

# Phenolic Compounds from Wine Industry By-Products: Antioxidant and Antimicrobial Potential against Antibiotic-Resistant Bacteria

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## 1 BACKGROUND



Wine production generates large amounts of by-products such as seeds, skins, and stems. Although often treated as waste, these materials are rich in phenolic compounds with antioxidant and antimicrobial properties. Their valorization supports sustainability and high-value applications.

## 2 OBJECTIVE



To recover phenolic compounds from wine industry by-products and evaluate their antioxidant capacity and antimicrobial activity against antibiotic-resistant bacteria.

## 3 MATERIALS AND METHODS



- Grape by-products (seeds, skins, stems)
- Phenolic extraction
- HPLC characterization
- Antioxidant activity assays
- Antimicrobial testing against antibiotic-resistant strains

## 5 CONCLUSION

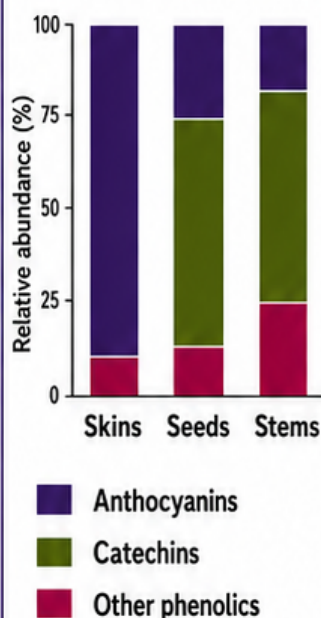


Wine industry by-products are promising sustainable sources of bioactive compounds. Their valorization contributes to waste reduction and resource efficiency while offering complementary strategies to help address antimicrobial resistance.

## 4 KEY RESULTS

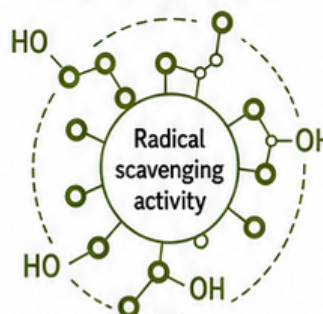
### A PHENOLIC PROFILE

Anthocyanins predominated in grape skins, while catechins were more abundant in seeds and stems.

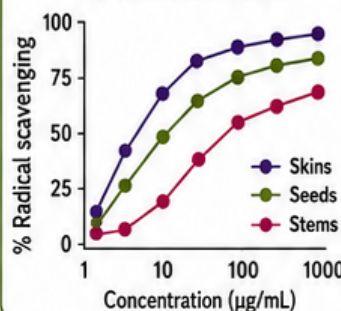


### B ANTIOXIDANT ACTIVITY

All extracts showed antioxidant activity, indicating potential to mitigate oxidative stress.



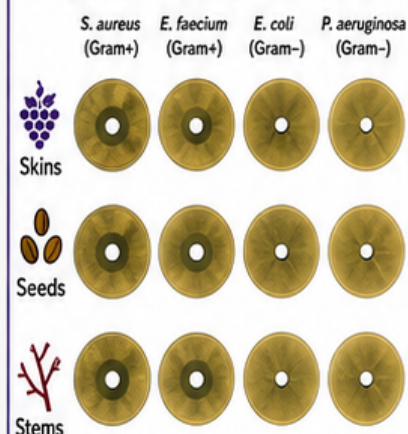
Dose-dependent antioxidant activity observed for all by-product extracts.



### C ANTIMICROBIAL ACTIVITY

Phenolic extracts inhibited several antibiotic-resistant bacteria, with greater efficacy against Gram-positive strains.

Agar diffusion (zone of inhibition)

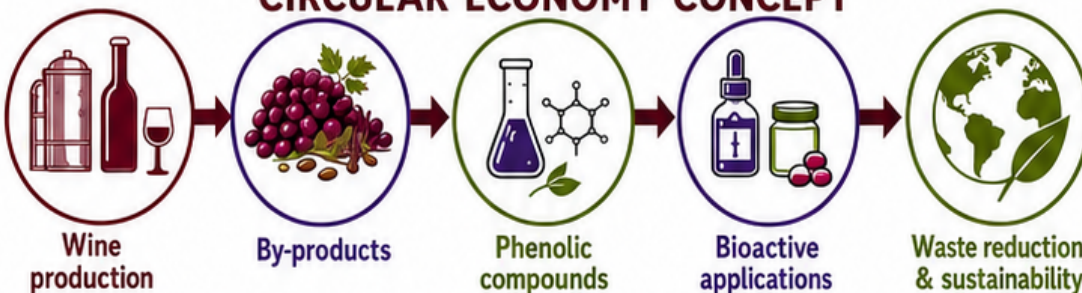


Higher activity against Gram-positive bacteria



- Grape by-products are valuable sources of phenolic compounds
- Extracts combine antioxidant and antimicrobial potential
- Greater antimicrobial efficacy was observed for Gram-positive bacteria
- These extracts may act as complementary antimicrobial agents

## CIRCULAR ECONOMY CONCEPT



## ACKNOWLEDGEMENTS

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