REUSE

Recovery of added value compounds from coffee and olive oil wastewaters

Water4All
Water security for the planet

Abstract

The REUSE project focuses on the circular economy approach addressing the recovery of valuable polyphenolic compounds from wastewaters taken as case studies from the processing of coffee and olive oil. Olive oil and coffee production generate large amounts of wastewater with high Biochemical Oxygen Demand (BOD5) and Chemical Oxygen Demand (COD), causing toxicity to plants and microorganisms, soil acidification, and pollution in rivers if untreated.
Traditional wastewater treatments, such as aerobic/anaerobic digestion and activated carbon filtration, are often costly, time-intensive, and lack the specificity needed to selectively recover valuable organic compounds, such as polyphenols. Polyphenols have strong antioxidant properties and, once recovered, could be used in industries like pharmaceuticals, food, and cosmetics, giving agricultural waste new commercial value. Furthermore, filtered water could potentially be recycled for agricultural use, reducing both waste and the environmental impact of water release. To tackle these issues, REUSE aims to develop advanced filtering systems that can selectively recover valuable polyphenolic compounds, and at the same time reducing the environmental impact. This project involves collaboration among three partner institutions with expertise in porphyrins, Metal-Organic Frameworks (MOFs), and selective filtration materials: the Institut de Chimie Moléculaire de l'Université Bourgogne Europe (France), Embrapa Instrumentação (Brazil), and the University of Rome Tor Vergata (Italy). Together, these teams will leverage their combined knowledge in chemistry, materials science, and engineering to create innovative filtration systems and sensors.
One key approach in REUSE's methodology is the development of advanced filtration materials, such as zeolite with porphyrin-based coatings, and MOFs. Zeolites, low-cost and widely available porous materials with high adsorption capabilities, will be functionalized with ad hoc porphyrins to selectively capture polyphenols from wastewater. Similarly, porphyrin-based MOFs will be tested as potential novel adsorbents. The presence of porphyrins as binding units also exploits their dual use as sensing elements, foreseeing the possibility of incorporating real-time monitoring technology using colorimetric, fluorometric, or electrochemical sensors that allow continuous assessment of filtration effectiveness and detect when filters need replacement.

The project aligns with the Water4all call's objectives of resource recovery and pollution reduction, specifically targeting sustainable solutions in wastewater treatment. REUSE's focus on polyphenol recovery meets the call's theme of resource valorization while promising significant environmental and economic benefits. Expected project outcomes include high-impact research publications, the development of efficient filtration technologies for industry use, and a sustainable approach to managing agricultural wastewater. By establishing a multidisciplinary and transnational team, REUSE leverages each partner's expertise to enhance the scalability and applicability of novel solutions, directly in major coffee- and olive oil-producing countries like Brazil and Italy.

Project coordinator

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Project partners

- UNIVERSITY TOR VERGATA - ITALY
- BRAZILIAN AGRICULTURAL RESEARCH CORPORATION, EMBRAPA INSTRUMENTATION - BRAZIL

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