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Evaluation of the Functional and Rheological Properties of Grape Pomace Flour with Different Particle Sizes

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INTRODUCTION & AIM

Grape pomace, a major by-product of winemaking, is rich in dietary fibre, phenolic compounds, and minerals. Its incorporation into food formulations may enhance nutritional and functional properties, contributing to circular economy and waste valorization.

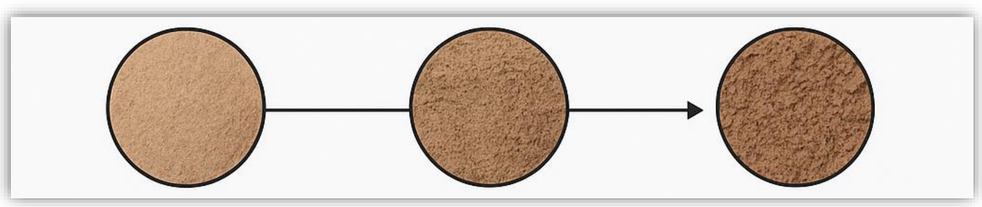
In general, the particle size of fruits pomace flours, plays a crucial role in determining its composition and technological properties. Finer particles usually present higher surface area and exposure of soluble compounds, improving hydration and rheological behaviour, whereas coarser fractions retain more insoluble fibres and structural integrity, affecting texture and solvent absorption.

This study **aimed** to evaluate how different particle sizes of grape pomace flour (GPF) influence its **functional** and **rheological** properties.

MATERIALS & METHODS

Raw Material: Red grape pomace (*Vitis vinife*ra) dried at 50 ºC and milled in sieves (Tamis Restch)

Fractions obtained: < 425 µm, 850-425 µm and 1000-850 µm



Functional tests:

- Water Holding Capacity (WHC)
- Oil Holding Capacity (OHC)
- Milk Holding Capacity (MHC)
- Solubility Index (SI)
- Swelling Capacity (SC)

$$HC = \frac{m_{hydrated} - m_{dry}}{m_{dry}}$$

$$SI = \frac{m_{soluble}}{m_{dry}}$$

$$SC = \frac{m_{final} - m_{initial}}{m_{initial}}$$

Rheological tests:

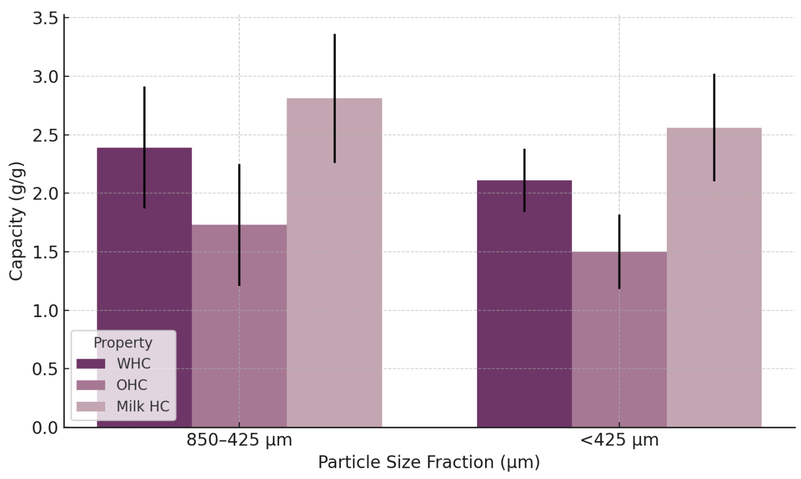
- Small amplitude oscillatory shear (SAOS) measurements was performed (Haake Mars iQ, Thermo Fisher Scientific, Germany) for viscoelastic parameters (G´, G´´) determination.

CONCLUSION

Particle size significantly influenced the functional and rheological behaviour of grape pomace flour (GPF). These differences reflect the distinct distribution of soluble and insoluble components between fractions. Overall, controlling particle size allows tailoring GPF functionality for specific food applications, supporting its use as a sustainable, value-added ingredient in bakery and semi-solid products.

RESULTS & DISCUSSION

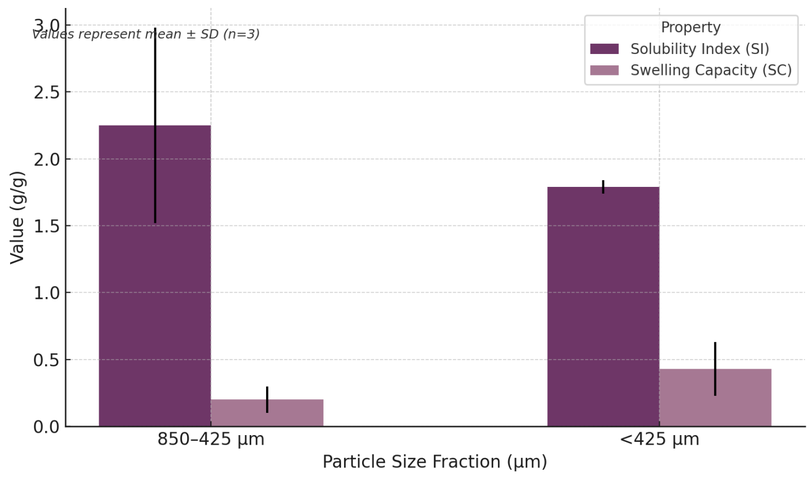
➢ Water, oil and milk holding capacities



Reflect the ability of the flour matrix to retain polar and non-polar solvents.

Figure 1. Hydration and lipid absorption properties of grape pomace flours.

➢ Solubility index and swelling capacity



Interaction of GPF particles with aqueous systems and their structural water retention ability.
Essential to assess the technological functionality of GPF for use as a texturizing and stabilizing ingredient in food formulations.

Figure 2. Solubility and swelling properties of grape pomace flours.

Particle size strongly affected the functional properties of grape pomace flour:

- Coarser fraction (850–425 µm): higher water, oil, and milk holding capacities, linked to its porosity and insoluble fibre content.
- Finer fraction (<425 µm): greater swelling but lower solubility.

These results suggest that coarse flour enhances solvent absorption, while fine flour improves water retention—key for optimizing food texture and stability.

➢ Rheological tests

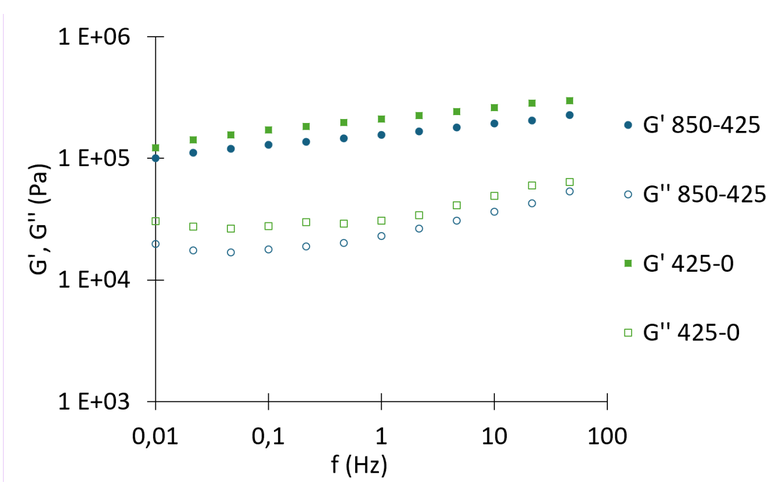


Figure 3. Mechanical spectrum of grape pomace flour (GPF).

Both samples showed elastic, gel-like behaviour (**G′ > G″**). The finer fraction (<425 µm) had higher **G′** and **G″**, indicating greater elasticity and improved internal structure. Smaller particles therefore enhance the viscoelastic strength of grape pomace flour, supporting its use in semi-solid and bakery formulations.