

VOLATILE COMPOUNDS IN MERLOT WINE POMACE SUPERCRITICAL EXTRACT

ISPARLJIVI SPOJEVI U SUPERKRITIČNOM EKSTRAKTU KOMINE SORTE MERLOT

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Introduction

After each grape harvest, following pressing and fermentation, high quantities of pomace are disposed directly in nature as waste with negative impacts on the environment, adding to greenhouse gas emissions, polluting ground and surface waters. Depending on grape variety, viticulture practices, environmental factors and winemaking techniques, grape pomace makes up for 20-30% of processed grape weight¹. It's the main solid by-product of winemaking, comprising mostly of skins and seeds which are rich in dietary fibres, residual sugars, lipids, proteins, phenols and other essential bioactive compounds, presenting an opportunity for exploitation and contributing to more sustainable agricultural practices. By applying effective extraction methodologies, such as supercritical extraction, it's possible to exploit this agro-industrial waste and the recoverable compounds in it for food, cosmetic and pharmaceutical industry applications. Supercritical fluid extraction (SFE) results in very pure extracts as no solvent remains in the finished product. In supercritical extraction with CO₂, thermal degradation is limited and there are no toxic solvents involved².

Keywords: volatile compounds, grape wine pomace, HS-SPME, GC-MS, supercritical extraction

Objective

This study was conducted to investigate volatile compounds in grape pomace supercritical extract produced using pomace left over after Merlot wine production in the Dalmatian hinterland.

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Methodology

Merlot grape pomace, sourced after winemaking during the 2023 harvest from the Čaporice region of Split-Dalmatia County, was dried and finely ground. The resulting material was processed by supercritical fluid extraction using CO₂. Extraction time was 120 minutes at 300 bar and CO₂ flow of 150kg/h. Separator vessel temperature was set to 50°C. The extract was refrigerated until screening for volatile compounds using headspace solid-phase microextraction gas-chromatography mass spectrometry (PAL Auto Sampler System model PAL RSI 85, CTC Analytics AG; Agilent Technologies model 8890 coupled with Agilent Technologies mass spectrometer model 5977E MSD). The resulting chromatography peaks were identified by searching Wiley 9 and NIST 20 mass spectra libraries using Dana Analysis software (Agilent Technologies).

Compound	RI	RI (database)	Area (%)
Octanoic acid	<800	645	7.2
Acetoin	<800	743	9.26
2,3-Butanediol	817	819	44.78
Butyrolactone	926	920	1.26
α-Thujene	939	930	0.49
α-Pinene	945	939	0.4
Hexyl acetate	1004	1014	2.13
Benzyl alcohol	1045	1061	0.36
Linalool	1105	1104	0.65
2-Phenylethanol	1123	1117	12.08
Terpinen-4-ol	1185	1178	0.62
Octanoic acid	1190	1180	1.73
Hexyl butyrate	1196	1190	1.57
Ethyl octanoate	1199	1196	3.57
Linalyl acetate	1260	1257	0.3
2-Phenylethyl acetate	1262	1260	0.43
Decanoic acid	1382	1377	1.27
Ethyl decanoate	1397	1397	7.47
Ethyl dodecanoate	1595	1596	2.1
Hexadecanoic acid	1994	1997	0.55

Table 1. SFE extract HS-SPME analysis results (RI – retention index; RI (database) – retention index according to database)

Conclusion

Results of this study demonstrate the potential of Merlot grape pomace, normally a waste product and environmental issue, as a resource of valuable compounds. By applying supercritical fluid extraction with CO₂ as solvent, several volatile compounds can be recovered, including 2, 3-butanediol and 2-phenylethanol. These have diverse uses, from printing inks and perfumes to food flavouring and pharmaceuticals. Utilizing grape pomace in the form of supercritical extract can form the base for new value-added products, significantly reducing negative environmental impact and providing benefits to industries, society and sustainability, in perfect alignment with circular economy principles.

Results

24 840g of ground Merlot grape pomace resulted in 840g of extract. A total of 20 volatile compounds were identified (Table 1). These can be classified into several chemical groups, including alcohols, acids, ketones, esters and terpenes. Among the identified compounds, 2, 3-butanediol was the most abundant (44,78%), followed by 2-phenylethanol (12,08%). 2, 3-butanediol has great potential in the manufacturing of printing inks, perfumes, synthetic rubber, antifreeze agents, fuel additives, foods and pharmaceuticals³. 2-phenylethanol, when present in low concentrations, contributes to pleasant aromas in wine, used as food flavouring and in the cosmetic industry⁴.



Picture 1. Extratex fluid extraction system (Extratex-SFI, France)

Citations

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