

DEVELOPMENT OF INNOVATIVE FORMULAS OF VERMOUTH WITH PARTICULAR PROPERTIES

Diana Moigradean¹, Mariana-Atena Poiana^{1*}, Liana-Maria Alda¹, Despina-Maria Bordean¹, Daniela Stoin¹, Simion Alda², Florina Radu¹

¹*Faculty of Food Engineering, University of Life Sciences „King Michael I” from Timisoara, Romania, Aradului Street No 119, 300645 Timisoara, Romania*

²*Faculty of Engineering and Applied Technology, University of Life Sciences „King Michael I” from Timisoara, Romania, Aradului Street No 119, 300645 Timisoara, Romania*

* corresponding author e-mail: marianapoiana@usvt.ro

Abstract

The aim of the study was to presents practical aspects of the production and characterisation under physico-chemical and sensory aspects of an aromatized white Vermouth wine. Aromatized vermouth wine which is a special wine obtained from basic white wine, sugar, hydroalcoholic macerates and citric acid. A hydroalcoholic maceration of dried herbs, dried fruit, citrus peel and spices was used to prepare the vermouth recipe. The hydroalcoholic macerate represents 2% of the volume of white vermouth prepared. Vermouth is available in a very wide range of varieties, depending on the amount of sugar and alcohol it contains. In terms of sugar content, it can be dry (20 g/L) to very sweet (180 g/L). Alcohol levels range from 14.5 - 20% (v/v). Total acidity is low (2-3.5 g/L H₂SO₄) and volatile acidity is below 0.5 g/L H₂SO₄. The white vermouth obtained in our study has the following characteristics: alcoholic degree 18% (v/v), sugar content 100 g/L and total acidity 4.0 g/L H₂SO₄. The resulting product belongs to the class of flavoured aperitif wines. The information obtained from this study contributes to the extension of knowledge in the field of designing white flavored wine formulations with particular properties.

Introduction

Aromatized wines are also known as aperitif wines and are made from wine with added sugar or must, wine distillate or food alcohol and flavoring substances obtained from various herbs. The Vermouth must be at least 70% wine. Under the current legislation [10], aromatized wines belong to the category of special wines. They are made from must or wine to which special, authorized treatments are applied during or after processing. Aromatized wines have specific characteristics, determined by the technological properties of the raw material and the technology applied during processing [3].

Vermouth is a special wine, aperitif and tonic made from white or red wines, with the addition of alcohol, sugar, herbal macerate and other ingredients [6]. The name comes from the German word "Wermuth" meaning wormwood; the wormwood is the main herb used to make this product [9]. The main characteristics of vermouth are the following: alcoholic strength 16-18% (v/v) and sugar content 40-180 g/L; characteristic bitter herbal aroma. Vermouth can be made from white or red wine, to which rectified ethyl alcohol, sugar syrup, herbal macerate and sometimes citric acid are added [8, 9]. The following conditions are required for the preparation of vermouth: (i) the raw material-wine must be old (2-3 years) and have an alcoholic strength of at least 12% vol; (ii) the sugar must be of good quality, contain a minimum of 99.8% sucrose and have a maximum moisture content of 0.2%; (iii) the alcohol must be rectified and have an alcoholic strength of at least 96% vol; (iv) the citric acid must be crystallized and free from impurities; (v) the plants must be well preserved and free of foreign tastes and odors; (vi) the

equipment must be chemically inert so as not to enrich the wine with toxic or mutagenic compounds [8].

The design of flavored wine types with specific properties is a current concern in the field of producing prototypes with distinct identity. In this respect, the aim of this study consists in the design and characterization under physico-chemical and sensory aspects of a variety of aromatized white wine, of Vermouth type [9].

Experimental

There are two main stages in the production of vermouth: preparation of the wine and auxiliary materials (syrup, macerate, citric acid solution) and production of the technological mixture. The raw wine must be healthy, moderately alcoholic, not very extractive and low in total acidity. For better preservation, it is recommended that when the wine is not used immediately in the preparation of vermouth, it should be sweetened and alcoholized to near the concentrations of the finished product [5]. The alcohol used in the preparation of vermouth must have an alcoholic strength of not less than 96°, must be free of foreign taste or odor, must not contain furfural and must not contain methyl alcohol. The sugar used to sweeten the vermouth must be white in color, with a gloss and crystals as uniform as possible, dry and not sticky, and must give a clear solution with water, free of extraneous tastes and odors [1]. The quality of the vermouth depends to a large extent on the number and proportion of herbs and spices used in the manufacturing recipe [2].

In order to prepare the vermouth recipe, a hydroalcoholic maceration was conducted using dried medicinal plants, dehydrated fruits, citrus peels and spices, in accordance with the information presented in Table 1.

Table 1. Quantity of plant material (medicinal, citrus, spices) used to obtain the hydroalcoholic macerate

Plant name	Plant parts (peel, leaves, flower)	Weight (g)*
<i>Achillea millefolium</i>	flower	2
<i>Citrus paradisi</i>	peel	20
<i>Artemisia absinthium</i>	stem	20
<i>Citrus limon</i>	peel	10
<i>Syzygium aromaticum</i>	flower	20
<i>Citrus × sinensis</i>	peel	18
<i>Carum carvi</i>	seeds	10
<i>Thymus serpyllum</i>	flower	10
<i>Urtica dioica</i>	leaves	5
<i>Hippophae</i>	fruit	20
<i>Hyssopus officinalis</i>	flower	15
<i>Ocimum basilicum</i>	leaves	1
<i>Silybum marianum</i>	fruit	5
<i>Cinnamomum verum</i>	peel	7
<i>Foeniculum vulgare</i>	fruit	5
<i>Mentha</i>	leaves	10
<i>Origanum vulgare</i>	leaves	10
<i>Salvia Rosmarinus</i>	stem	15
<i>Cynara cardunculus var. Scolymus</i>	flower	15
<i>Coriandrum sativum</i>	fruit	15

* 2000 mL of aqueous solution 45% (v/v) of absolute alcohol to the plant material has been added

Innovativeness

The white aromatized wine of the Vermouth type obtained is based on the premise of inserting innovative aspects into the classic technology of making aromatized wines. The innovative aspects of the product are: (i) the selection of plant material (medicinal plants, spices and fruit) and hydroalcoholic maceration techniques to obtain a hydroalcoholic macerate with a high content of bioactive compounds; (ii) the valorization of the varietal character of the white base wine, obtained from NOVA grapes in the hilly area in the south of the country in order to adapt to the tastes of the modern consumer who explores new flavor combinations, focusing on sustainability and health, thus meeting contemporary demands; (iii) the design of the assortment was based on technological calculations of total and partial material balance in the useful components: ethyl alcohol and sugar.

The process of manufacturing the white vermouth wine type

The white aromatized wine of the Vermouth type is a distinctive alcoholic beverage appreciated for its complexity and refinement. It is obtained by fortifying the basic white wine with sugar and natural plant and fruit extracts in the form of hydroalcoholic macerate [5].

Selection of the base wine: white wine from the NOVA grape variety (harvested year 2021) was used, with a neutral flavor profile to allow the hydroalcoholic macerate to stand out.

Addition of the macerate: the macerate, added at a rate of 2% of the final volume of the Vermouth obtained, imparts unique flavors and olfactory and gustatory complexity.

Sweetening: the sweetening was achieved by adding edible sugar to balance the bitterness due to the botanical ingredients from which the macerate was prepared [4].

Maturation: the technological blend was matured for 30 days at a temperature of 15-20°C, allowing the aromas to harmonize. After this time, the hydroalcoholic macerates were filtered and incorporated into the basic white wine [5].

Analytical methods of white Vermouth wine

The following chemical analyses were carried out according to the International Organization of Vine and Wine methodology (OIV) [7]. These included determinations of total acidity, alcohol degree, sugar contents, total dry extract and non-reducing dry extract. All chemicals and reagents were purchased from Merck, Fluka, Sigma. The bidistilled water used.

Results and discussion

Aromatized wines are aperitif, tonic, pleasantly aromatic and bitter-tasting. Both the aromas and the taste come from certain plants and ingredients, the number and proportions of which are often manufacturing secrets. These products are obtained either by the infusion of aroma and taste constituents during must fermentation, or from wine by the addition of sugar or must, wine distillate or refined food alcohol, citric acid and macerates of plants and fruits [4].

The quantities of raw materials required for the preparation of 5000 mL of white Vermouth were calculated using a material balance. This comprised a total material balance and partial material balance in alcohol and sugar (Table 2). Citric acid is used to correct wine acidity [6].

Table 2. The materials needed to make 5000 mL of white Vermouth

Materials	Values
Basic wine NOVA (mL)	3868
Alcohol 96% v/v (mL)	407
Sugar (g)	529
Hydroalcoholic macerate of plants (mL)	100
Water (mL)	296
Citric acid (g)	6.5

Table 3 shows the characteristics of white wine from the NOVA grape variety.

Table 3. The base wine physicochemical characteristics

Physicochemical characteristics	Values
Total acidity (g/L H ₂ SO ₄)	4.0
Alcohol (% v/v)	12.0
Sugar (g/L)	1.50
Total dry extract (g/L)	24.10
Non-reducing dry extract (g/L)	22.60

A sensory analysis provides insights into the provenance and maturation of a given wine, offering a comprehensive representation of its intrinsic characteristics [2]. The sensory properties of white Vermouth type wine are presented in Table 4 and Table 5 shows the physicochemical characteristics of this drink.

Table 4. The sensory properties of white Vermouth type wine

Sensory properties	Description
appearance	clear, without suspended particles or sediment
color	gold yellow with an amber tint
taste	pleasant taste, with a slightly bitter distinct aroma by fruit, flower and vegetable notes (derived from the macerate extract)
odor	pleasant, characteristic of aromatized wine

Table 5. The physicochemical characteristics of white wine Vermouth type

Physicochemical characteristics	Values
Total acidity (g/L H ₂ SO ₄)	4.0
Alcohol (% v/v)	18.0
Sugar (g/L)	100
Total dry extract (g/L)	116.46
Non-reducing dry extract (g/L)	16.46

This assortment is a special, flavored aperitif wine [6]. This flavored wine is suitable for special occasions and is an excellent choice for events and social gatherings, bringing an element of elegance [3].

Conclusion

Thanks to the combination of herb, spices and fruit, Vermouth offers a multifaceted taste experience that can satisfy even the most demanding palate. Consumed moderately, this flavored wine may have digestive benefits due to the herbs and botanicals used in the preparation of the macerate. The white Vermouth-type aromatized wine obtained is based on the premise of inserting innovative aspects into the traditional technology of making aromatized wines. The aspects that support the innovativeness of the product consist in capitalizing on the varietal character of the basic white wine in order to adapt it to the tastes of the modern consumer who is exploring new flavor combinations, focusing on sustainability and health. The design of the assortment was based on technological calculations of total and partial material

balance in useful components: ethyl alcohol and sugar. The techniques accessed in the direction of obtaining special white wine of Vermouth type are relatively simple, easy to apply, being recommended for the purpose of expanding the assortment of flavored wines.

References

- [1] D.J.W. Burns, A.C. Noble, *J Texture Stud.* 16 (1985) 365-381.
- [2] R. Culea, M. Radiana, R.M Tamba-Berehoiu, C. Popa, *Scientific Papers Series Management, Economic Engineering in Agriculture and Rural Development.* 1 (2015) 147-152.
- [3] V.K. Joshi, D.K., Sandhu, B.A.B.T. 43(5) (2000) 537-545.
- [4] V.M. Kiselev, T.F. Kiseleva, A.V. Petropavlovskaya, L.P. Lipatova, M.A. Nikolaeva, in *BIO Web of Conferences*, EDP Sciences, vol. 103, 2024, pp.96.
- [5] A. Morata, C. Vaquero, F. Palomero, I. Loira, M.A. Banuelos, J.A. Suárez-Lepe, *Alcoholic Beverages, Volume 7: The Science of Beverages.* 2019, pp.35-63.
- [6] E. Mudura, T.E. Coldea, *Bulletin UASVM Food Science and Technology*, 73(1) (2016), 28-32.
- [7] OIV (Organisation Internationale de la Vigne et du Vin), *Compendium of International Methods of Wine and Must Analysis*, 2008. vol.1, Paris
- [8] P.S. Panesar, N. Kumar, S.S. Marwaha, V.K. Joshi, *Nat. Prod. Radiance.* 8(4) (2009) 334-344.
- [9] P.S. Panesar, V.K. Joshi, R. Panesar, G.S. Abrol, *Adv Food Nutr Res.* 63 (2011) 251-283.
- [10] ***Order No. 142 from February 29, 2008, published in *The Official Gazette of Romania* No. 565 from July 28, 2008, <http://old.madr.ro/pages/inspectii/ordin-142-din-2008.pdf>.