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BIOACTIVE COMPOUND PROFILE OF WINE LEES: IMPACT OF DEHYDRATION METHODS ON ANTIOXIDANT PROPERTIES

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Abstract: *This study highlights the potential of wine lees, a winemaking by-product, as a valuable source of bioactive compounds, particularly B vitamins and phenolics, supporting their role in the circular economy pronciples. Among the tested dehydration methods, spray drying best preserved these compounds, underscoring its suitability for developing functional ingredients for the food and feed industries.*

• Introduction

The valorization of wine lees, a significant by-product of the wine industry, represents an important opportunity in the context of circular economy principles. This study investigates the bioactive potential of dehydrated wine lees obtained through three distinct methods: lyophilization, conventional drying, and spray drying. The composition of water-soluble B complex vitamins (B1-thiamine, B2-riboflavin, B3-nicotinic acid, B6-pyridoxine, B7-biotin, and B9-folic acid), total phenolic content (TPC), and antioxidant capacity (CUPRAC method) were analyzed along with proximal analysis and rheological measurements.

• Material and method

The experimental material consisted of wine lees obtained from the wine resort "Apoldia Maior" in Sibiu County, Romania. Four different types of wine lees were collected, providing diverse samples for analysis. Prior to dehydration processes, the wine lees biomass underwent sample preparation (thermally treated by autoclave - 121°C for 15 minutes, while another equivalent portion was kept at -20°C as control).

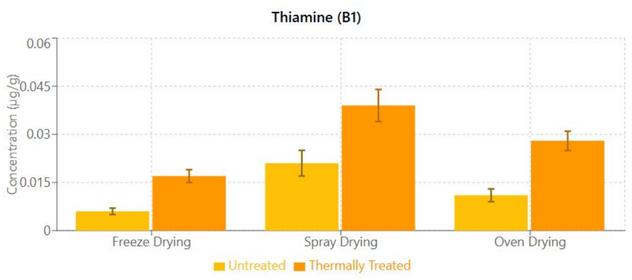
The resulted variants were subjected to three different drying methodologies: f**reeze-drying** (lyophilization) using a Telstar LyoQuest freeze dryer, **oven drying** at 105°C, and **spray drying** with Büchi Mini Spray Dryer B-290.

Total phenolic content was determined using the Folin-Ciocalteu method, with results expressed as gallic acid equivalents (GAE). Antioxidant capacity is assessed using the CUPRAC (cupric reducing antioxidant capacity) assay, which measures the samples' ability to reduce Cu(II) to Cu(I).

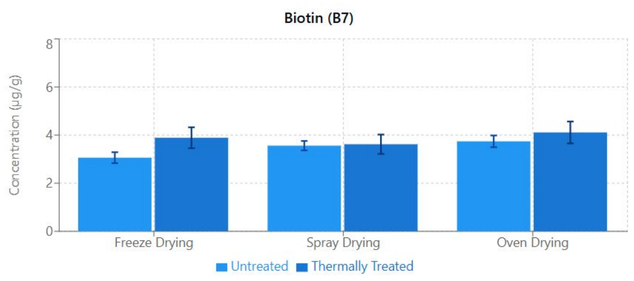
For bioactive compounds identification and quantification, high-performance liquid chromatography (HPLC) analysis is conducted using an Agilent 1200 HPLC-DAD-ESI-MS system or Shimadzu 8040 HPLC-LC-MS Quadrupole.

• Results and discussions

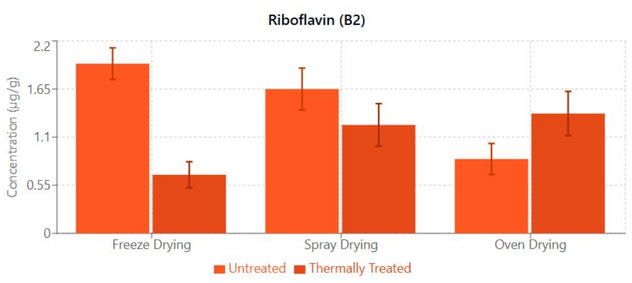
The bar-charts below show the **mean concentration** (µg/g extract) of each vitamin across the replicates that belong to every drying-method for both treated and thermally treated variants.



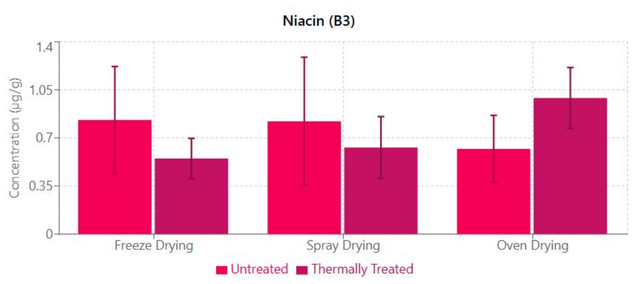
Thermal treatment increased B1 content across all drying methods, with moderate variability.



B7 content increased with thermal treatment across all drying methods, with highest variability in thermally treated samples.



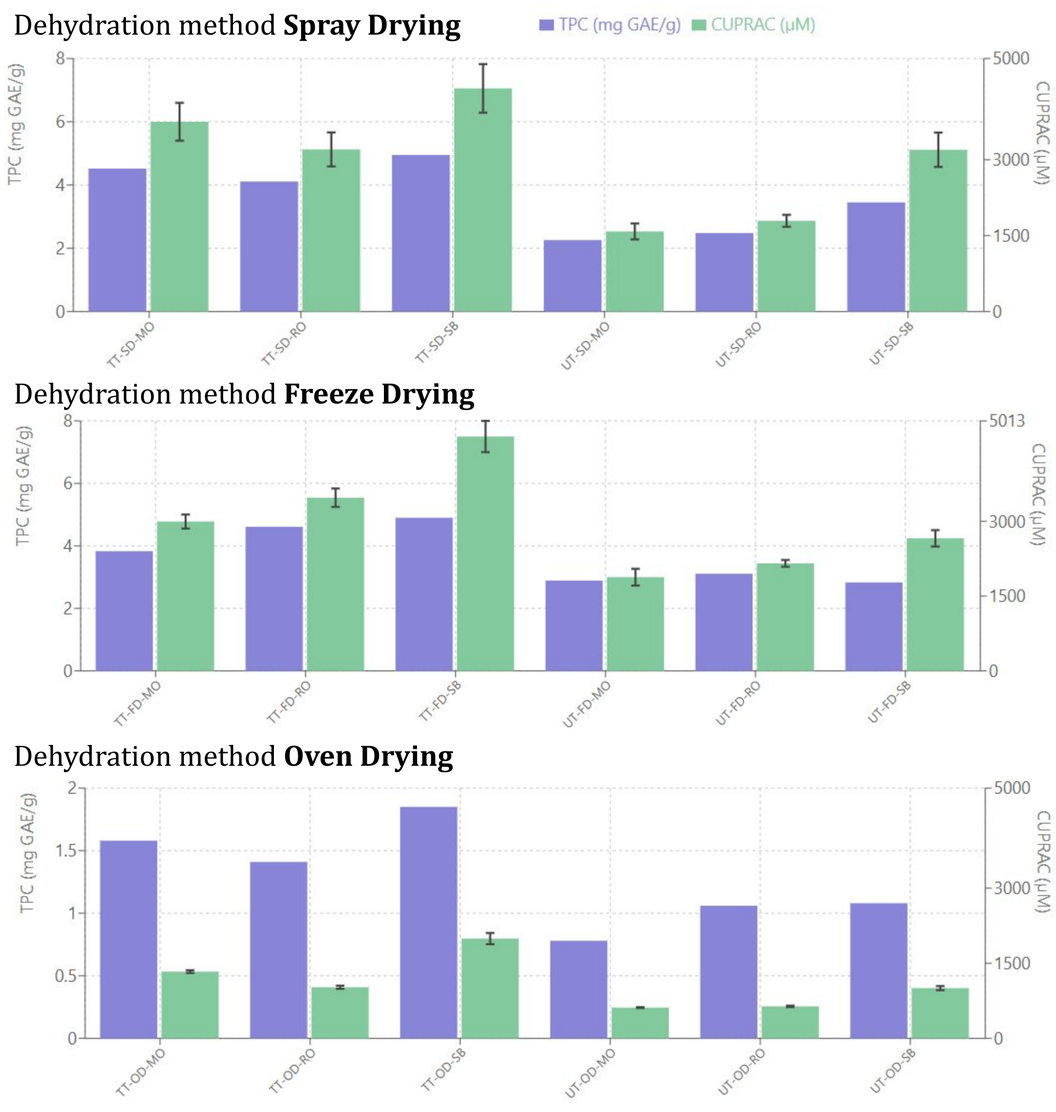
B2 content decreased with thermal treatment for freeze and spray drying but increased for oven drying, with notable variability.



B3 content decreased with thermal treatment for freeze and spray drying but increased for oven drying, with high variability especially in untreated samples.

• Results and discussions (continuation)

Wine Lees Antioxidant Capacity and Total Phenolic Content



• Conclusions

Optimal Processing of Wine Lees for B Vitamin Retention

Thermally treated oven drying is conclusively the superior method for preserving and enhancing B vitamin content in wine lees. This method yields not only the highest total B vitamin concentration but also demonstrates consistent performance with acceptable variation between batches.

Maximizing Bioactive Compound Preservation

Our comprehensive analysis of various processing methods for wine lees demonstrates that both thermal treatment and drying methodology significantly impact the preservation of phenolic compounds and antioxidant capacity. The data conclusively shows that employing thermal treatment followed by spray drying or freeze drying yields optimized preservation of bioactive compounds, with spray drying offering slightly superior performance in thermally treated samples. These findings have immediate implications for both production efficiency and product quality.

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