Environmental Assessment of Olive Stone Valorisation: From Cultivation to Biorefinery

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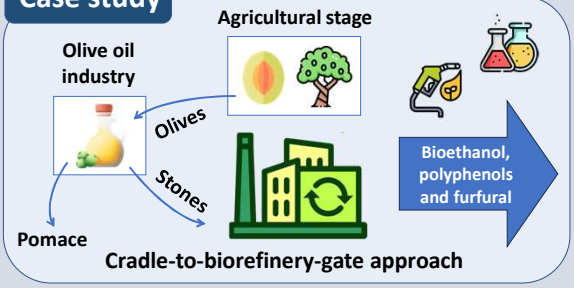
Introduction

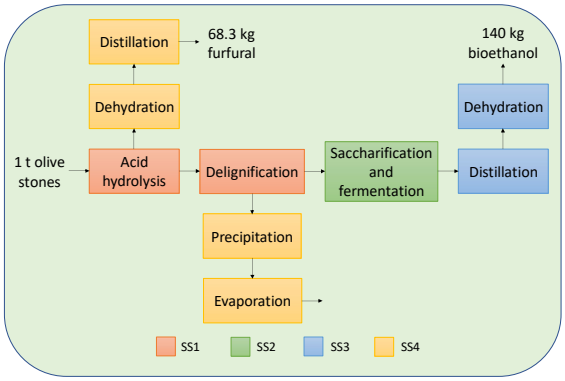
Olive oil production is a **major industry** in **Mediterranean countries**, with Spain being the leading producer within the European Union. The growing demand for economically viable, socially equitable, and environmentally sustainable food systems has positioned this industry as a **key player** in the efficient management of food waste. Among the main by-products generated by the olive oil sector are olive stones. In this context, this study aims to design and assess the environmental impacts of an **innovative biorefinery** that converts **olive stones** into **bioethanol, polyphenols** and **furfural**.

Case study



Methodology

Biorefinery design



Methodology

Economic allocation between olive pomace and stones

Functional unit: 1 t of treated olive stones (OS)

ReCiPe

SimaPro

Impact categories

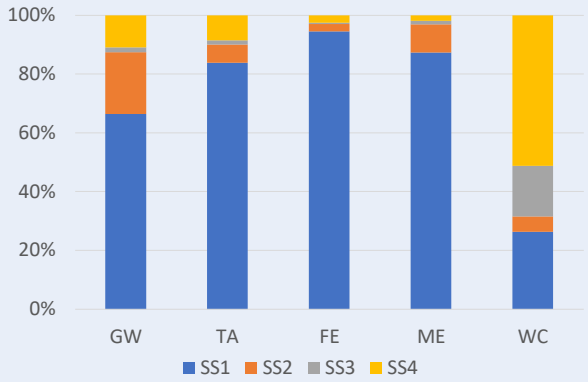
Global Warming (GW)

Terrestrial Acidification (TA)

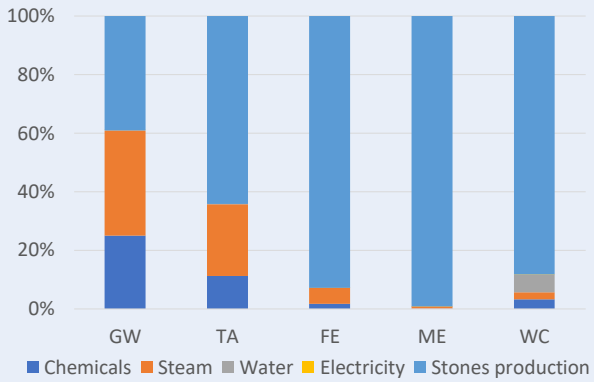
Freshwater (FE) & Marine Eutrophication (ME)

Water Consumption (WC)

Results



Main contributor: SS1



Impact category	Value	Unit
GW	603.9	kg CO_2 eq
TA	9.61	kg SO_2 eq
FE	2.24	kg P eq
ME	1.14	kg N eq
WC	303.5	m^3

Main hotspots

Olive cultivation in stones production	Due to the decomposition of fertilisers into N_2O, NO_3^-…
Steam production	Based on the average Spanish energy mix

Conclusions

- Pretreatment is the main contributing stage, particularly due to the impacts associated with the agricultural phase of olive production.
- The biorefinery exhibits relatively low impacts compared to other biorefineries, considering the amount of feedstock processed.
- Excluding the raw material acquisition, the impacts are reduced by 26%, 54%, 88%, 87% and 23% in GW, TA, FE, ME and WC, respectively.

References

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