



Valorization of Wine Industry By-Products in Breadmaking: Functional Properties and Antioxidant Activity

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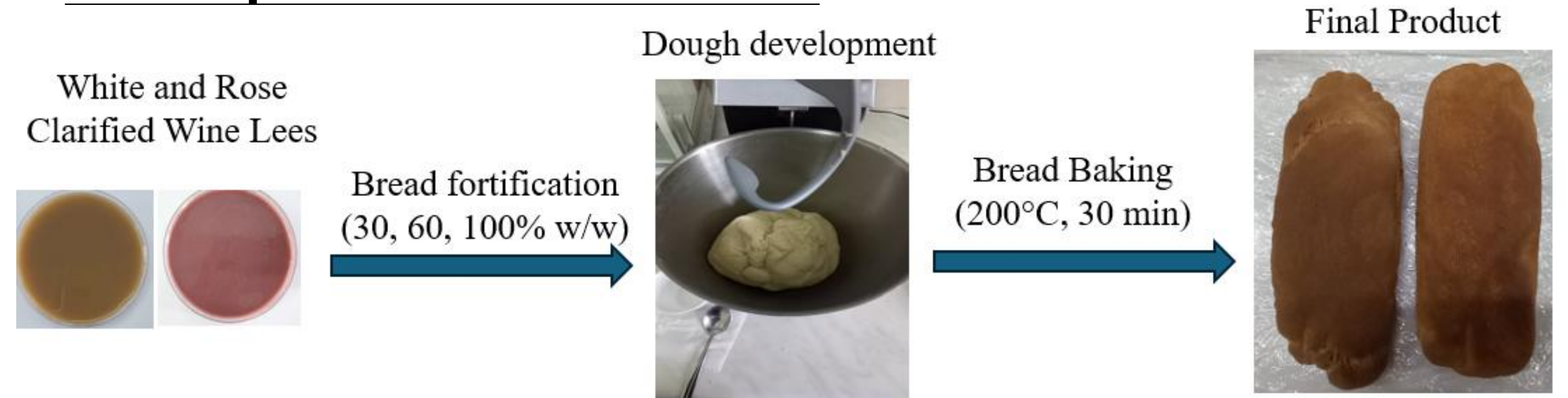
Agri-food Waste Management
for Sustainable bio-economy
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INTRODUCTION

- ✓ Wine lees, a by-product of winemaking, have potential for use in various applications, supporting the circular economy.
- ✓ While often studied for extracting valuable compounds, their direct use in food production remains underexplored.
- ✓ Bread is a staple food globally, with a projected market value of \$49.48 billion by 2029.
- ✓ Thus, this study investigates the use of untreated white and rosé wine lees as a water substitute (30%, 60%, 100% w/w) in breadmaking.

MATERIALS & METHODS

Bread production flowchart



- ✓ Bread samples were prepared using wheat flour, salt, dry yeast, and water (i.e. control) or clarified wine lees from white/rosé vinification process, which replaced water at 30%, 60%, or 100% (w/w).
- ✓ Doughs containing red and white wine lees were coded as RD and WD, respectively, and the corresponding breads as RB and WB.
- ✓ The effects on dough development (proofing, baking loss), bread properties (color, texture, porosity, nutrition), and antioxidant activity were evaluated.
- ✓ Sensory analysis and purchase intention were conducted only for breads with 100% wine lees substitution.

RESULTS & DISCUSSION

- ✓ **Proofing improved with lees addition** (by 58% at 100%WD and 68% at 30%RD) due to fermentable sugars.
- ✓ **Baking losses decreased with wine lees addition**, from 13.2% in the control to 12.06% in 100%WB and 12.07% in 100%RB due to the higher sugar content in wine lees, which improved water retention and reduced evaporation during baking.
- ✓ At 100% substitution, rosé wine lees addition **increased protein by ~28% and doubled fat content**, while white lees had a similar protein level to the control but **nearly doubled fat content**.
- ✓ At 100% substitution, **phenolics increased** by 8.3% in WB and 15.6% in RB, enhancing antioxidant activity by 10.4% and 11.8%, respectively highlighting the functional potential of wine lees addition.
- ✓ Rosé wine lees addition **reduced brightness and yellowness while redness increased**. White wine lees addition showed similar but less intense changes.
- ✓ Regarding the Texture Profile Analysis, a **reduced cohesiveness and elasticity with increasing lees incorporation was found**, while hardness varied.
- ✓ Wine lees **reduced pore number** by 71–80%, and **increased pore size and perimeter** leading to fewer but more irregular pores. These changes modified crumb structure and may further contribute to improved texture.
- ✓ At 100% clarified wine lees substitution, **no sensory differences** were perceived (n=100) compared to control. Informing participants about wine lees **increased their willingness to pay** (by 58% for white wine lees and 27% for red wine lees vs 15% for control sample).

CONCLUSIONS

- ✓ This research highlights wine lees as a **promising functional ingredient in breadmaking**.
- ✓ Clarified wine lees **enhanced bread's nutritional and antioxidant profile**, improved water retention and baking performance, and influenced color, texture, and structure.
- ✓ The increased purchase intention suggests that **consumers are environmentally conscious** and **novel products developed under circular economy principles**.

Disclaimer

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