Table S1 Life cycle inventory (LCI) with input and output data for each process to obtain lignocellulosic hydrolysate.

Stage 1: Biomass Preparation		
Inputs		
Raw Biomass (51% H_2O)	kg	29.842
Energy	KWh	6.588
Outputs		
Crushed biomass	kg	19.763
Water vapor	kg	10.079
Stage 2: Organosolv pretreatment		
Inputs		
Crushed biomass	kg	19.763
Water	kg	296.443
Ethanol	kg	78.162
Energy	KWh	163.636
Outputs		
Pretreated pulp	kg	13.034
Black liquor	kg	183.706
Effluent (chemical waste)	kg	197.628
Stage 3: Enzymatic Hydrolysis		
Inputs		
Pretreated pulp	kg	0.079
Citric acid (buffer solution)	kg	0.007
Sodium citrate (buffer solution)	kg	0.004
Water (buffer solution)	kg	0.956
Enzyme (Cellic® CTec3 Novozymes)	kg	0.001
Energy	KWh	284.585
Outputs		
Lignocellulosic hydrolysate	kg	1.00
Effluent (chemical waste)	kg	0.049

Data obtained by the authors, 2026.

Table S2 List of impact categories included, recommended characterization model and indicator.

Impacts	LC-IMPACT Methods
Acidification - terrestrial	The characterization factor for terrestrial acidification is Acidification Potential (AP) derived using the emission-weighted world average fate factor of SO_2. The unit is yr/kg SO_2 equivalents.
Climate Change	The characterization factor of climate change is the global warming potential, based on the IPCC 2013 report. For the Individualist perspective, a 20-year time horizon was used, for Hierarchist 100 years, and for Egalitarian 1000 years. The unit is yr/kg CO_2 equivalents.
Ecotoxicity - freshwater	The characterization factor of freshwater eutrophication accounts for the environmental persistence (fate) of the emission of N-containing nutrients. The unit is yr/kg N to freshwater equivalents.
Ecotoxicity - terrestrial	The characterization factor of ecotoxicity accounts for the environmental persistence (fate) and toxicity (effect) of a chemical. The unit is yr/kg 1,4-dichlorobenzene (1,4-DCB) emitted.
Eutrophication - freshwater	The characterization factor of freshwater eutrophication accounts for the environmental persistence (fate) of the emission of P-containing nutrients. The unit is yr/kg P to freshwater equivalents.
Human Toxicity	The characterization factor of human toxicity accounts for the accumulation in the human food chain (exposure), and toxicity (effect) of a chemical. The unit is yr/kg 1,4-dichlorobenzene (1,4-DCB) emitted.
Ionizing Radiation	The characterization factor of ionizing radiation accounts for the level of exposure for the global population. The unit is yr/kBq Cobalt-60 equivalent to air.
Natural Land Transformation	The amount of land transformed or occupied for a certain time. The unit is m^2*yr.
Fossil Depletion	The characterization factor of fossil resource scarcity is the fossil fuel potential, based on the higher heating value. The unit is kg oil equivalents.
Water Depletion	The factor for water use is the amount of freshwater consumption. The unit is m^3 water consumed. Current implementation includes regionalized characterization factors in the endpoint version of the method.

ReCiPe 2016 is an updated and extended version of ReCiPe 2008 (Simapro Database, 2023).

Table S3 ReCiPe midpoint impact indicators (FU: 1 kg product of lignocellulosic hydrolysate).

Impacts	**Total value**		**Normalization Factors**	**Normalized Value**
	Unit		person equivalents (yr^{-1})	person equivalents (yr^{-1})
Acidification - terrestrial	kg SO_2 eq.	0.188	1.08E+04	1.75E-05
Climate Change	kg CO_2 eq.	0.188	1.08E+04	1.75E-05
Ecotoxicity - freshwater	kg 1,4-DB eq.	1.80E-07	1.26E+01	1.43E-08
Ecotoxicity - terrestrial	kg 1,4-DB eq.	3.19E-06	6.73E+03	4.74E-10
Eutrophication - freshwater	kg P eq.	1.06E-06	6.50E-01	1.63E-06
Human Toxicity	kg 1,4-DCB eq.	2.11E-09	1.60E+01	1.32E-10
Ionising Radiation	kBq Co-60 eq.	2.31E-04	4.70E+02	4.92E-07
Natural Land Transformation	m^2	8.27E-07	6.17E+03	1.34E-10
Fossil Depletion	kg oil eq.	0.0311	5.70E+02	5.46E-05
Water Depletion	m^3	3.17E-06	2.67E+02	1.19E-08

Data obtained by the authors, 2026.