Exergy and Environmental Ranking of Bioethanol Production Routes

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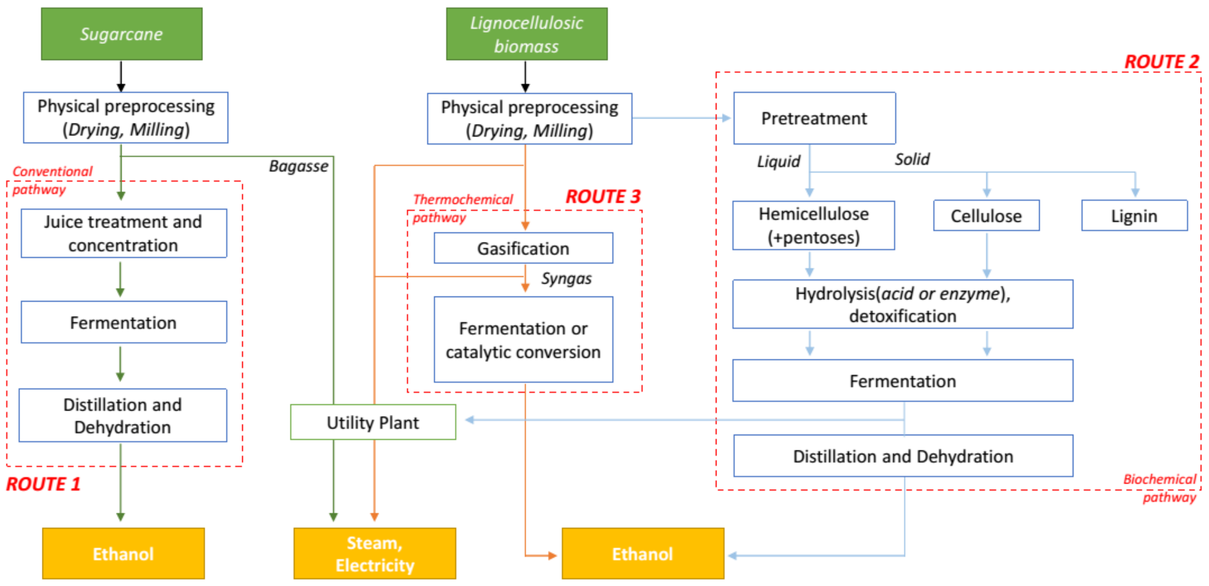
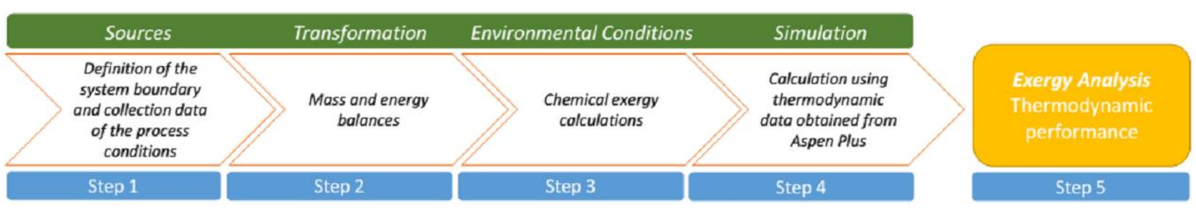
RESEARCH AIMS



SCENARIOS PROPOSED

ROUTE 1: *Ethanol (1G) and electricity;*
ROUTE 2: *Ethanol (2G), hydrolysis and electricity;*
ROUTE 3: *Liquid fuels and electricity.*

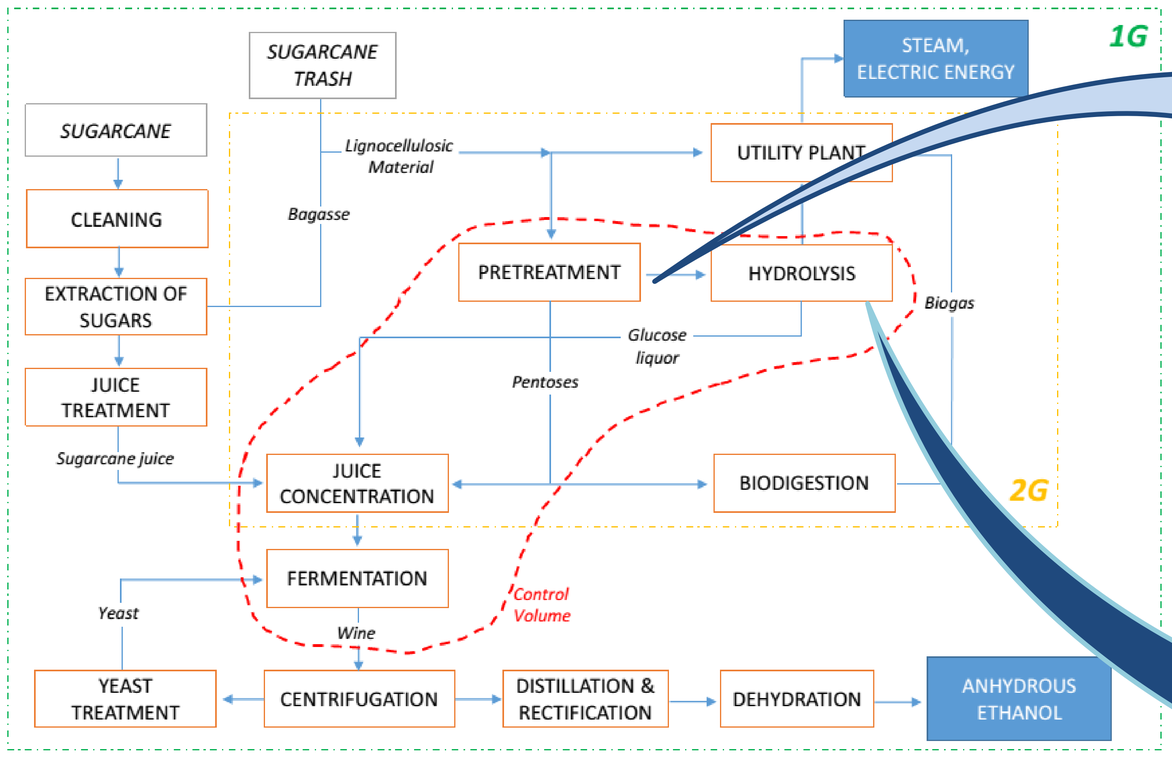
METHODOLOGY

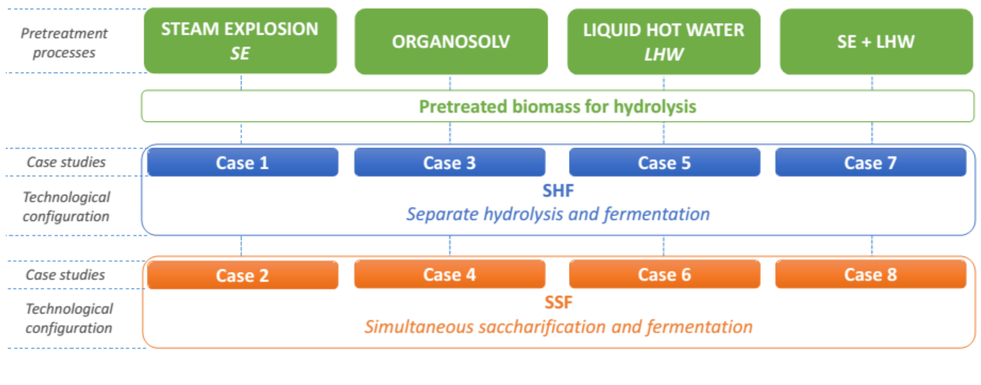


SPECIFIC OBJECTIVES

- Characterizing energy conversion processes in each configuration analyzed in terms of waste/rejects and the most representative consumption-production data of these processes.
- Developing thermodynamic models for simulating the energy conversion processes of the proposed routes.
- Comparing the exergy performances of the routes evaluating alternatives to minimize entropy generation (irreversibility) in order to improve the quality of the products obtained.
- Defining appropriate exergo-environmental indicators for ranking the studied biorefineries configurations in certain scenarios for bioethanol and electricity production.
- Based on a thermo-economic analysis, assessing how the changes in the proposed biorefineries configurations alter the exergetic monetary costs of the products formation process.

Integrated 1G-2G ethanol and electricity production

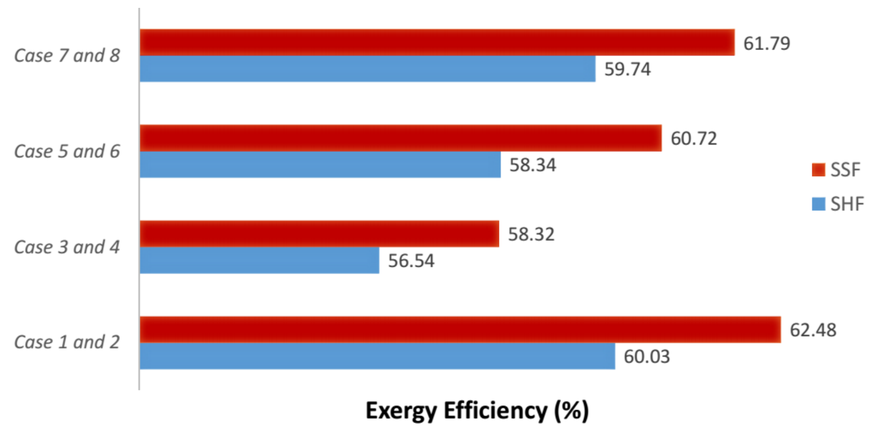




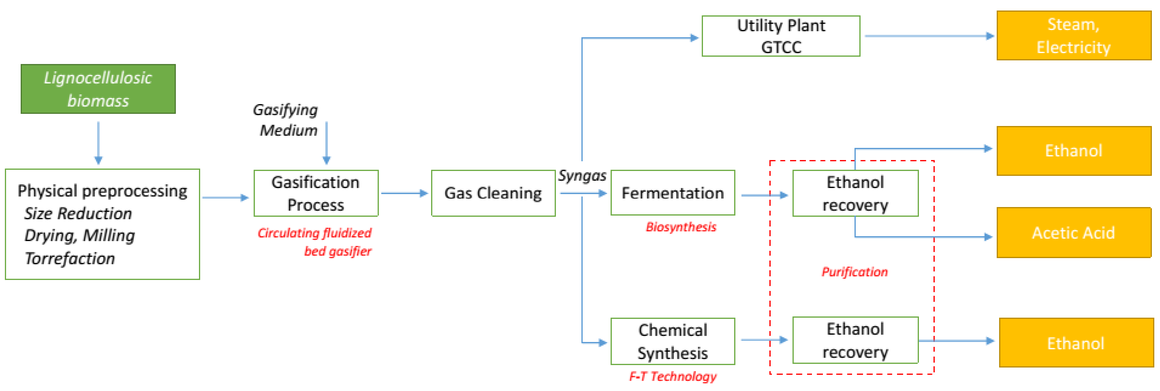
Pretreatment	Raw Material	Steam Explosion	Organosolv	Liquid Hot Water	SE+LHW
Exergy Efficiency (%)	1	91.0	83.3	93.3	94.4
	2	93.2	85.4	94.1	95.1
Destroyed Exergy Rate (MW)	1	13.5	39.9	9.4	8.5
	2	10.6	36.4	8.8	8.0
Input bagasse Exergy Rate (%)	1	9.9	29.2	6.8	6.2
	2	7.2	24.8	6.0	5.5

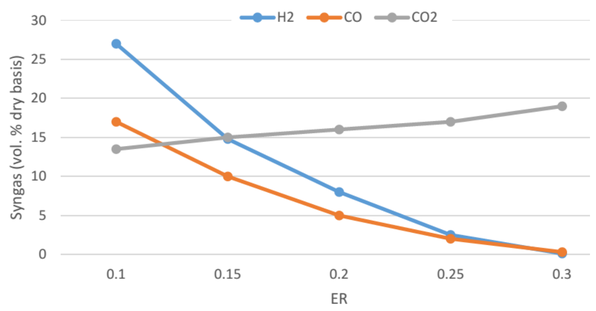
Raw material 1 (w/w):
cellulose 47.5%, hemicellulose 20%, lignin 30%, and ash 2.5%.

Raw material 2 (w/w):
cellulose 43.38%, hemicellulose 25.63%, lignin 23.24%, ash 2.94%, and extractives 4.81%.

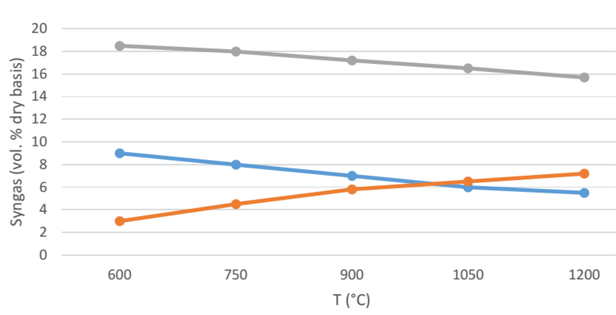


Exergy analysis of thermochemical route of bioethanol production via sugarcane bagasse gasification





Effect of equivalent ratio (ER) on syngas composition



Effect of temperature on syngas composition

SCIENTIFIC PAPERS

SILVA ORTIZ P., OLIVEIRA JR. S., *Exergy analysis of pretreatment processes of bioethanol production based on sugarcane bagasse.* **Energy**, Available online 3 June 2014. http://dx.doi.org/10.1016/j.energy.2014.04.090

SILVA ORTIZ P., OLIVEIRA JR. S., *Compared exergy analysis of sequential enzymatic hydrolysis-fermentation and simultaneous saccharification-fermentation of sugarcane bagasse.* **Proceedings of the ICCE 2014**. Istanbul, Turkey.

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