Watermelon Wine and Its Analysis

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Abstract

Watermelon wine stands as a testament to the ingenuity and creativity within the realm of winemaking, where traditional techniques meet innovative flavors to create unique and captivating libations. In this report, we delve into the world of watermelon wine, exploring its origins, production process, flavor profile, and growing popularity. From its humble beginnings as an experimental venture to its emergence as a beloved beverage choice, watermelon wine embodies the essence of summer in a bottle, offering a refreshing alternative to traditional wines. Through a comprehensive analysis, we uncover the secrets behind crafting this enticing drink, examine its cultural significance, and discuss its potential impact on the wider beverage industry. Join us as we uncork the potential of watermelon wine and discover the artistry and passion behind this delightful concoction.

Keywords: **Fermentation process, Wine chemistry, Wine microbiology, Yeast strains in winemaking, Sugar content analysis, Acidity levels in wine, Tannin analysis.**

INTRODUCTION

Watermelon (Citrulluslanatus) is a fruit which belongs to the family of cucumbitacea. The fruit is round with reddish mesocarp having a lot of seed and is mostly grown in the northern part of Nigeria. It contains vitamin B1 and B6, potassium and magnesium in addition to vitamin A and C which is generally common to all fruits and vegetables [1]. Watermelon (Citrululunatus) is rich in carotenoids some of which include lycopene, phytofluene, phytoene, beta carotene, lutein and neurospnene. Lycopene makes up the majority of the carotenoids of watermelon. Carotenoids have antioxidant activity and free scavenging property thereby help in reducing the risk of cancers, cardiovascular diseases, arteriosclerosis diabetes and arthritis and protects against macular degeneration. A watermelon is nominally 60% flesh Journal of Biomaterials 2018; 2(2): 65-73 66 and about 90% of the flesh is juicy which contains 7 to 10% (w/v) sugar. Thus, over 50% of the watermelon is readily fermentable liquid [2]. The nutritional profile of watermelon is full array of nutrients, including carbohydrates, sugar, soluble and insoluble fiber, sodium, vitamins, minerals, fatty acids, amino acids and more. A serving cup of watermelon contains 12.31mg of vitamin C, 864.88IU of vitamin A, 170.24MG of potassium and 45.60 calories [3]. In Nigeria, watermelon is fermented, blended and consumed as juice, nectars, fruit cocktails and can also be used as an appetizer or snacks, depending on how it is prepared [4]. The seeds are also reported to possess medicinal properties and are used to treat chronic or acute eczema. It contains high levels of proteins, lipids and is a rich source of carbohydrate and fiber. Arginine, glutamic acid, aspartic acid and leucine are the predominant amino acids in watermelon proteins. Reports are also available on the biological value, true digestibility, protein efficiency ratio and net protein utilization of watermelon seeds [5]. Moreover, they are used as a domestic remedy for urinary tract infection, hepatic congestion, catarrh, worm remedy, abnormal blood pressure [6]. The production of wine from common fruits could help reduce the level of post-harvest losses and increases the variety of wines [7]. Wine is any alcoholic beverage produced from juices of variety of fruits by fermentative action of microorganisms either spontaneously or seeding with a particular strain mainly of yeast species to adopt a particular quality of wine [8]. Grapes are usually preferred because of the natural chemical balance of the

grape juice which aids their fermentation process without the addition of sugars, acids, enzymes, or other nutrients. However, fruits such as banana, cucumber, pineapple, watermelon and other fruits are used in wine production. [9-11].

PROBLEM STATEMENT

Watermelon, a nutrient-rich fruit widely cultivated in Nigeria, has significant post-harvest losses due to inadequate storage and utilization methods. Despite its rich nutritional content and fermentable liquid, the potential of watermelon in wine production remains underexplored. This research aims to investigate the feasibility of using watermelon juice as a primary raw material for wine production, optimizing fermentation conditions to produce high-quality wine, and analyzing its physicochemical properties. Additionally, the study seeks to address challenges in processing and storage, while promoting innovative ways to reduce post-harvest losses and expand the economic utility of watermelon.

OBJECTIVE

1. Assess the potential of watermelon juice as a primary raw material for wine production.
2. Determine the ideal fermentation conditions (temperature, yeast strain, duration) for producing high-quality watermelon wine.
3. Analyze the physicochemical properties of the produced wine, including pH, alcohol content, sugar content, and antioxidant levels.
4. Assess the nutritional composition of watermelon wine and compare it to other fruit-based wines.
5. Develop a scalable wine production process to reduce watermelon wastage and extend its shelf life.
6. Explore the economic benefits and market potential of watermelon-based wine in reducing agricultural losses and increasing farmer income.
7. Identify and propose solutions for challenges in the processing, preservation, and storage of watermelon wine.

LITERATURE SURVEY

Watermelon, known scientifically as Citrulluslanatus, has gained attention not only for its refreshing taste and high-water content but also for its potential applications beyond traditional consumption. Rich in vitamins, minerals, and antioxidants, watermelon has been studied extensively for its nutritional benefits and functional properties. Previous research has explored various aspects of watermelon juice, including its chemical composition, sensory attributes, and potential uses in food and beverage industries. However, there remains a gap in understanding its suitability for wine production. The research paper under review aims to address this gap by conducting nutrient analyses of watermelon flesh-juice and investigating its fermentation potential for wine production. By systematically evaluating the composition and characteristics of watermelon juice as a wine base, this study contributes to the growing body of knowledge on alternative fruit sources for alcoholic beverage production.[13] Recent advancements in biocatalysis have sparked interest in novel approaches to wine production, particularly through the immobilization of yeast on unconventional substrates. Agricultural waste products, such as watermelon (Citrullus vulgaris) rind, have emerged as promising supports for yeast immobilization due to their porous structure and abundant availability. This innovative approach offers several potential advantages over traditional fermentation methods, including enhanced fermentation kinetics, improved product quality, and increased operational stability. Previous studies have demonstrated the feasibility of using watermelon rind as an immobilization support for yeast in wine production, with promising results in terms of fermentation performance and

volatile compound profiles. However, further research is needed to optimize immobilization conditions, scale up production, and evaluate the sensory characteristics of the resulting wines. Characterization of volatile compounds, using techniques such as gas chromatography-mass spectrometry (GC-MS) and solid-phase microextraction (SPME), provides valuable insights into the aroma and flavor profiles of wines produced using immobilized yeast on watermelon rind. These findings contribute to the growing body of knowledge on biocatalytic processes in the food and beverage industry and hold potential implications for sustainable wine production practices.[14] x VIT B.Tech. (Chemical) The paper by Ogodo et al. (2015) explores the production and quality of wine made from mixed fruits, specifically banana (Musa acuminata), pawpaw (Carica papaya), and watermelon (Citrullus vulgaris), using Saccharomyces cerevisiae isolated from palm wine. The study highlights the feasibility of utilizing these fruits, which are often subject to significant post-harvest losses, in wine production, thereby reducing waste and creating value-added products. This paper contributes to the understanding of fruit wine production using mixed fruits, showcasing an innovative approach to reducing fruit wastage and enhancing the diversity of wine products. The use of palm wine yeast for fermentation is particularly notable for its resilience and efficiency in converting sugars to alcohol [15].

METHODOLOGY

Making watermelon wine involves several unique steps due to the high-water content and delicate flavor of the fruit. Here's a comprehensive methodology for making watermelon wine:

1. Selection and Preparation of Watermelons - Selection: Choose ripe, sweet watermelons with a deep red flesh and minimal white rind. - Cleaning: Wash the watermelons thoroughly to remove any dirt and pesticides.

2. Extracting Juice Cutting and Peeling: Cut the watermelons into small pieces and remove the rind and seeds. -Juicing: Use a juicer or blender to extract the juice from the flesh. Strain the juice through a fine mesh or cheesecloth to remove pulp and any remaining seeds. Adding strawberry juice for flavor after removing the pulp and seeds from the fruit.

3. Measuring and Adjusting Juice - Quantity: Measure the amount of juice extracted. You will need around 10-12 pounds of watermelon to produce about one gallon of juice. - Sugar Content: Measure the sugar content (Brix) of the juice using a hydrometer. Watermelon juice typically has a lower sugar content than grapes, so additional sugar may be needed. -Acidity-Check the acidity (pH) and adjust if necessary. Watermelon juice often requires the addition of acid blend to reach the desired pH of around 3.2-3.4.

4. Preparing the Must - Mixing Ingredients: Combine the watermelon juice with additional ingredients: - Sugar: Add granulated sugar to achieve a specific gravity (SG) of 1.085-1.095. Dissolve the sugar completely. Acid Blend- Adjust the acidity as needed. - Yeast Nutrient: Add yeast nutrient to support fermentation. -Pectic Enzyme: Add pectic enzyme to break down pectin and clarify the wine. - Campden Tablets: Crush and add Campden tablets to the must to sanitize it, eliminating wild yeasts and bacteria. Let the must sit for 24 hours.

5. Fermentation - Yeast Addition: After 24 hours, add suitable wine yeast (e.g., Lalvin EC-1118 or Champagne yeast). Hydrate the yeast according to the manufacturer's instructions before adding it to the must. - Primary Fermentation: Transfer the must to a sanitized primary fermentation vessel. Cover it with a cloth or lid with an airlock to allow gases to escape. Stir the must daily to mix the sediment back in and keep the yeast active.- Temperature: Maintain a fermentation temperature of 20-25°C (68-77°F). Primary fermentation typically lasts 5-7 days.

6. Secondary Fermentation Racking: Once the primary fermentation slows down and the specific gravity drops to around 1.020, transfer (rack) the wine into a secondary fermentation vessel, leaving behind the sediment (lees). Airlock: Fit the vessel with an airlock to prevent oxygen exposure while allowing gases to escape. Secondary fermentation can take several weeks to a few months.

7. Clarification and Stabilization -Racking: Rack the wine multiple times to clarify it, each time leaving the sediment behind. - Stabilization: After the wine is clear, stabilize it by adding potassium sorbate and Campden tablets. This prevents any remaining yeast from fermenting additional sugars and protects against spoilage.

8. Aging xvi VIT B.Tech. (Chemical) -Bulk Aging Age the wine in bulk for 3-6 months in a cool, dark place. - Bottling: Once the wine is fully clarified and stable, bottle it using sterilized bottles and corks or caps. - Bottle Aging: Allow the wine to age in bottles for an additional 6-12 months for the best flavor development.

Key Considerations: -Sanitation: Keep all equipment and bottles sanitized to prevent contamination. - Temperature Control: Maintain consistent fermentation and aging temperatures to ensure the best results. - Monitoring: Regularly monitor the specific gravity and taste to track the wine's progress and make any necessary adjustments. Watermelon wine is typically light and refreshing with a subtle fruit flavor, making it a unique and enjoyable homemade wine.

FUCTIONAL REQUIREMENTS

1. Juice Extraction: System or process to efficiently extract juice from watermelon while minimizing waste.
2. Fermentation Control: Mechanism to monitor and control fermentation parameters such as temperature, pH, and yeast activity.
3. Quality Testing: Tools for testing the physicochemical properties (e.g., alcohol content, sugar levels) of the wine.
4. Nutritional Analysis: Capability to analyze the nutritional profile of the watermelon wine, including vitamins, antioxidants, and minerals.
5. Preservation and Storage: Methods for preserving the wine and maintaining quality over time (e.g., bottling, pasteurization).
6. Scalability: Ability to produce wine at different scales, from small batches to large-scale production.
7. Compliance: Ensures adherence to food safety and beverage industry standards.

NON FUCTIONAL REQUIREMENTS

1. Efficiency: The system should minimize resource wastage (e.g., water, watermelon flesh) during wine production.
2. Usability: Processes should be user-friendly and require minimal technical expertise for operation.
3. Reliability: The fermentation system should maintain consistent quality across multiple batches.
4. Cost-Effectiveness: The production process should be affordable and accessible for small-scale producers or farmers.
5. Environmental Impact: Use eco-friendly methods to manage waste and by-products from wine production.
6. Adaptability: The system should be adaptable to other fruit-based wines for broader application.
7. Safety: Ensure the end product is free of harmful contaminants and meets health regulations.

CONCLUSION

Watermelon wine represents a unique and innovative addition to the wine industry, offering a refreshing alternative to traditional grape wines. Its distinctive flavor profile, lower alcohol content, and potential

health benefits make it an appealing choice for a diverse range of consumers. The production of watermelon wine can leverage local agricultural resources, support regional economies, and provide winemakers with opportunities to diversify their product lines. In conclusion, watermelon wine offers a promising opportunity for wineries to expand their product offerings, attract new customers, and support sustainable agricultural practices. Its unique characteristics and market potential make it a valuable addition to the evolving landscape of the wine industry.

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