

Evolution of Free Amino Acids in Young Madeira Wines Submitted to Controlled Heating Conditions

Pontes, M.¹, Pereira, V.¹, Albuquerque F.², Câmara J. S.¹, Ferreira A. C.³, Marques J.C.^{1*}

¹ Centro de Química da Madeira, Departamento de Química da Universidade da Madeira, Campus da Penteada, 9000-390 Funchal, Portugal.

² Madeira Wine Company, Rua dos Ferreiros, 9000-082 Funchal, Portugal.

³ Escola Superior de Biotecnologia da Universidade Católica, Rua Dr. António B. Almeida, 4200-072 Porto, Portugal.

*marques@uma.pt



Objectives

The purpose of this study was:

- to determine the typical distribution of amino acids in sweet and dry young Madeira wines;
- to evaluate the changes in composition when these wines are heated under controlled conditions in order to detect any influence in the formation of the aroma.

Introduction

Amino acids represent the main fraction of non volatile nitrogen compounds in wines. They are an importante source of nitrogen during yeast fermentation and are directly involved in the formation of aroma compounds.

They can also be used for the characterization of grape varieties and the evaluation of the impact of processing changes introduced in the vinification process.

Madeira wines are currently submitted to controlled oxidising conditions, known as *estufagem*, after fermentation and fortification, which are responsible for the aroma characteristics of these fortified wines.

Methodology

Sweet wines (Malvasia) were submitted to a partial fermentation and dry wines (Sercial) to a complete fermentation.

After fortification, the wines were heated at: -30 °C, -40 °C, -50 °C



Samples were collected from the vats every 30 days and preserved under refrigeration before used.

Amino acids were determined in a Waters HPLC system equipped with a fluorescence detector (Fig. 1).

The method used was based on the method proposed by A. C. Ferreira and L. Pripis-Nicolau *et al.* Involving a pre-column derivatisation with iodoacetic acid (IDA) and o-phthalaldehyde (OPA).



Fig. 1 – HPLC system used on the determination of amino acids.



Fig. 2 – Gradient programme used in the study and composition of mobile phases.

Results

Table 1 – % decrease of amino acids content in Malvasia sweet wines.

Amino Acids	30 °C	45 °C	55 °C
Aspartic Acid	40	76	80
Glutamic acid	26	45	27
Cysteine	48	72	81
Asparagine	26	52	79
Serine	14	33	44
Glycine	**	**	17
Arginine	6	32	53
Alanine	11	26	36
Tyrosine	15	20	12
Valine	14	15	19
Phenylalanine	14	22	26
Isoleucine	9	10	12

In Malvasia Sweet wines, cysteine, aspartic acid and asparagine have the main decrease in the *estufagem*, followed by arginine.

In Sercial Dry wines cysteine, phenylalanine and tyrosine have the main decrease in *estufagem*, followed by aspartic acid and arginine.

Conclusions

The study carried out allowed the implementation of a routine amino acid determination.

Significant changes in the composition of amino acids were detected not only in sweet and dry wines but also when similar wines are fermented under slightly different conditions, showing the importance of complete and uniform control of fermentation conditions for high quality Madeira wines.

The results also show that some amino acids play an important role in the formation of complex aroma during the heating step of the vinification process, which can affect colour, aroma and final organoleptic perception of commercial wines.

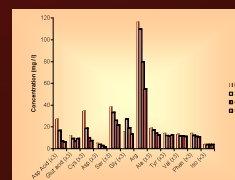


Fig. 4 – Amino acid composition (mg/l) in sweet wine samples (Malvasia), before and after the heating step (4 months) at the considered temperatures.

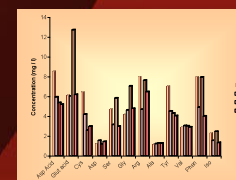


Fig. 5 – Amino acid composition (mg/l) in dry wine samples (Sercial), before and after the heating step (4 months) at the considered temperatures.

The main amino acid observed before heating is arginine (116 mg/l), followed by serine, aspartic acid and cysteine (~10 times lower content).

The initial amino acid profile is quite different from Malvasia wine, namely in what concerns the content of arginine, cysteine and alanine. Major aminoacids are aspartic acid, arginine and phenylalanine.

Glutamic acid, tyrosine and phenylalanine show higher amounts than those obtained in sweet wines.

References

- P. Hernandez-Orte, J. Cacho and Vicente Ferreira; J. Agric. Food Chem., 50 (2002) 2891;
- C. Ferreira; PhD thesis, Université Victor Segalen Bordeaux (1998);
- L. Pripis-Nicolau, G. Revel, S. Marchand, A. A. Belouqui and A. Bertrand; J. Sci. Food Agric., 81 (2001) 731.

Acknowledgements

- This research work was supported by Agência da Inovação (projecto IMPACT).
- The authors are grateful to Madeira Wine Company for the wines used in the study.