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The Influence of Temperature and Storage Time on Alcohol Content of Pineapple Infused Arak Bali

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Abstrak

Pengembangan minuman gastronomi dari budaya lokal adalah suatu potensi yang menarik, terutama dalam hal minuman tradisional seperti Arak Bali. Namun, keberlanjutan produk minuman beralkohol seperti Arak Bali dapat dipengaruhi oleh berbagai faktor, termasuk suhu dan waktu penyimpanan. Penelitian ini bertujuan untuk menginvestigasi pengaruh suhu dan periode waktu penyimpanan terhadap kadar alkohol dalam Arak Bali yang diinfus dengan nanas. Penelitian ini menggunakan metode Quasi Experimental dengan desain Rancangan Acak Lengkap (RAL) 2 faktor, yaitu faktor suhu dan faktor waktu penyimpanan. Hasil analisis menunjukkan bahwa kandungan Metanol dalam sampel Arak Bali memiliki hasil yang negatif. Dalam sampel yang disimpan pada suhu 1ºC–8ºC selama 7, 14, 21, dan 28 hari, kandungan Etanol berkisar antara 16,38% hingga 17,27%. Sementara itu, sampel yang disimpan pada suhu 24ºC–30ºC selama periode yang sama memiliki kandungan Etanol berkisar antara 17,27% hingga 20,49%. Hasil analisis statistik menggunakan Two Way Anova menunjukkan bahwa terdapat pengaruh yang signifikan dari suhu dan waktu penyimpanan terhadap kadar alkohol dalam Arak Bali yang diinfus dengan nanas. Hasil penelitian ini memberikan pemahaman lebih lanjut tentang faktor-faktor yang memengaruhi kestabilan dan karakteristik minuman tradisional seperti Arak Bali, dan dapat menjadi panduan dalam pengembangan produk minuman beralkohol yang berkelanjutan dan bermutu.

***Kata kunci*:** *Suhu,Waktu Penyimpanan, Arak Bali Infused Nanas, Kadar Alkohol.*

Abstract

The development of gastronomic drinks from local cultures is an interesting potential, especially in terms of traditional drinks such as Balinese Arak. However, the sustainability of alcoholic beverage products such as Arak Bali can be affected by various factors, including temperature and storage time. This study aims to investigate the effect of temperature and storage time period on alcohol content in Balinese Arak infused with pineapple. This study used the Quasi Experimental method with a Complete Randomized Design (RAL) design of 2 factors, namely temperature factors and storage time factors. The results of the analysis showed that the Methanol content in the Bali Arak sample had negative results. In samples stored at 1ºC–8ºC for 7, 14, 21, and 28 days, the Ethanol content ranged from 16.38% to 17.27%. Meanwhile, samples stored at temperatures of 24ºC–30ºC during the same period had Ethanol content ranging from 17.27% to 20.49%. The results of statistical analysis using Two Way Anova show that there is a significant influence of temperature and storage time on alcohol content in Balinese Arak infused with pineapple. The results of this study provide further understanding of the factors that influence the stability and characteristics of traditional drinks such as Balinese Arak, and can be a guide in the development of sustainable and quality alcoholic beverage products.

Keywords: Temperature, Storage Time, Pineapple Infused Arak Bali, Alcohol Content..

1. INTRODUCTION

Gastronomic drinks are one of the local cultures that have an important role so that drinks can also become a centre of tourist experience, especially for foreign tourists. The penchant of foreign tourists by consuming alcoholic beverages can open opportunities for Arak Bali as a new gastronomic tourist attraction. Traditional drinks are all types of drinks that are made and processed using local ingredients and various processing methods based on generations, and have local regional characteristics and are usually consumed by local people. Arak is a type of traditional Balinese alcoholic drink which has recently developed greatly in the tourism industry as a new form of gastronomic tourism. Literally the Arak Bali drink has developed since the arrival of Hinduism in Bali and has become an authentic

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Balinese drink, not only for the people but also religiously used in every religious ceremony or traditional event (Ardini et al., 2018; Sudiarta, 2017; Widuri, 2017). Arak is a typical Balinese alcoholic drink made from coconut sap, palm sap or palm sap, namely by fermentation with sticky rice and through a distillation process. Arak Bali is now legal to produce and consume in Bali. In its development as an innovative product, Bali Arak is now often added with various types of fruit (infused) to enhance the taste and provide a unique taste, for example Bali Arak infused with pineapple.

Previous research shows that Pineapple Infused Arak Bali contains negative methanol and based on the ethanol content, it is included in group B in accordance with government regulations regarding Safety and Quality Standards for Alcoholic Drinks with a content of 18.08% (Pakaya et al., 2021; Ratih & Habibah, 2022; Waisnawa et al., 2022). Previous research also shows that the Pineapple Infused Arak Bali contains secondary metabolite compounds (Alkaloids, Flavonoids, Phenols, Tannins and Terpenoids) (Habibah & Ratih, 2023; Sudiarto et al., 2022; Suharti et al., 2023). Many people think alcoholic drinks can last forever. The alcohol is all types of drinks that contain ethyl alcohol or ethanol, for example whiskey, vodka, gin, beer, saguer, palm wine, brem, arak and ciu. But some types have a shorter shelf life. Extreme temperatures can change the taste of a product, because temperature can break down a type of organic molecule in alcohol called terpene. Meanwhile, a relatively cold storage temperature will make it last longer. As the temperature increases, the alcohol begins to expand and can evaporate more quickly so the alcoholic drink has the potential to oxidize more quickly and change flavor over time.

In research on the effect of storage time on the alcohol content of palm wine, it was obtained that storage results from the first to the fifth day continued to increase in palm wine ethanol content, 8.1%, 8.2%, 9.1%, 10.6%, and 11.6% (Mussa, 2014; Pradnyandari et al., 2017; Sari & Fajar, 2019). This result in line with other research regarding the influence of variations in temperature and storage time on increasing alcohol content in palm sap (Amema et al., 2017; Sondakh & Ghiffari, 2022). Apart from that, the addition of pineapple to the Pineapple Infused Arak Bali product can also increase the alcohol content. The ethanol content in pineapple increases with increasing temperature and storage time (Chadare et al., 2021; Xing et al., 2022).

Based on this description, the authors are interested in conducting research related to the influence of variations in temperature and storage time on the alcohol content of Pineapple infused Arak Bali products using the Gas Chromatography method. This method was chosen because the analysis process is carried out quickly, usually in minutes, is more efficient, has high resolution, high sensitivity, can detect in ppm (parts per million) and even ppb (parts per billion), quantitative analysis with high accuracy, requires samples in small amounts (generally in µl), reliable, relatively simple, identification of all types of volatile organic compounds, and can carry out qualitative and quantitative analysis of compounds in mixtures (McNair et al., 2019; Poole, 2021). This research was conducted with the aim of determining the influence of variations in temperature (1ºC – 8ºC and 24ºC – 30ºC) and storage time (7 days, 14 days, 21 days, 28 days) on the alcohol content of the Pineapple Infused Arak Bali as a new gastronomic tourist attraction product.

2. METHODS

The type of research used was Quasi experimental with a Completely Randomized Design with 2 factors, namely the temperature factor and the storage time factor, and divided into 2 treatment groups, namely storage treatment at a temperature of 1ºC – 8ºC and storage at a temperature of 24ºC – 30ºC. Alcohol content analysis was carried out in 2 replications. Based on the variations in treatment in this study, it can be explained that the total number of

group I and group II sample treatments at each storage time (7 days, 14 days, 21 days, 28 days) was carried out as many as 16 treatments or 16 samples. The samples used were Arak Bali obtained from Merita Village - Karangasem and fresh local pineapple.

Pineapple Infused Arak Bali is made with the composition of 400 grams of fresh pineapple mixed into 500 ml of Arak Bali. In this research, Pineapple Infused Arak Bali products were stored at varying temperatures of 1ºC – 8ºC and 24ºC – 30ºC and storage time variations of 7 days, 14 days, 21 days and 28 days were used as sample. The alcohol content test in this study used the Gas Chromatography method.

This method is used to test the purity of certain substances, or separate different components from a mixture. The data obtained in this research are the results of alcohol content analysis tests expressed in percent units (%). Analysis of Alcohol content was carried out at UPT-Analytic Laboratory of Udayana University with the specifications of the Gas Chromatography Varian 3300 instrument at room conditions of 20±2°C and 60±10% humidity. To determine the effect of temperature and storage time on the alcohol content of Pineapple Infused Arak Bali, Two Way Anova statistical test was carried out. Meanwhile, to determine the effect of each treatment, a Multiple Comparison test was carried out with Tukey HSD.

3. RESULTS AND DISCUSSION

Result

Alcohol content testing consists of testing for ethanol content (%) and methanol content (%) contained in the entire test sample with 2 replications are presented in Table 1, Figure 1, Figure 2, Figure 3 and Table 2.

Table 1. Results for Methanol Content and Ethanol Content of Pineapple Infused Arak Bali

Sample		Methanol Content	Ethanol Content (%)	Mean (%)
SD	7	Negative	16,34	16,38
			16,41	
	14	Negative	16,68	16,68
			16,67	
	21	Negative	16,83	16,87
			16,91	
	28	Negative	17,12	17,27
			17,42	
SR	7	Negative	17,14	17,27
			17,39	
	14	Negative	18,49	18,49
			18,48	
	21	Negative	19,63	19,59
			19,54	
	28	Negative	20,33	20,49
			20,65	

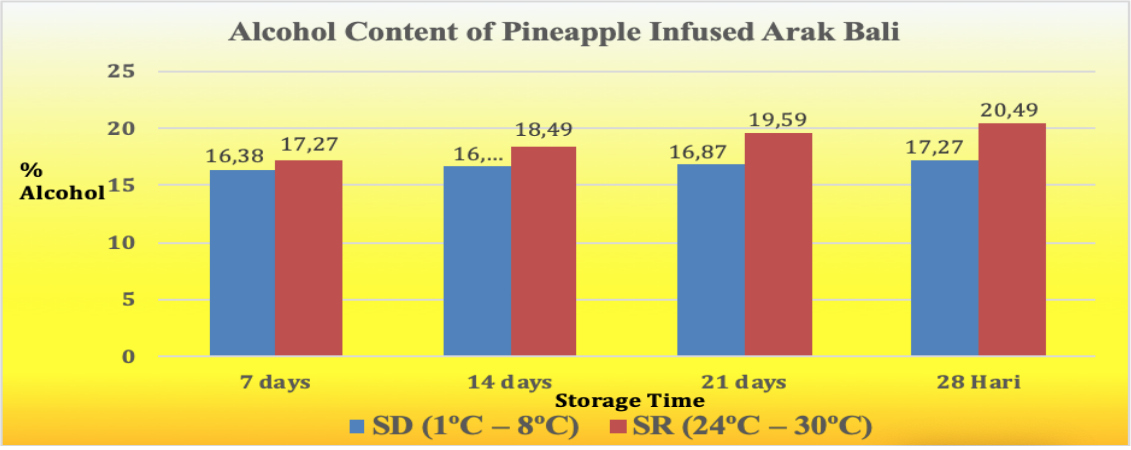

Figure 1. Graph of Alcohol Content based on Temperature and Storage Time

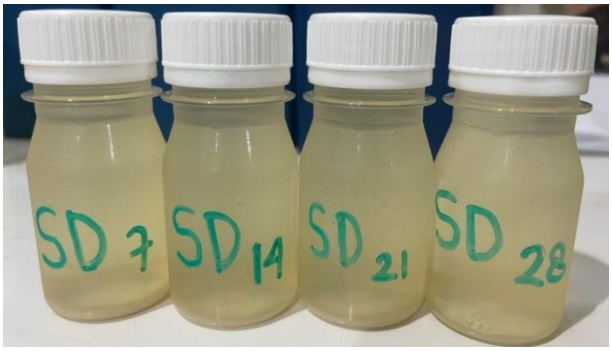

Figure 2. Pineapple Infused Arak Bali at Storage Temperature 1ºC – 8ºC (SD)

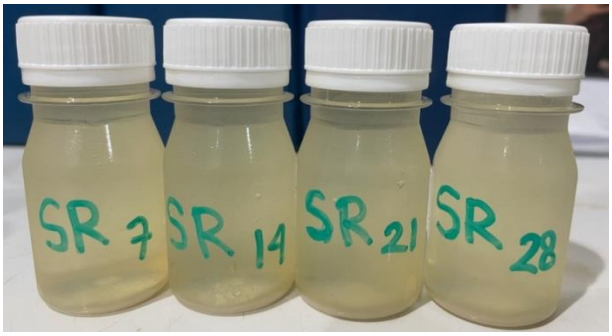

Figure 3. Pineapple Infused Arak Bali at Storage Temperature 24ºC – 30ºC (SR)

Table 2. Anova Test Results on The Influence of Temperature and Storage Time on The Alcohol Content of Pineapple Infused Arak Bali

Source	Type III Sum of Squares	df	Mean Square	F	Sig.
Corrected Model	31.145	7	4.449	259.340	.000
Intercept	5113.323	1	5113.323	298044.302	.000
Temperature	18.641	1	18.641	1086.532	.000
Time	9.337	3	3.112	181.416	.000
Temperature * Time	3.167	3	1.056	61.533	.000
Error	.137	8	.017		
Total	5144.605	16			
Corrected Total	31.282	15			

Discussion

Analysis of alcohol content in SD and SR samples was carried out using the Gas Chromatography method to detect the presence of ethanol and methanol in the samples. In principle, the separation in Gas Chromatography (GC) is based on the difference in the ability of the analyte distribution between the mobile phase and the stationary phase in the column at different speeds and times. The advantages of the gas chromatography method are short analysis times and high separation sharpness. Gases and vapors have low viscosities, and the partition equilibrium between gas and liquid takes place rapidly. The gas phase compared to most of the liquid phase is not reactive to the stationary phase and dissolved substances (Aryasa et al., 2019; Rahmi et al., 2013; Sudarma & Parwata, 2017).

Based on the analysis of alcohol content in SD and SR samples, negative results for methanol content were obtained. The SD sample contained 16.38% Ethanol at 7 days of storage, 16.68% at 14 days of storage, 16.87% at 21 days of storage, and 17.27% at 28 days of storage. Meanwhile, the SR sample contained 17.27% ethanol at 7 days of storage, 18.49% at 14 days of storage, 19.59% at 21 days of storage, and 20.49% at 28 days of storage. This is in accordance with the regulation that concerning Standards for Safety and Quality of Alcoholic Beverages, which states that the definition of Arak is an alcoholic beverage obtained from the distillation of alcoholic liquids from fermented foodstuffs such as rice, sorghum, molasses, juice and/or fruit with standard quality of Arak scent, normal and unique flavor, ethanol content not less than 30% V/V, methanol content not more than 0.01% V/V (calculated against product volume) (Rusdi et al., 2023; Sibuea, 2017). The content of ethanol in liquor in small quantities provides the advantage of a warm taste (Mustikasari et al., 2019; Najiyah & Hariani, 2021).

The increase in ethanol content in SD and SR is in accordance with previous research on the effect of temperature and storage time on the alcohol content of palm sap, the longer the storage time, the higher the alcohol content produced (Ansar et al., 2019; Herayati et al., 2022). Alcohol content can increase because the optimum temperature is room temperature, and at low temperatures the growth of alcohol-forming microbes will be inhibited (Lestari et al., 2018; Setiawati & Yunianta, 2018). The increase in alcohol content with the length of storage time can also be caused by the presence of pineapple fruit. Previous research on the effect of storage temperature on the ethanol content of Queen pineapples showed that the ethanol content in pineapple increased with increasing temperature and storage time (Chadare et al., 2021; Xing et al., 2022). The results of the analysis of alcohol content in SD samples showed a smaller increase in alcohol content compared to SR samples. This is because storage at cold temperatures can slow down the speed of metabolic reactions, where generally a decrease in temperature causes the reaction speed to be reduced by half. Not only because respiration activity decreases, but also because the growth of microbes that cause rot and damage can be inhibited (Amema et al., 2017; Sondakh & Ghiffari, 2022). Cold temperatures cannot kill microbes but only inhibits their growth (Laswati, 2017; Sumartini, 2019). To determine the effect of temperature and storage time on the alcohol content of Pineapple Infused Arak Bali, Two Way Anova statistical test was carried out. The statistical test results show that the P value is smaller than α=0.05, which means that there is an influence of temperature and storage time on the alcohol content of Pineapple Infused Arak Bali. To determine the effect of each treatment, a Multiple Comparison test was carried out with Tukey HSD. The results obtained were that there was an influence of each treatment on alcohol content, between Pineapple Infused Arak Bali which was stored at a temperature of 24ºC – 30ºC for 7, 14, 21, 28 days and between Pineapple Infused Arak Bali which was stored at a temperature of 1ºC – 8ºC for 7, 14, 21, 28 days. Based on these results, Pineapple Infused Arak Bali products should be stored at a temperature of 1ºC – 8ºC to maintain the alcohol content of the product as a new gastronomic tourist attraction product.

4. CONCLUSION

Based on the results of research that has been carried out, analysis of the alcohol content in Pineapple Infused Arak Bali samples, negative results for methanol content were obtained. Samples stored at 1ºC–8ºC for 7, 14, 21, and 28 days contained 16.38%, 16.68%, 16.87%, and 17.27% ethanol. Meanwhile, samples stored at 24ºC–30ºC for 7, 14, 21 and 28 days contained 17.27%, 18.49%, 19.59%, 20.49% ethanol. The results of the Two Way Anova test show that there is an influence of temperature and storage time on the alcohol content of Pineapple Infused Arak Bali.

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