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Green Extraction and Integrated Valorisation Strategies for Wine Industry By-Products



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Wine production is one of the most relevant agricultural activities in Mediterranean countries, including Portugal, and is associated with the generation of large amounts of by-products, such as grape pomace, grape stems and grapevine pruning residues. When inadequately managed, these residues may represent environmental burdens; however, within a circular economy framework, they can be regarded as valuable renewable resources. In particular, wine industry by-products are rich in natural polyphenols and other bioactive compounds, making them attractive targets for sustainable valorisation strategies.

In this work, we explored several pathways for the re-use of winery by-products in different application fields. Natural bioactive extracts were obtained using three eco-friendly extraction techniques, ultrasound-assisted extraction, microwave-assisted extraction and subcritical water extraction, and compared with a conventional extraction method. The resulting extracts were characterised in terms of phenolic composition and antioxidant activity using chromatographic and spectrophotometric assays. Based on their bioactive potential, the most promising extracts were further applied in different sectors, namely in cosmetic formulations and in biodiesel stabilisation. In parallel, grapevine pruning residues were also valorised through their conversion into biochars, which were evaluated for contaminant adsorption in wastewater treatment and as a sustainable remediation strategy for fire-affected soils.

Overall, this research highlights the potential of wine industry by-products as sustainable sources of

natural antioxidants and functional materials. The adoption of green extraction and conversion technologies supports circular economy principles, enabling the transformation of winemaking residues into high value-added products for other industrial sectors.

Short Bio

Manuela M. Moreira is an Auxiliary Researcher at the *Grupo de Reação e Análises Químicas* (GRAQ; www.graq.isep.ipp.pt), a research group of the Associated Laboratory for Green Chemistry (LAQV) of REQUIMTE, based at ISEP. Since 2007, her research has focused on the sustainable valorisation of agro-food wastes, including green extraction of bioactive compounds and the development of value-added products for food, cosmetic and pharmaceutical applications. Her recent work includes the production of biochars from agroforestry wastes for wastewater treatment and soil remediation.

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Webinar Host

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