Table 1. Chemical composition of liquid fraction (rich on hemicellulosic oligosaccharides mixtures) obtained by autrohydrolysis treatment (common to all valorising schemes).

Component	**Composition**
Monosaccharides	g/L
Glucose	0.32
Xylose	0.28
Arabinose	0.37
Galactose	0.26
Mannose	0.11
Galacturonic acid	0.72
Hemicellulosic oligosaccharides	
GlcOS	8.64
XylOS	12.22
AraOS	0.74
GalOS	1.25
ManOS	1.22
AcOS	3.30
OGalA	1.05
Degradation compounds	
Acetic acid	1.99
Hydroxymethylfurfural	0.08
Furfural	0.27
Antioxidants composition	
Total phenolic content	2.05
Total flavonoid content	1.05

GlcOS = glucooligosaccharides; XylOS= xylooligosaccharides; AraOS = arabinooligosaccharides; GalOS = galactooligosaccharides; ManOS= mannooligosaccharides; AcOS = acetyl substituents in oligomers; OGalA = galacturonyl groups linked to oligosaccharides oligogalacturonides

Table 2. Summary of main relevant foreground inventory data (per functional unit) from vine shoots valorisation into high added value products for the different scenarios under assessment.

Inputs	Scenario I	Scenario II	Scenario III	Scenario IV	Scenario V
Autohydrolysis (SS1)					
Vine shoots	100 kg d.m.				
Tap water	795 kg				
Electricity - Reactor	1763 MJ				
Centrifugation (SS2)					
Electricity - centrifuge	2.43 MJ				
Oligosaccharides extraction (SS3)					
Ethyl acetate[1]	1964 kg	--	1964 kg		
Electricity	20.4 MJ		20.4 MJ		
Ethyl acetate recovery (SS4)					
Electricity	943 MJ	--	943 MJ		
Concentration & Freeze drying (SS5)					
Electricity - Nanofiltration	408.9 MJ				
Electricity – Freeze dryer	4523 MJ				
Wastewater treatment plant (SS6)					
Wastewater	21927 kg				22107 kg
Delignification (SS7)					
Electricity - Autoclave	8505 MJ				--
Electricity - Organosolv	--				1146.6 MJ
Tap water - Delignification	429.4 kg				12.32 kg
NaOH	7.51 kg				
H_2SO_4	94.0 kg				48.0 kg
Tap water - Filtration	32.0 kg				4.00 kg
Ethanol	--				294.4 kg
Electricity - Filtration	5.72 MJ				
Tap water - Washing	20644 kg				
Enzymatic hydrolysis (SS8)					
Electricity - agitation			5056 MJ		--
Tap water			758.2 kg		--
β-glucosidase		--	6.18 kg		--
Celluclast			11.20 kg		--
Citrate buffer			46.68 kg		--
Centrifugation (SS9)					
Electricity - centrifuge		--	2.61 MJ		--
Inoculum preparation (SS10)					
Electricity - Fermenter		--		334.5 MJ	--
Tap water		--		93.0 kg	--
Nutrients		--		2.00 kg	--
Fermentation (SS11)					
Electricity - Fermenter		--		5856 MJ	--
Nutrients		--		28.0 kg	--
Centrifugation (SS12)					
Electricity - Centrifuge		--		167.9 MJ	--
Distillation (SS13)					
Electricity - Distiller		--		6364 MJ	--
Energy production (SS14)					
Solid waste fraction (from SS9)		--	8.40 kg d.m.		--

[1] 3v/v: ethyl acetate:hydrolysate. It is expressed in the table in terms of kg of acetate consumed. All ethyl acetate is recovered in a further step

Table 2 (cont.). Summary of main relevant inventory data (primary data) from vine shoots valorisation into high added value products for the different scenaria under assessment.

Outputs	Scenario I	Scenario II	Scenario III	Scenario IV	Scenario V
Antioxidant extract (from SS4)	2.8 kg	---	2.8 kg		
Ethyl acetate (from SS4)[1]	1964 kg	---	1964 kg		
Waste steam into air (from SS5)	113.1 kg	---	113.1 kg		
Purified Hemicellulosic Oligosaccharides (from SS5)	17.9 kg				
Treated water (from SS6)	21927 kg				22107 kg
Cellulose (from SS7)	17.0 kg d.m.		--	--	16.6 kg d.m.
Lignin (from SS7)	16.0 kg d.m.			--	2.0 kg d.m.
Glucose liquors (from SS9)[2]	--		933.3 kg	--	
Ethanol (from SS13)	--			10.7 kg	
Energy (from SS14) Electricity Heat	--		13.1 kWh 25.2 kWh		--

[1] kg of acetate; [2] 22.39 kg glucose; d.m. dry matter

Table 3. Description of the main ecoinvent database ® processes and literature sources considered in this study for the background processes

Input	Process
Electricity (CHP unit)	Electricity, high voltage {ES}| heat and power co-generation, wood chips, 6667 kW, state-of-the-art 2014 | Alloc Rec, U
Electricity (avoided)	Electricity, medium voltage {ES}| market for | Alloc Rec, U
Heat (avoided)	Heat, central or small-scale, natural gas {RER}| market group for | Alloc Rec, U
Tap water	Tap water {Europe without Switzerland}| market for | Alloc Rec, U
Inorganic chemical	Chemical, inorganic {GLO}| market for chemicals, inorganic | Alloc Rec, U
Wastewater treatment	Wastewater, average {CH}| treatment of, capacity 1E9l/year | Alloc Rec, U
Ethanol (avoided)	Ethanol, without water, in 99.7% solution state, from fermentation {GLO}| market for | Alloc Rec, U
Ethyl acetate	Ethyl acetate {GLO}| market for | Alloc Rec, U
Sodium hydroxide	Sodium hydroxide, without water, in 50% solution state {GLO}| market for | Alloc Rec, U
Sulfuric acid	Sulfuric acid {GLO}| market for | Alloc Rec, U
Buffer	Chemical, inorganic {GLO}| market for chemicals, inorganic | Alloc Rec, U
Enzymes (β-glucosidase and Celluclast)	Nielsen et al. (2007); Feijoo et al. (2017)

Table 4. Market prices and potential economic value of the products expected for each valorizing scenario per batch.

Co-products	Market price	Scenario I	Scenario IV	Scenario V
Antioxidant extract	167.3 €·g^{-1}[(a)]	2.8 kg		
Purified Hemicellulosic Oligosaccharides	36.3 €·g^{-1}[(b)]	19.7 kg		
Cellulose	686 €·t^{-1}[(c)]	17.0 kg	--	16.6 kg
Lignin	302 €·t^{-1}[(c)]	16.0 kg	--	2.0 kg
Ethanol	0.64 €·kg^{-1}[(d)]	--	10.7 kg	--
Electricity	0.140 €·kWh^{-1}[(e)]	--	13.1 kWh	--
Heat	0.016 €·kWh^{-1}[(e)]	--	25.2 kWh	--
	Economic value	**1,118,226 €**	**1,118,219 €**	**1,118,222 €**

(a) González-García et al. (2016); (b) Megazyme, 2015; (c) Mercopress, 2006; (d) Joelsson et al., 2016;
(e) http://www.gealianova.com/secciones/geotermia/documentos/comparativa.pdf; "--" no production