



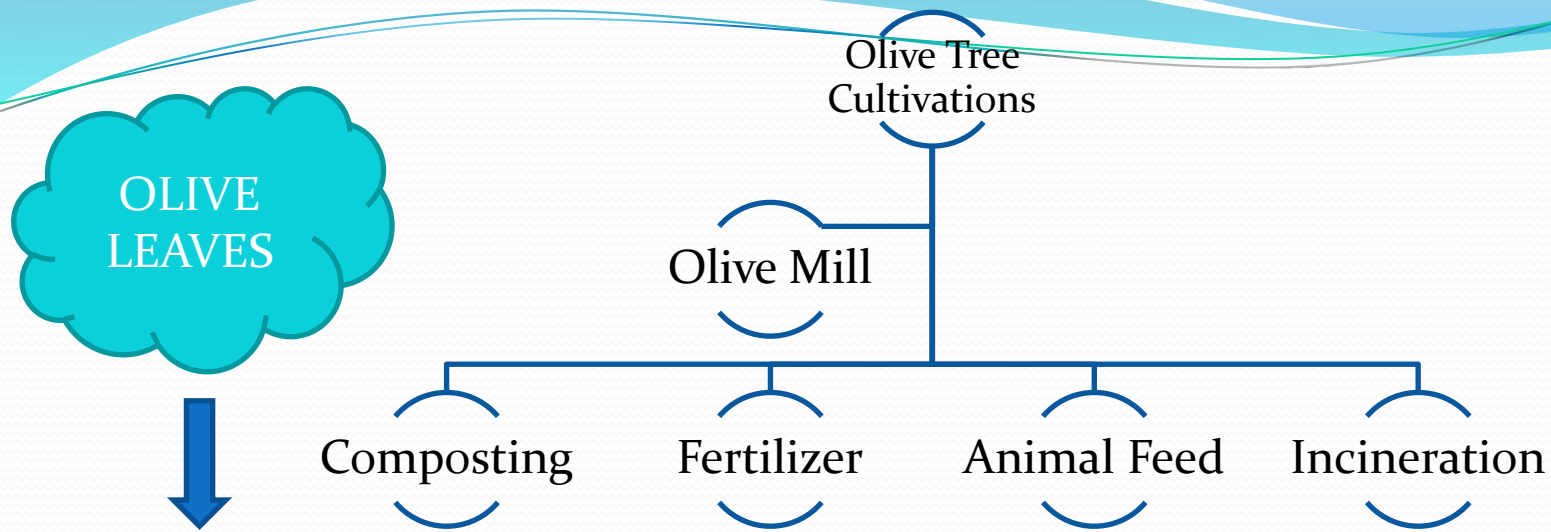
National Technical University of Athens

School of Chemical Engineering

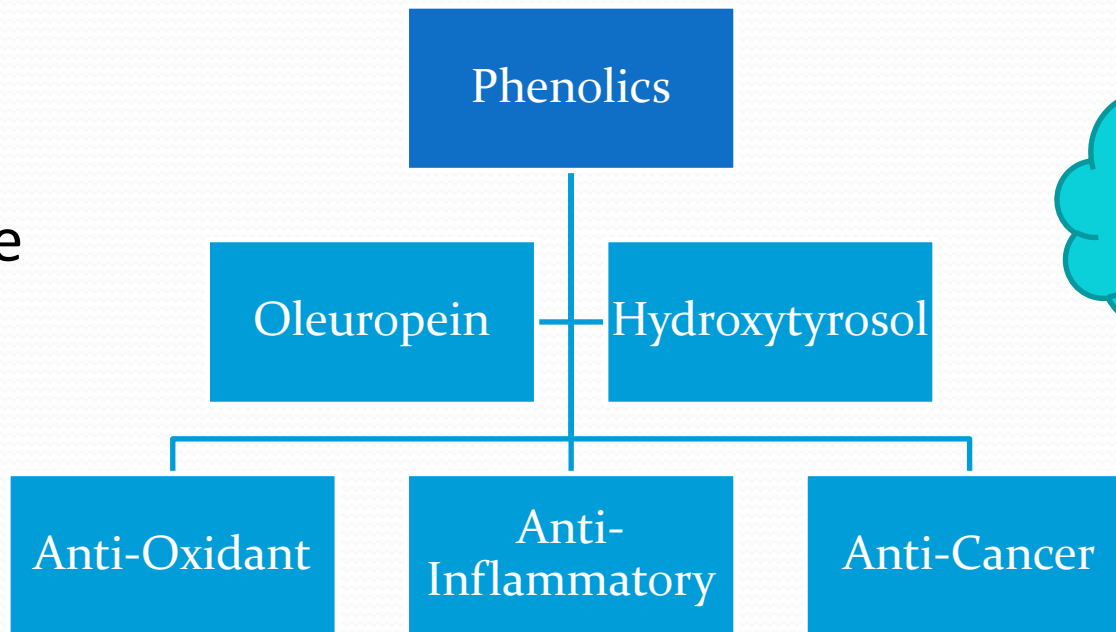
DEPARTMENT OF PROCESS ANALYSIS & PLANT DESIGN

Environmental footprint analysis of
valuable compounds recovery and
formulation from olive mills' waste

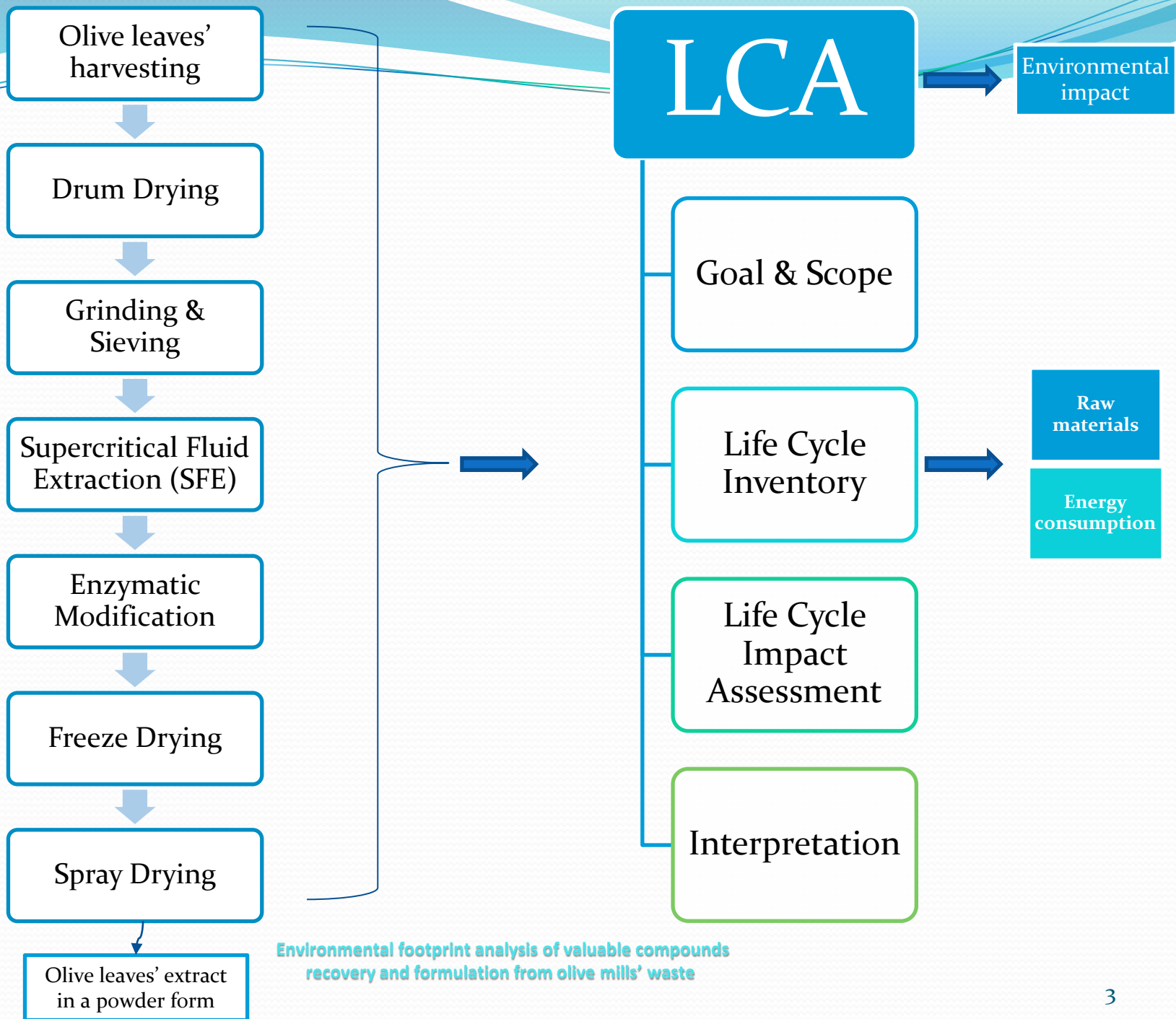
Presenter : K. Kritsotakis



- Functional foods
- ↑ shelf life
- Cosmetics



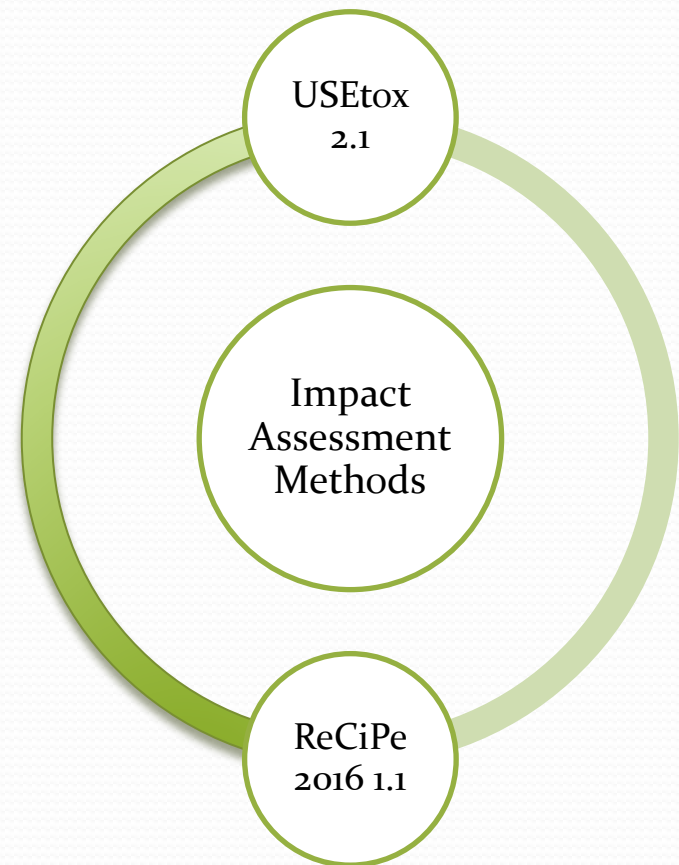
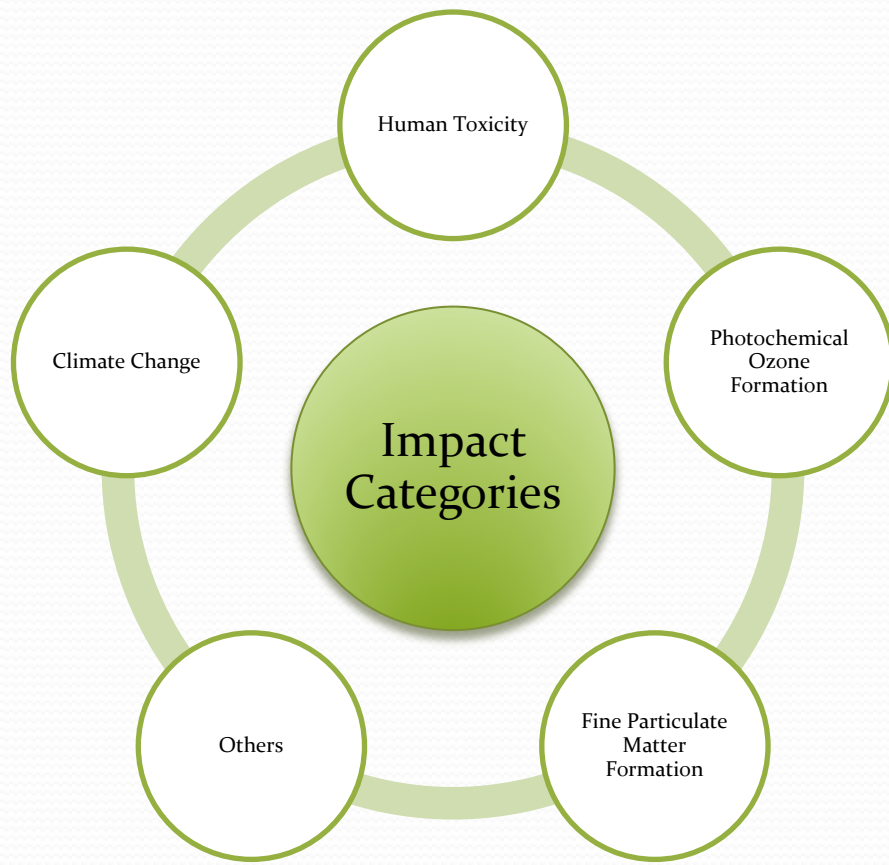
Environmental footprint analysis of valuable compounds recovery and formulation from olive mills' waste



Environmental footprint analysis of valuable compounds recovery and formulation from olive mills' waste

Encapsulated Bioactive Compounds in a Powder Form

- Reference Unit: 1 tablet – 1 cosmetic cream
- System's Boundaries: Cradle to Gate



Transportation

- Input of raw olive leaves
- Mean route distance
- Defoliation machine

Drum Drying

- 87 % energy efficiency
- High drying rate
- 47 % moisture removal

Mill & Sieve

- 0.19 kWh/ kg raw olive leaves

SFE

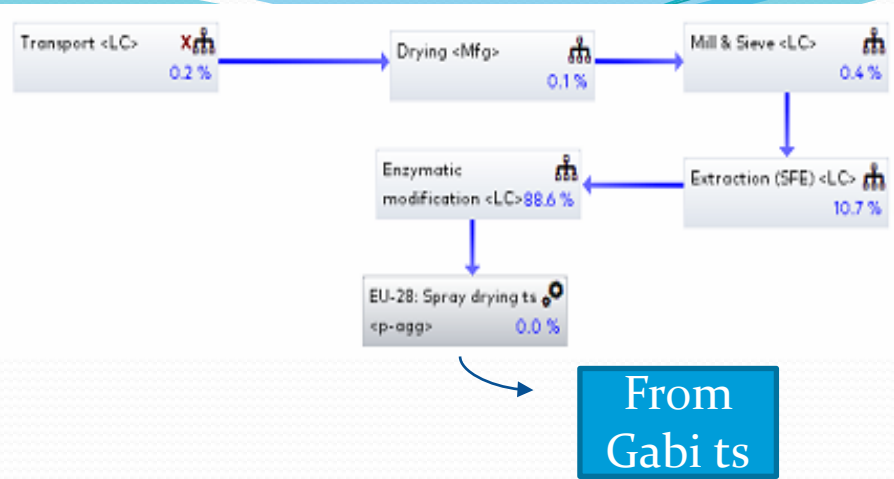
- CO₂ Compression, Refrigeration, Heating
- 12 % extraction yield
- Size of transformation technology

Enzymatic Modification

- Nanobiocatalyst's production
- Modified extract's production (CST bioreactor)
- Freeze Drying > extract's preservation

Spray Drying

- Drying medium: Hot air
- Fast drying (up to 30 seconds)
- 55.6 % encapsulation performance



THE PROCESSES

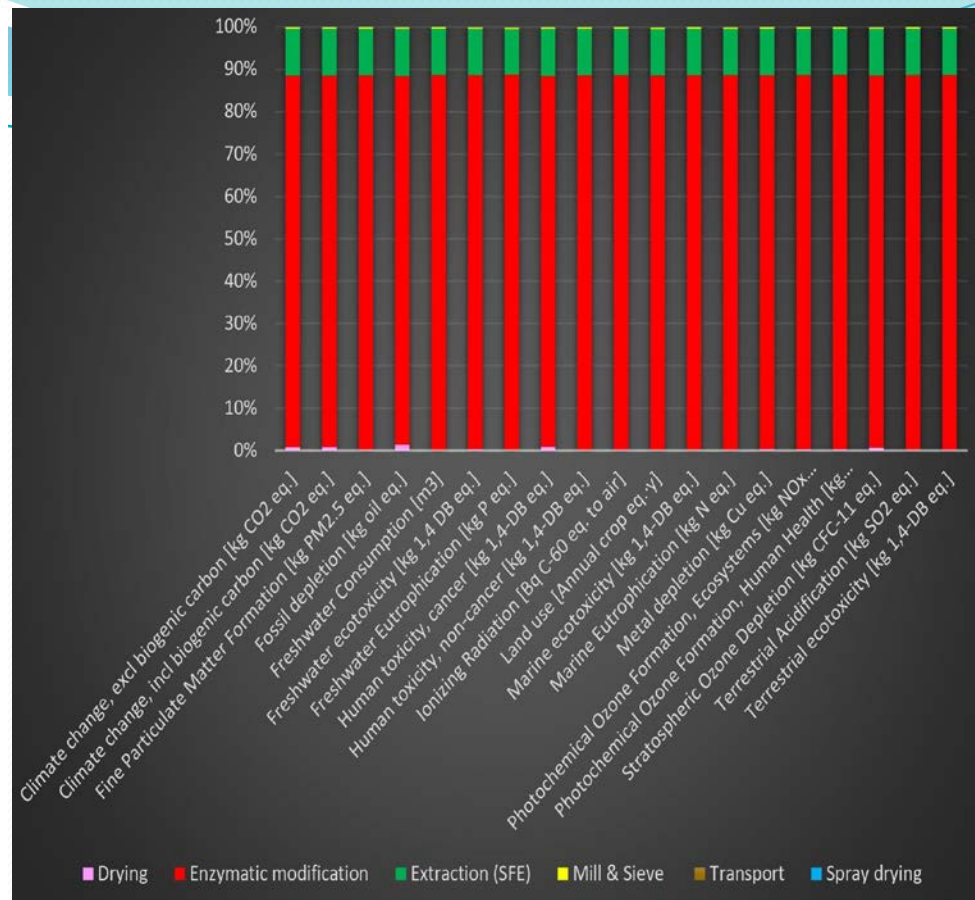
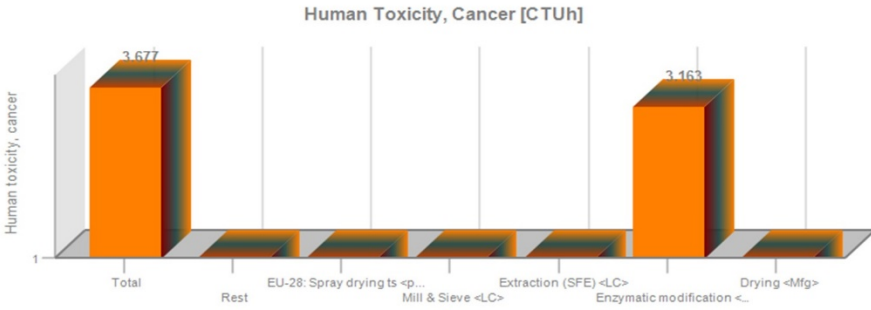
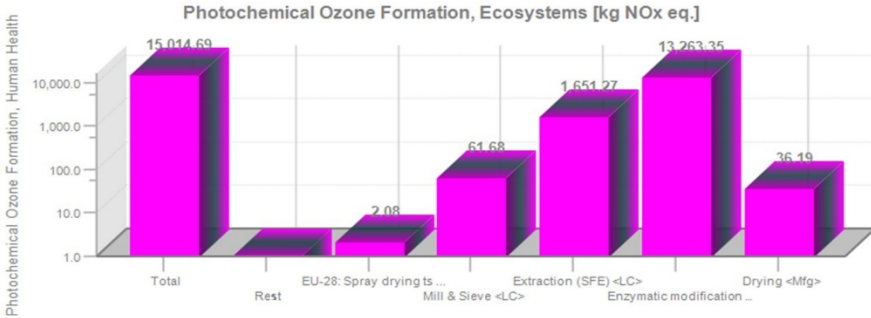
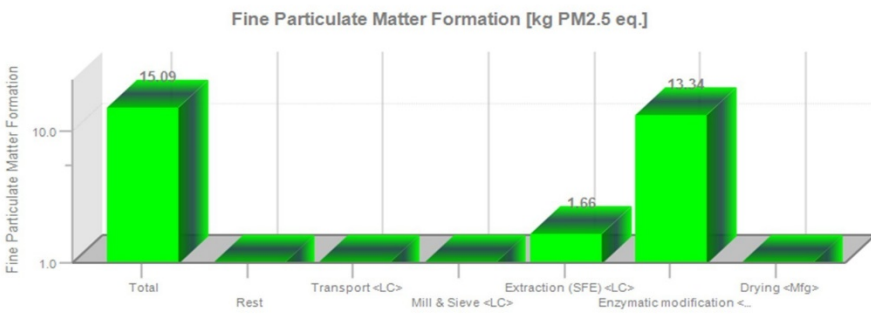
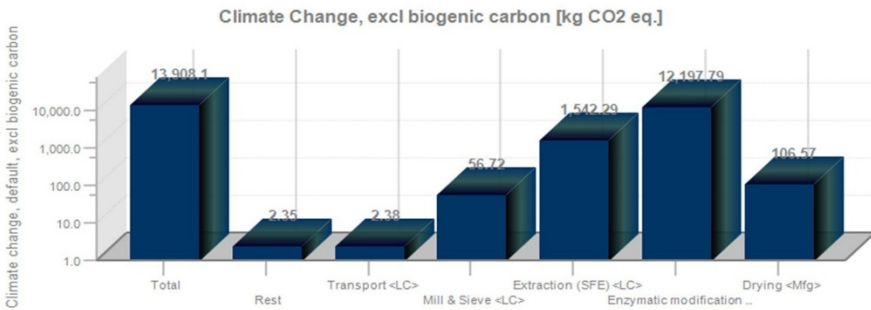
Process	Flow	Quantity	Amount	Unit	Source
Transport	Route Distance	Length	100	km	Calculated
	Raw Olive Leaves (Input)	Mass	300	kg	Questionnaire
Drying	Steam (Ip)	Mass	507.7	kg	Gabi's Database
	Dried Olive Leaves (Output)	Mass	158	kg	Gabi's Database
Mill & Sieve	Electricity	Energy (Net Calorific Value)	56.8	kWh	[14]
	Milled&Sieved Olive Leaves (Output or Input for SFE)	Mass	158	kg	Gabi's Database
Extraction	Thermal Energy	Energy (Net Calorific Value)	438.4	MJ	Calculated
	SFE's Extract (Output)	Mass	18.9	kg	Measured
Enzymatic Modification	Electricity (Lyophilizer)	Energy (Net Calorific Value)	11610	kWh	Calculated
	Modified Extract (Output or Input for Spray Drying)	Mass	18.9	kg	Gabi's Database
Spray Drying	Spray Dried Product (Output)	Mass	10.5	kg	Gabi's Database

LCI data



Main dataset

Environmental footprint analysis of valuable compounds recovery and formulation from olive mills' waste



Environmental footprint analysis of valuable compounds recovery and formulation from olive mills' waste

Interpretation

If Drum Drying



Climate Change
decrease by 87.6 %

Largest Footprint
for Enzymatic
Modification

Freeze drying is
an energy
intensive process

Sensitivity
analysis

Solid residue to
composting or
incinerator

Conclusions

- Freeze drying



Need
for optimization



↓ Plan's environmental
footprint

- SFE second most energy
intensive process



ΕΡΑΝΕΚ 2014-2020
OPERATIONAL PROGRAMME
COMPETITIVENESS
ENTREPRENEURSHIP
INNOVATION



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Thank
you



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