

# Analysis of Greek Grape Marc Spirits of Various Origins and Traditional Production Styles: Volatile Organic Compound Fingerprint

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## Introduction

Greek grape marc spirits, known as tsipouro, raki, or tsikoudia, are traditional alcoholic beverages deeply rooted in the country's culture. These spirits are produced by distilling the pomace leftover from winemaking, and their distinct flavors and aromas are influenced by various factors, including grape varieties, production methods, and regional variations. This article explores the Volatile Organic Compound (VOC) fingerprint of Greek grape marc spirits, highlighting the impact of origin and traditional production styles on their aromatic profiles. By analyzing these VOCs, we gain insights into the rich diversity of Greek grape marc spirits and the factors contributing to their unique sensory characteristics. These traditional alcoholic beverages are made by distilling the residue left after the pressing of grapes for winemaking, known as grape marc or pomace. While the primary purpose of tsipouro production was to utilize grape waste, it has evolved into a cherished and culturally significant drink in Greece. The aromatic and flavor profiles of Greek grape marc spirits vary significantly based on several factors, including grape variety, geographical origin, and production techniques. One way to unravel the complexity of these spirits and gain a deeper understanding of their sensory characteristics is through the analysis of Volatile Organic Compounds (VOCs). VOCs are responsible for the aromas and flavors we perceive in beverages and play a pivotal role in shaping the overall sensory experience [1].

This article aims to explore the VOC fingerprint of Greek grape marc spirits, investigating how different grape varieties, geographical origins, and traditional production styles influence their aromatic profiles. By examining these factors, we can appreciate the diversity and complexity of these spirits and the factors contributing to their unique and cherished sensory attributes. Greece boasts a remarkable diversity of grape varieties, many of which are used to produce grape marc spirits. The choice of grape variety profoundly impacts the final flavor and aroma profile of the spirit. Muscat grapes are renowned for their intense floral and fruity aromas. When used in grape marc spirit production, they impart a pronounced floral and fruity character to the final product. Muscat-based tsipouro is celebrated for its fragrant and aromatic qualities, making it a favorite among connoisseurs. Xinomavro is a red grape variety known for its high acidity and tannin content. When used in grape marc spirit production, it contributes a robust and complex flavor profile with notes of red fruit, herbs, and a hint of bitterness. Xinomavro-based tsipouro is popular in northern Greece, particularly in the region of Macedonia [2].

## Description

Savatiano is a white grape variety prevalent in central Greece. Spirits made

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from Savatiano grapes are characterized by a lighter and more delicate aroma profile, with subtle floral and citrus notes. These tsipouro variations are often considered more approachable and refreshing. Vilana is a white grape variety native to Crete. Tsikoudia made from Vilana grapes exhibits a unique combination of herbal and citrus notes, with a hint of Mediterranean herbs like thyme and oregano. The island's terroir greatly influences the aromatic complexity of these spirits. The geographical origin of the grapes and the terroir where they are grown have a profound impact on the flavor and aroma of grape marc spirits. Greece's diverse landscape and microclimates contribute to a wide range of terroirs, each imparting its unique character to the grapes and, consequently, to the spirits. Grape marc spirits produced on Greek islands often exhibit a distinct coastal influence. They may carry saline notes and hints of sea breeze, adding a unique dimension to their aroma profiles. Spirits from the mainland, on the other hand, reflect the terroir of the specific region, which can range from mountainous and continental to semi-arid. The altitude at which grapevines are cultivated significantly affects the grape marc's composition. Higher altitudes may result in grapes with greater acidity and more pronounced aromatic compounds. Spirits made from high-altitude grapes often showcase vibrant and refreshing qualities [3].

The composition of the soil, whether it is limestone, volcanic, or sandy, contributes to the mineral character of the grapes. This mineral influence is transmitted to the spirits, influencing their aromatic complexity. The production of Greek grape marc spirits follows traditional methods that have been passed down through generations. These methods are deeply rooted in local cultures and contribute to the distinctive character of the spirits. The distillation process itself plays a crucial role in shaping the VOC fingerprint of the spirits. Traditional pot stills, often made of copper, are commonly used for tsipouro and raki production. Copper is an excellent conductor of heat and helps remove unwanted compounds during distillation while preserving desirable aromas. Some grape marc spirits, such as aged tsipouro, are aged in wooden barrels or casks. This aging process can introduce additional flavors and aromas, including vanilla, oak, and spice notes, enriching the sensory profile of the spirits.

Blending different batches or grape varieties is a common practice in grape marc spirit production. This allows distillers to achieve a desired flavor profile and consistency. The art of blending is essential in crafting spirits with well-balanced and harmonious aromatic profiles. Analyzing the VOC fingerprint of Greek grape marc spirits involves identifying and quantifying the volatile organic compounds present in the liquid. Gas Chromatography-Mass Spectrometry (GC-MS) is a powerful analytical technique used for this purpose. The VOCs identified in the spirits are responsible for the various aromas and flavors perceived by the drinker [4].

The primary alcohol responsible for the alcoholic strength of the spirits. These compounds contribute fruity and floral notes. Aldehydes can impart nutty, fruity, or waxy aromas. Terpenes are responsible for the aromatic characteristics of Muscat-based spirits. These compounds can contribute herbal, smoky, or spicy notes. The VOC fingerprint of spirits often reflects the terroir where the grapes were grown. For example, spirits from coastal regions may contain compounds associated with saltiness or marine influences, while those from mountainous regions may exhibit herbal or alpine notes [5].

## Conclusion

Different grape varieties contribute distinct VOC profiles to the spirits. Muscat-based spirits are rich in terpenes, while Xinomavro-based spirits may contain more tannins and phenolic compounds. Traditional production methods, such as copper pot distillation and wooden aging, can introduce specific VOCs to

the spirits. Copper can remove sulfur compounds, while aging in oak barrels can impart vanilla and spice notes. Greek grape marc spirits, with their rich history and cultural significance, offer a captivating study in the diversity of flavors and aromas. The VOC fingerprint of these spirits reflects the interplay of grape varieties, geographical origins, and traditional production styles. By analyzing the volatile organic compounds present, we gain valuable insights into what makes each spirit unique and how the choices made in the production process impact their sensory profiles. Understanding the VOC fingerprint of Greek grape marc spirits not only enhances our appreciation of these traditional beverages but also provides opportunities for quality control and product development. Distillers can use this knowledge to refine their techniques and create spirits that showcase the best of Greece's terroir and heritage, ensuring that these beloved drinks continue to thrive in the modern world. In doing so, they preserve a cherished tradition while also offering new and exciting expressions of this age-old craft.

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None.

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## Conflict of Interest

There is no conflict of interest by author.

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