic area promotes its economic and social development, improving the use of the natural resources to obtain competitive products to fossil fuels.

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References

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