SUMMARY

of the doctoral thesis entitled:

STUDY REGARDING THE INFLUENCE OF MEDIUM CHAIN FATTY ACIDS ON THE STOPPING OF ALCOHOLIC FERMENTATION TO OBTAIN WINES WITH NATURAL RESIDUAL SUGAR

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In the current context of the wine industry, sulfur dioxide (SO_2) plays a central role in the winemaking process, being widely used due to its antioxidant, antioxidasic, antimicrobial properties, as well as its positive sensory role. This compound is essential for stabilizing wines, preventing unwanted fermentation, and protecting the wine from oxidation and microbiological spoilage. However, the use of sulfites has become a subject of intense debate, mainly because of its impact on human health, in some cases causing allergic reactions or other conditions such as asthma. Consumers are also becoming increasingly concerned about green/organic products, which has led to an increasing demand for wines with reduced sulfite content.

In international markets, this trend towards wines with reduced sulfite content has led researchers and producers to explore alternative wine preservation solutions, especially in sweet wines, where maintaining a balance between sweetness and microbiological stability is essential. In this context, medium-chain fatty acids (MCFA) have been identified as potential sulfite replacements, offering a way to stop alcoholic fermentation without compromising wine quality.

This paradigm shift in winemaking is not only a reaction to health concerns but also an adaptation to the modern demands of the wine market, which is looking for innovative, but also healthy products. Thus, current research is increasingly focused on using MCFA as an alternative method of stopping fermentation, aiming to produce sweet wines that meet consumers' organoleptic and health expectations.

The doctoral thesis entitled "**Study regarding the influence of medium-chain fatty acids on the cessation of alcoholic fermentation to obtain wines with natural**

residual sugar" analyzes the role of medium-chain fatty acids (MCFA) in the winemaking process, especially in the cessation of alcoholic fermentation for the production of wines sweet, contributing to this line of research by exploring in detail the effects of MCFA on wines and providing new insights for the production of wines low in sulfites.

The work is structured in two main parts: a bibliographic study and own research.

Part I: Bibliographic study. This single-chapter part of the thesis reviews the literature on alcoholic fermentation inhibitors, focusing on sulfur dioxide, potassium sorbate, lysozyme, chitosan, and other similar compounds. Details about fatty acids are also presented, including their general characteristics and their effects on the human body and wine quality. The thesis also explores methods for determining volatile compounds in wine, emphasizing the role of medium-chain fatty acids in preserving the aromas and sensory profile of wines.

Fatty acids, either free or as an integral part of complex lipids, play an essential role in metabolism, serving as the primary metabolic fuel by storing and transporting energy, constituting fundamental components of cell membranes, and acting as genetic regulators. Within complex lipids, these fatty acids contribute significantly to the thermal and electrical insulation of cells, as well as to their mechanical protection. In addition, free fatty acids and their salts exhibit amphipathic properties, allowing them to function effectively as detergents and soaps by forming micelles. Considering this last property, their use to stop alcoholic fermentation can be an optimal solution, from many points of view, to obtain a product with a low SO_2 content and with positive influences on the final organoleptic qualities.

Part II: Own research. The purpose of this research was to test and compare the effectiveness of medium-chain fatty acids against traditional methods of stopping alcoholic fermentation.

This part of the thesis comprises three chapters that describe the research objectives and methods, discuss the results obtained, and include conclusions and recommendations.

Chapter II establishes the experimental framework of the thesis, describing the main objectives and research methodology. The main aim is to evaluate the effectiveness of MCFA in ceasing alcoholic fermentation compared to traditional methods used in winemaking.

The research was carried out on the Tămâioasă Românească variety, a grape variety known for its potential in the production of sweet wines, with residual natural sugar. Experimental variants include the use of MCFA at different doses, both individually and in combination, to determine the most effective way to stop fermentation without compromising wine quality.

The chapter details the methods used for the physicochemical and sensory analysis of wines, including using an electronic nose to determine the aroma profile. It also includes details about the statistical methods used in the studies.

Chapter III: Results and Discussions is the central chapter of the thesis, where the experimental results and their analysis are presented.

The results indicate that the MCFA treatments significantly impacted the fermentation process, with minor variations in alcohol concentration and residual sugars. MCFA also influenced the aromatic profile of the wines, contributing to the preservation of the desired organoleptic characteristics.

Sensory analyses revealed the different perceptions of sweetness, astringency, and color intensity depending on the applied treatment. For example, combinations of octanoic and decanoic acid effectively maintained a balanced aroma profile with a high perception of aroma intensity.

Chromatographic analyses identified the volatile compounds in the wines, confirming that MCFAs can be used to obtain wines with distinct aromatic characteristics. Electronic nose results demonstrated that MCFA treatments can significantly influence the aromatic composition, producing ethyl esters that contribute to the aromatic complexity of the wine.

The study showed that the use of these acids can provide a viable and effective alternative to traditional methods of preserving sweet wines and also includes a methodological and legislative proposal for the introduction of MCFA as an alternative to traditional fermentation inhibitors.

The conclusions chapter summarizes the main findings of the research. It is concluded that medium chain fatty acids represent a viable alternative to traditional methods of arresting alcoholic fermentation, having the potential to reduce the need to use sulfur dioxide in winemaking. This approach can lead to wines with a reduced sulfite content, which is in line with current trends in the international wine market.

The major contribution of the thesis is to propose a new methodology for the use of MCFA in the winemaking process, allowing producers to control alcoholic fermentation and obtain sweet wines with a low SO_2 content. Organoleptic detection limits of MCFA were also identified, indicating that doses above 20 mg/l influence the aromatic profile of wines, thus providing winemakers with an additional tool for fine-tuning sensory characteristics. However, for a minimal influence on the wines, the doses must still be maintained at a maximum of 10 mg/l medium chain fatty acids.

This study opens new research directions, especially regarding the long-term effects of MCFA on the compositional and sensory evolution of wines during maturation and storage, thus contributing to the development of sustainable technologies in winemaking.