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Valorization of agri-food industry residues through photoheterotrophic fermentation by purple phototrophic bacteria

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Oral Presentations #8

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Keywords: *Agri-food residues; Purple phototrophic bacteria; Photoheterotrophic fermentation; Biorefinery; Carotenoids*

The transition towards sustainable biorefineries requires integrated strategies capable of converting residual streams into valuable bioproducts while reducing their environmental impact. In this context, the present work aims to evaluate the potential of purple phototrophic bacteria (PPB) for the valorization of pretreated agri-food liquid streams generated within biorefinery schemes.

PPB represent a versatile microbial platform due to their ability to grow under anaerobic photoheterotrophic conditions, assimilate a wide range of organic carbon sources, and produce compounds of industrial interest. Their capacity to use near-infrared light provides an additional advantage for selective cultivation in complex residual matrices, enabling the coupling of wastewater treatment with the production of microbial biomass and added-value intracellular metabolites.

The experimental approach will focus on different liquid streams obtained after upstream pretreatment or fermentation processes, including mixed carboxylic acid streams, exhausted fermentation effluents, and washing fractions. Key operational and biological parameters will be evaluated, including irradiance, initial chemical oxygen demand (COD), and culture configuration using axenic cultures and mixed cultures enriched in PPB. Process performance will be assessed in terms of microbial growth, COD removal, substrate conversion, single-cell protein production, and carotenoid accumulation.

Once the most suitable operating conditions are identified, the process will be applied to selected residual streams to assess the feasibility of a cascade valorization strategy. This approach is expected to contribute to the development of integrated biorefinery schemes in which pretreated agri-food residues are sequentially transformed into added-value products. Overall, the proposed strategy combines residual stream treatment with the production of microbial biomass and carotenoids, supporting circular and sustainable alternatives for agri-food and biobased industries.

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