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BIOREFINERY APPROACH FOR THE VALORIZATION OF JUICING WASTE: RECOVERY OF LIPID, EMULSIFIER, AND ANTIOXIDANTS FROM POMEGRANATE POMACE

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SPOKE, WP AND TASK

SPOKE 8: Circular economy in agriculture through waste valorization and recycling

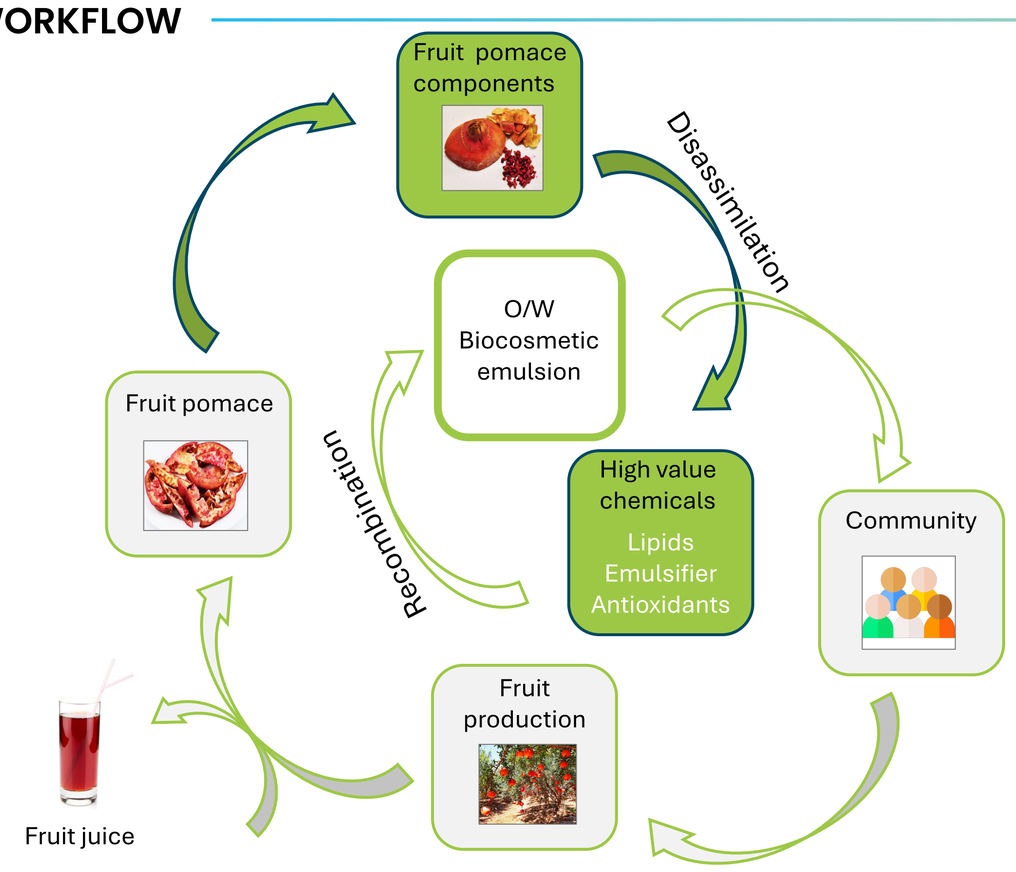
WP 8.1: Producing new products to upgrade waste value

TASK 8.1.1: Valorization of the waste by green chemistry to obtain high value molecules or new products

ABSTRACT

The processing of fruit and vegetables generates globally high amount of organic waste, which is suitable to be valorized because of the chemistry it encloses. Conventional treatment methods for waste biomass generate low value products and cause climate altering emissions. Small biorefineries are valid alternatives for the sustainable waste biomass conversion, but their feasibility is strictly related to the use of low-energy process, and the market positioning of the final product. The present work provides an innovative approach for the green conversion of juicing waste into high value products, with the aim to encourage the deployment of biorefinery at a local scale. It involves the enzymatic disassimilation of plant cell wall to yield chemicals with specific functions from fruit waste components. The proposed biorefinery model have been applied to pomegranate pomace, and lead to the recovery of pectin from pomegranate mesocarp (11%), oil from arils (12%), and antioxidant hydrolysate from pomegranate exocarp (76%), with the final aim to recombine them in form of emulsion, as a product prototype for food and cosmetic sector.

WORKFLOW



METHODS

Disassimilation of pomegranate pomace components via enzymatic assisted reactions

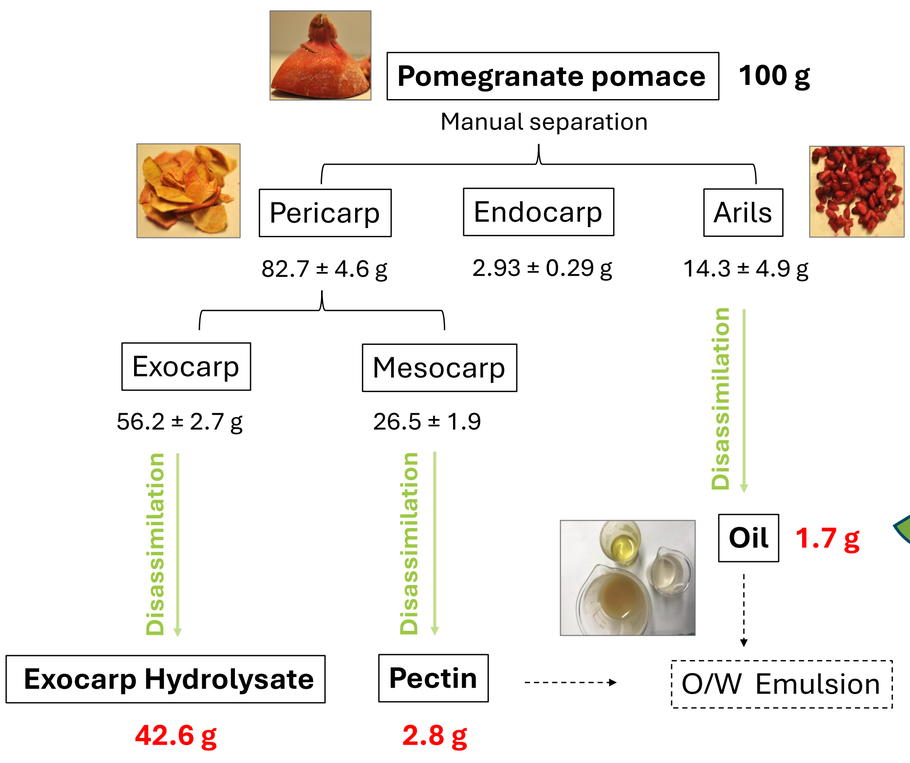
- **Extraction of oi**l from pomegranate arils catalysed by polygalacturonase (3h, 50°C, pH 4) and protease (3h, 50°C, pH 6)
- **Extraction of pectin** from pomegranate mesocarp with thermal treatment (50 min, 90°C, pH 3) followed by reaction with hydrolase exhibiting xylanase and cellulase activities (5 min, 50°C)
- **Hydrolysis of pomegranate pericarp** with sequential employment of polygalacturonase (2h, 50°C, PH 3) and cellulase (1 h, 50°C, pH 5)

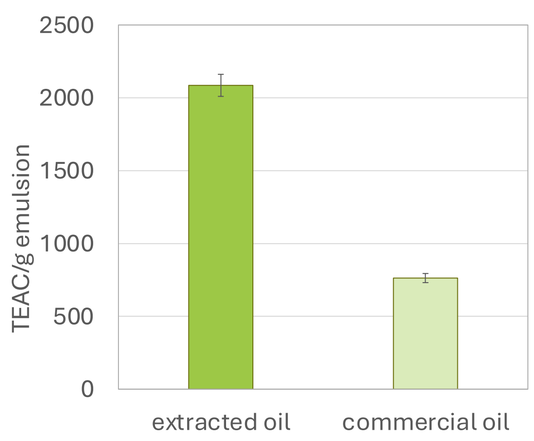
Preliminary tests to aim the recombination of pomegranate pomace components into emulsion with cosmetic functionality

- Realization of emulsion prototype made of pomegranate oil and pectin
- Evaluation of emulsifying capacity and stability of pectin [1]
- Evaluation of antioxidant capacity (DPPH assay [2]) expressed as TEAC – Trolox equivalent antioxidant capacity.

RESULTS

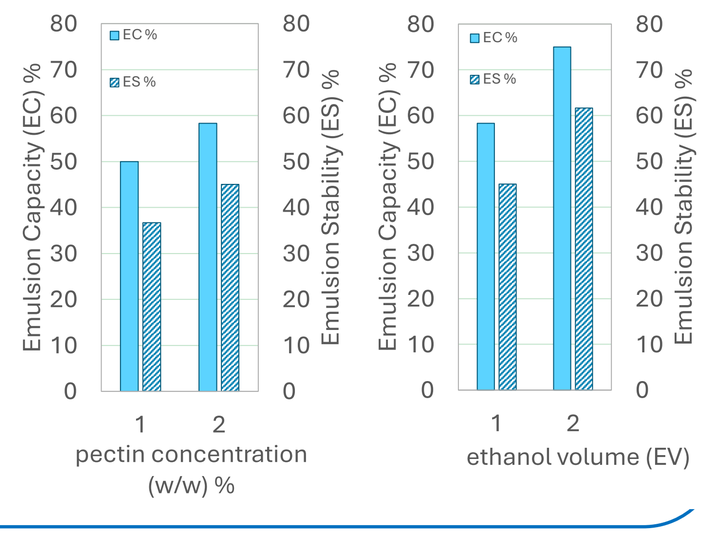
Recovery of high value chemicals (oil, pectin, antioxidants) from pomegranate pomace following a biorefinery approach





High antioxidant power from extracted pomegranate oil

Found out the conditions for extracted pomegranate pectin to act as emulsifier with good stability properties



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[1] Bayar, N., Kriaa, M., Kammoun, R.: Extraction and characterization of three polysaccharides extracted from Opuntia ficus indica cladodes. Int. J. Biol. Macromol. 92, 441-450 (2016).
[2] Brand-Williams, W., Cuvelier, M. E., Berset, C. L. W. T.: Use of a free radical method to evaluate antioxidant activity. LWT. 28(1), 25-30 (1995).

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