

Comparative Study of the Antimicrobial and Antioxidant Properties of Polyphenolic Extracts Derived from Grape Seed Oil Production Residues

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Ensuring the quality, safety, and sustainability of food and animal feed remains one of the most important global challenges, particularly in the context of increasing population demands and environmental safety concerns. It is essential to produce food and feed that are safe, resistant to storage conditions, have a long shelf life, and cause minimal negative effects on human and animal health. To achieve this, synthetic antioxidants and antimicrobial agents have long been used and are still widely applied in food and feed production. However, recent studies confirm that their extensive use significantly raises risks related to toxicity, carcinogenicity, and environmental harm. Furthermore, the growing problem of antimicrobial resistance intensifies these concerns, driving interest in natural, effective, and environmentally safe alternatives and highlighting the urgent need for their rapid identification and implementation in production. Such a transition is both beneficial for businesses and vital for protecting consumer rights.

In light of these issues, our research aimed to evaluate the bioactive potential of an underutilized agricultural resource—grape seed oilcake, the residue from Georgian grape seed oil production—as a natural source with antioxidant and antimicrobial properties for extending shelf life and improving the preservation of food and animal feed.

From the grape seed oil production residues, two different polyphenolic fractions were extracted using ethyl acetate and an ethanol–water solution. The total polyphenol and flavonoid contents were determined, and antioxidant activity was assessed via luminol-based chemiluminescence and other standard methods. Antimicrobial and antifungal activity was tested against standard microorganisms—*S. aureus*, *E. coli*, *S. abony*, *C. albicans*, and *A. brasiliensis*—using the disk diffusion and drop-on-agar methods. The activity of the extracted polyphenol fractions was compared with commercially used synthetic and natural compounds.

The results demonstrate the strong antioxidant and antimicrobial potential of Georgian grape seed oil production residues, positioning them as a promising natural raw material and a bio resource

contributing to zero-waste production. These findings suggest a possible reduction in safety risks associated with food and animal feed in the future.