GreenChem-26

ABSTRACTS E-BOOK

7th International Conference on Green Chemistry and Sustainable Engineering



Gran Canaria,
Canary Islands, Spain

22–24 July 2026

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ATR-FTIR spectroscopy as a green screening tool for sustainable wine less valorization

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1. Introduction – Wine lees are a heterogeneous by-product generated during wine production and represent a significant fraction of winery waste. Their composition includes proteins, polysaccharides, phenolic compounds, organic acids, minerals, and yeast-derived materials, making them a promising source of value-added compounds for sustainable valorisation strategies [1]. However, conventional characterisation of wine lees often requires multiple analytical techniques, extensive sample preparation, and the use of chemical reagents.
Attenuated Total Reflection Fourier Transform Infrared (ATR-FTIR) spectroscopy is a label-free, non-destructive technique that enables rapid analysis of complex biological matrices with minimal sample preparation [2]. As a solvent-free analytical approach, ATR-FTIR is consistent with the principles of green analytical chemistry and offers the potential for rapid screening of winery by-products.
Therefore, the aim of this study was to evaluate the applicability of ATR-FTIR spectroscopy for the rapid characterisation of white and red wine lees obtained from the autochthonous grape varieties Grašac and Probus, respectively, and to assess its potential as a green screening tool for by-product valorisation.
2. Experimental – Wine lees obtained from the autochthonous grape varieties Grašac and Probus were analysed using ATR-FTIR spectroscopy. Spectra were recorded in the mid-infrared region and interpreted in relation to the chemical composition of the samples. The applicability of ATR-FTIR as a rapid and solvent-free screening tool for wine lees characterisation was evaluated.
3. Results and Discussion – ATR-FTIR spectra of white and red wine lees revealed characteristic absorption bands associated with proteins, polysaccharides, organic acids, and phenolic-rich fractions. Differences observed in the intensity and distribution of selected absorption regions reflected the distinct chemical composition of the analysed samples. White wine lees exhibited spectral features associated with protein-rich fractions, whereas red wine lees showed more pronounced signals associated with phenolic-rich fractions, reflecting their distinct compositional profiles.
The absence of residual ethanol signals confirmed the effective removal of alcohol during sample processing, while the previously determined low sulphur dioxide content further supported the suitability of wine lees for subsequent valorisation processes. Overall, ATR-FTIR analysis enabled rapid discrimination between white and red wine lees and provided valuable information regarding their compositional characteristics without the need for extensive sample preparation or solvent consumption, highlighting its potential as a green analytical approach for the preliminary assessment and classification of winery by-products intended for further valorisation.
4. Conclusions – ATR-FTIR spectroscopy proved to be a rapid, non-destructive, and solvent-free technique for the characterisation of wine lees. The method enabled the rapid differentiation of white and red wine lees and provided compositional information relevant to their potential valorisation pathways. Due to its minimal sample preparation requirements and reduced use of chemical reagents, ATR-FTIR represents a promising green screening tool for the sustainable management and valorisation of winery by-products.
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