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Formulation and Analysis of Alcohol Content in Pineapple Infused Arak Bali with Gas Chromatography

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Abstrak

Minuman gastronomi merupakan salah satu budaya lokal yang memiliki peran penting dalam perkembangan dunia pariwisata, salah satunya adalah arak Bali. Berbagai produk Arak Bali infused mulai dikembangkan untuk memperkaya citarasa. Salah satu bahan yang potensial untuk meningkatkan aroma dan citarasa adalah buah nanas. Penelitian ini dilakukan untuk mengetahui formulasi yang paling digemari serta kadar alkohol dari Arak Bali Infused Nanas sebagai minuman gastronomi baru yang aman sesuai dengan peraturan pemerintah. Jenis penelitian yang digunakan adalah True Experimental dengan rancangan Posttest Only Control Group Design. Sampel yang digunakan adalah arak Bali infused nanas yang diformulasikan menjadi 5 variasi konsentrasi. Selanjutnya dilakukan analisis kadar alkohol dengan metode Kromatografi Gas. Sampel F4 terpilih berdasarkan uji organoleptis dari 30 panelis sebagai formula yang paling digemari. Analisa kadar alkohol menunjukkan kedua sampel negatif methanol sedangkan kandungan etanol pada FD (34.22%) termasuk minuman keras golongan C dan FU (18.08%) termasuk golongan B sesuai dengan peraturan pemerintah.

Kata kunci: *Formulasi Arak Bali, Arak Bali Infused Nanas, Kadar Alkohol*

Abstract

Gastronomic drinks are one of the local cultures that have an important role in the development of the tourism world, one of which is Arak Bali. Various products of Arak Bali infused began to be developed to enrich the flavor. One of the potential ingredients to increase scent and flavor is pineapple. This study was conducted to determine the most popular formulation and the alcohol content of Pineapple Infused Arak Bali as a new safe gastronomic drink in accordance with government regulations. The type of research used True experimental with Posttest Only Control Group Design. The sample used was pineapple infused Arak Bali that was formulated into 5 concentration variations. Furthermore, the alcohol content analysis was carried out using Gas Chromatography method. Sample F4 was selected based on organoleptic tests from 30 panelists as the most popular formula. Analysis of alcohol content showed that both samples were negative for methanol while the ethanol content in FD (34.22%) was classified as group C liquor and FU (18.08%) was classified as group B in accordance with government regulations.

Keywords: Formulation of Arak Bali, Pineapple Infused Arak Bali, Alcohol Content

1. INTRODUCTION

Bali is one of the famous islands in the field of tourism because of its natural beauty, diversity of arts and culture, and religious traditions (Jaya et al., 2019; Pratiwi et al., 2017; Yeni & Khairunnisa, 2021). Along with the development of the tourism industry and increasing competition between tourist destinations in various regions, now local culture has become valuable as a product and activity to attract tourists (Dewi et al., 2014; Sucitawathi et al., 2019). Gastronomic drinks are one of the local cultures that have an important role so that drinks can also become a center 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 (Dragan, 2020; Vacl, 2019).

Arak is a traditional Balinese drink that contains alcohol (ethanol). In general, arak is made from coconut sap, palm sap or palm sap, but there is also arak made from rice or glutinous rice with fermentation and distillation process (Hayati et al., 2018; Sukadana & Tenaya, 2016). Arak Bali included in the category C alcoholic beverages because it has an

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alcohol content of above 25%. The specifications of this drink are clear, colorless liquid, with a strong alcoholic taste (Sukadana et al., 2012; Sukadana & Tenaya, 2016). Liquor production in Indonesia is generally prohibited, but in contrast to Arak Bali. Arak is actually used as a souvenir for tourists who come to Bali. Arak Bali is believed to be efficacious for warming the body, relieving nausea and other traditional remedies, it can also be used as a boreh or warming medicine to relieve itching. Arak continues to grow consumed by local people and foreign tourists (Astuti et al., 2018; Waisnawa et al., 2022). The effectiveness of the promotion of Arak Bali as a local gastronomic product has the potential to leave a certain impression in the minds of tourists after their experience of consuming local products. Thus the product will have certain attribute values for the destination which will become a kind of pull motivation for tourists (Elistyawati et al., 2020).

One of the local ingredients that can be used is pineapple, which is processed by thinly sliced and then fermented and filtered. This flavor infusion has a unique taste and is able to increase the commercial value of the product (Fenita et al., 2015; Machin, 2012). In turn, this infused arak can also be used as a basic ingredient for making products such as sauces for food and cocktails in beverages. In addition, another advantage of processing local ingredients into liquor is the added economic value that contributes to the prosperity of the local community (Elistyawati et al., 2020). The process of making Arak infused products is made by inserting a pineapple that has been cut into small pieces into the Arak Bali, then shaking and soaking it. This pineapple infused Arak Bali product was allowed to stand for one week at room temperature before the testing process was carried out. Storage for one week is similar to the extraction method of maceration, namely the process of soaking the material with a solvent that is in accordance with the active compound to be taken. Extraction time is very influential on the compounds produced. The right maceration time will produce optimal compounds. Maceration time that is too short can result in not all compounds being dissolved in the solvent used, so it takes one week for the extraction of these secondary metabolites to be carried out optimally (Budiyanto & Yulianingsih., 2008; Hayati et al., 2018; Syartanti, 2021).

The principle of this infused Arak drink is to use Arak Bali as a soaking solvent which will take the active compounds from the pineapple, so that the secondary metabolites present in the pineapple will be extracted into the Arak. Arak Bali is known to contain ethanol, ethanol has polar properties that can attract most of the active compounds contained in pineapples (Sukadana et al., 2012; Sukadana & Tenaya, 2016). The solvent will attract secondary metabolites with similar solubility in the cytoplasm and carry them out. The liquid-liquid extraction preparation method is based on the principle of the law of like dissolves like that polar compounds will dissolve in polar compounds and nonpolar compounds will dissolve in nonpolar compounds. Shaking is carried out with the aim of balancing the concentration of the substance to be extracted and getting the desired extract results (Sulihono et al., 2012).

The fermentation process is more than three days, there will be an overhaul of sugar into alcohol and carbon dioxide, as well as oxidation of organic nitrogen compounds. The longer the fermentation time, the higher the alcohol content produced and the more yeast dose given, the higher the alcohol content (Fibriari et al., 2012; Rosyadi et al., 2014). That the high and low levels of sugar and alcohol content is influenced by the amount of carbohydrate content (Sriyanti, 2003). The results of phytochemical tests on pineapple pulp juice samples were reported to contain secondary metabolites of the Alkaloids, Flavonoids, Steroids/Terpenoids, and Tannins (Yusliana et al., 2019). Flavonoids have various types and are present in the free form (aglycone) or bound as glycosides (Astarina et al., 2013).

Flavonoid glycosides contain a number of hydroxyl groups and sugars, with the sugar content in this type of flavonoid, there are carbohydrates that can affect the ethanol content of

pineapple infused Arak Bali products. The presence of these secondary metabolites is an important factor in the mechanism of action of pineapple as an antibacterial. Pineapple is also often used as a flavor enhancer in alcoholic beverages such as cocktails. The acceptability of the pineapple cocktail flavor variant is also the most preferred flavor variant as an alternative to pineapple processing that is beneficial for the community (Rahayu et al., 2018). Based on this description, the authors are interested in conducting research related to innovative products of gastronomic drinks in the form of " Pineapple Infused Arak Bali " which is popular and safe for consumption as an alcoholic beverage. This research was conducted with the aim of presenting the unique taste of Arak Bali which is also safe for consumption based on the alcohol content in accordance with government regulations.

2. METHODS

The type of research used is true experimental with Posttest Only Control Group Design which aims to measure the effect of treatment (intervention) on the experimental group by comparing the group with the control group (Noor, 2012). The samples used were Arak Bali obtained from Merita Village- Karangasem and fresh local pineapple which was formulated into five formulas of Pineapple Infused Arak Bali with variations in the composition of fresh pineapple as much as 100 grams (F1), 200 grams (F2), 300 grams (F3), 400 grams (F4), and 500 grams (F5). The data obtained in this study included the results of organoleptic testing of various formulations of pineapple infused Arak Bali which included color, flavor and scent parameters as well as the results of analysis of alcohol content. Organoleptic test is an initial test to determine a formula that is acceptable to consumers based on the parameters of color, flavor and scent. This test was conducted using 30 panelists. The results of the organoleptic test were then analyzed using a Likert Scale to obtain the most popular formula. The selected formula was then used as the test product (FU) and further testing was carried out by analyzing the alcohol content by gas chromatography on the FU sample and the basic formula sample (FD). Analysis of Alcohol content was carried out at UPT-Analytic Laboratory of Udayana University with the specifications of the GC Varian 3300 instrument at room conditions of 20±2°C and 60±10% humidity.

3. RESULTS AND DISCUSSION

Result

Organoleptic test or sensory test is a test method using the human senses as the main tool for measuring product acceptance. The organoleptic instrument for color, flavor, and scent uses a 5-level Likert scale, which is very poor to excellent. Five formulations of Pineapple Infused Arak Bali showed in Figure 1.

Figure 1. Five formulations of Pineapple Infused Arak Bali

The organoleptic test was carried out by tasting a small amount of the product as a sample, with the rule that the panelists were accustomed to consuming Arak Bali, and after

tasting each product formula the panelists neutralized their sense of taste by drinking a little mineral water. Results of the Organoleptic test with a Likert scale showed in Table 1.

Table 1. Results of the Organoleptic test with a Likert scale.

Organoleptic Test	Likert Percentage (%)				
	F1	F2	F3	F4	F5
Color	70.00	78.66	93.33	**97.33**	95.33
Flavor	28.00	76.66	77.33	**95.33**	75.33
Scent	63.33	77.33	92.00	**96.66**	80.00

The following are the criteria for interpreting the scores based on intervals:

- 0% – 19.99% = Very poor
- 20% – 39.99% = Poor
- 40% – 59.99% = Fair / Neutral
- 60% – 79.99% = Good/Like
- 80% – 100% = Excellent

Based on the results of the organoleptic test, the selected test formula was F4, then coded as FU. The selected formula sample (FU) showed in Figure 2. Pure Arak Bali as the basic formula sample (FD) showed in Figure 3.

Figure **2**. The selected formula sample (FU)

Picture 3. Pure Arak Bali as the basic formula sample (FD)

Analysis of the alcohol content in this study used the Gas Chromatography method. This method is used to test the purity of certain substances, or to separate different components of the mixture. The alcohol content test consisted of the Ethanol content test (%) and the Methanol content from the basic formula sample (FD) and the selected formula sample (FU) with 3 times replicated. Results of Analysis of Alcohol Content showed in Table 2.

Table 2. Results of Analysis of Alcohol Content

Sample	Methanol Content	Ethanol Content (%)	Mean (%)
FD	Negative	35.32	34.22
	Negative	33.32	
	Negative	34.02	
FU	Negative	18.43	18.08
	Negative	17.66	
	Negative	18.16	

Discussion

Organoleptic tests are widely used to assess quality in the food industry and other agricultural products industries. This test was conducted to determine the level of consumer preference for color, flavor, scent. The preference test is a test which is a test that asks the panelists to express their response in the form of liking or disliking the properties of the material being tested (Maligan et al., 2018; Saragih et al., 2018). In the assessment of foodstuffs, the characteristic that determines whether a product is accepted or not is its sensory properties. The senses used in assessing the nature of the senses are the senses of sight, touch, smell and taste. While the questionnaire is a tool in the form of a list of questions that must be filled out by the person (panelist) to be measured (Maryuliana, Subroto, I. M., & Haviana, 2016; Maryuliana, 2016).

The organoleptic test in this study was conducted to determine the selected formulation with the test method carried out, namely scoring based on the highest Likert percentage score. The results of the organoleptic test obtained F4 formula with the highest score and excellent interpretation criteria on color parameters (97.33%), flavor (95.33%), and scent (96.66%). Color is the first impression that appears and is judged by the panelists. Color is the first organoleptic parameter in presentation. Color is the first impression because it uses the sense of sight. Attractive colors will invite panelists or consumers to taste the product (Winarno, 2002). Flavor is one of the factors that can determine whether a product is acceptable or not by consumers (Fibriari et al., 2012; Udin et al., 2020). Scent is one of the parameters in testing the sensory properties (organoleptic) using the sense of smell. Scent is acceptable if the resulting material has a specific scent. Furthermore, scent is a subjective sensation produced by smell.

Analysis of alcohol content in FD and FU 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 (Sudarma & Parwata, 2017; Udin et al., 2020).

Based on the analysis of alcohol content in samples FD and FU obtained negative results on the Methanol content. The FD sample (pure Arak Bali) contained 34.22% of Ethanol and the FU sample (selected formula) contained 18.08% of Ethanol. 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 distinctive flavor, ethanol content not less than 30% V/V, methanol content not more than 0.01% V/V (calculated against product volume). Ethyl alcohol or ethanol is a chemical that belongs to the alcohol group. Ethanol has a chemical structure of C_2H_5OH, volatile, colorless, and polar so it is used as a solvent for various compounds. The polar nature of ethanol makes this chemical often used as a drug solvent, preservative in the medical world, disinfectant and is usually used as an antidote (compound that reduces or eliminates toxicity) methanol and ethylene glycol poisoning. The content of ethanol in liquor in small quantities provides the advantage of a warm taste (Ayuningtyas, 2016; Sukadana & Tenaya, 2016).

Ethanol content in sample FU decreased from FD (as the basic formula). This shows the pineapple infused Arak Bali product is included in category B based on the regulation of the Minister of Health regarding liquor which states that alcoholic beverages are Group A:

1% to 5% of ethanol content, Group B: 5 to 20 % of ethanol content, Group C: more than 20 to 55% of ethanol content. The decrease in ethanol content in FU can also be caused by the addition of fresh pineapple as an infused material so that increases the water content in the FU sample. Pineapple has a high water content of 85.3% but is low in protein content and has pectin which is easily hydrolyzed (Fenita et al., 2015; Muchtadi, 2000). This relatively high water content (85.3%) causes pineapple to be a fruit that cannot be stored for a long time because it is easily damaged, shrinks, and rots quickly (Rahayu et al., 2018; Yusliana et al., 2019).

4. CONCLUSION

Based on the results of research that has been carried out on the formulation of Arak Bali Infused Pineapple and analysis of alcohol content shows that F4 was selected based on the results of organoleptic tests from 30 panelists as the most popular Pineapple Infused Arak Bali formula. Based on the analysis of alcohol content, it can be concluded that the two samples showed negative results on the Methanol content and the Ethanol content in the FD sample was classified as group C liquor, while the FU sample entered group B in accordance with government regulations regarding the content of Methanol and Ethanol in liquor. The results of the analysis of alcohol content in this study are also in accordance with the Safety and Quality Standards of Alcoholic Beverages.

5. REFERENCES

Astarina, N. W. G., Astuti, K. W., & Wardiatiani. (2013). Skrining Fitokimia Ekstrak Metanol Rimpang Bangle. *Jurnal Farmasi Udayana*.

Astuti, N. P. W., Suaniti, N. M., & Mustika. (2018). Validasi Metode Dalam Penentuan Kadar Etanol Pada Arak Menggunakan Kromatografi Gas Detektor Ionisasi Nyala. *Jurnal Kimia (Journal of Chemistry)*, *12*(2). https://doi.org/10.24843/JCHEM.2018.v12.i02.p06.

Ayuningtyas, K. D. (2016). *Efek Etanol dan Metanol Pada Minuman Oplosan Terhadap Perubahan Histopatologi Organ Hepar Tikus Wistar Jantan*. Universitas Jember.

Budiyanto, A., & Yulianingsih. (2008). Pengaruh Suhu Dan Waktu Ekstraksi Terhadap Karakter Pektin dari Ampas Jeruk Siam (Citrus nobilis L). *Jurnal Pascapanen*, *5*(2). https://doi.org/10.21082/jpasca.v5n2.2008.37-44.

Dewi, I. A. K. S., Sendratari, L. P., & Mudana, I. W. (2014). Pemertahanan Tradisi Budaya Petik Laut Oleh Nelayan Hindu Dan Islam Di Desa Pekutatan, Jembrana -Bali. *Widya Winayata: Jurnal Pendidikan Sejarah*, *2*(3). https://doi.org/10.23887/jjps.v2i3.4153.

Dragan, V. (2020). Gastronomic product in the function of development of different forms of tourism in Srem district. *Održivi razvoj*, *2*(2). https://doi.org/10.5937/OdrRaz2002041V.

Elistyawati, I. A., Wendri, I. G. M., & Agung, I. G. A. G. (2020). Sustainable Utilization of "Arak Bali"; Processing It into Liqueur as Base Stuff for Food and Beverage Production. *PalArch's Journal of Archaeology of Egypt/ Egyptology*, *17*(7).

Fenita, Y., Mega, O., & Daniati, E. (2015). Pengaruh Pemberian Air Nanas (Ananas cosumus) terhadap Kualitas Daging Ayam Petelur Afkir. *Jurnal Sain Peternakan Indonesia*, *4*(1). https://doi.org/10.31186/jspi.id.4.1.43-50.

Fibriari, I., Gunawan, G., & Hastuti, R. (2012). Pengkayaan Alkohol Ciu Bekonang dengan Metode Destilasi Adsorptif Menggunakan Zeolit Alam dan Silika Gel. *Jurnal Kimia Sains dan Aplikasi*, *15*(3). https://doi.org/10.14710/jksa.15.3.79-83.

Hayati, A., Winarni, D., Antari, N. W. S., Resita, I. N., & Fauziah, E. N. (2018). Effects of

Arak Bali Administration on Spermatozoa DNA Fragmentation and Testosterone Level of Rats (Rattus norvegicus). *Folia Medica Indonesiana*, *54*(1). https://doi.org/10.20473/fmi.v54i1.8051.

Jaya, Ngakan, A. W., M., D. K. S., & Putu, S. (2019). Mapping the potential for tourism strategic areas to improve the equality of development in Bali. *Matec Web of Conferences*, *276*. https://doi.org/10.1051/matecconf/201927602008.

Machin, A. (2012). Potensi Hidrolisat Tempe Sebagai Penyedap Rasa Melalui Pemanfaatan Ekstrak Buah Nanas. *Biosaintifika: Journal of Biology & Biology Education*, *4*(2). https://doi.org/10.15294/biosaintifika.v4i2.2275.

Maligan, J. M., Salsabella, F., & Wulan, S. N. (2018). Uji Preferensi Konsumen Pada Karakteristik Organoleptik Produk Roti Gandum Utuh Di Kota Malang Jawa Timur. *Jurnal Pangan dan A*, *6*(4). https://doi.org/10.21776/ub.jpa.2018.006.04.8.

Maryuliana, Subroto, I. M., & Haviana, S. F. (2016). Sistem Informasi Angket Pengukuran Skala Kebutuhan Materi Pembelajaran Tambahan Sebagai Pendukung Pengambilan Keputusan Di Sekolah Menengah Atas Menggunakan Skala Likert. *Jurnal Transistor Elektro dan Informatika (TRANSISTOR EI)*, *1*(2), Jurnal Transistor Elektro dan Informatika (TRANSIS. https://doi.org/10.30659/ei.1.1.1-12.

Maryuliana. (2016). Sistem Informasi Angket Pengukuran Skala Kebutuhan Materi Pembelajaran Tambahan Sebagai Pendukung Pengambilan Keputusan Di Sekolah Menengah Atas Menggunakan Skala Likert. *Jurnal Transistor Elektro dan Informatika*, *1*(2), 1–12. https://doi.org/10.30659/ei.1.1.1-12.

Muchtadi. (2000). *Fisiologi Pasca Panen. Pelatihan Pasca Panen dan Prosesing Hortikultura, Ciawi*. BPLLP.

Noor, J. (2012). *Metodologi Penelitian*. Kencana Prenada Media Group.

Pratiwi, D. P. E., Ayomi, P. N., & Candra, K. D. P. (2017). Balinese Arts And Culture As Tourism Commodity In Bali Tourism Promotion Videos. *MUDRA: JURNAL SENI BUDAYA*, *32*(3). https://doi.org/10.31091/mudra.v32i3.178.

Rahayu, W. E., Mukminah, N., & Romalasari, A. (2018). Daya Terima Varian Rasa Koktail Buah Nanas (Ananas comosus L. Merr) dalam Menunjang Diversifikasi Produk. *Jurnal Ilmiah Ilmu dan Teknologi Rekayasa*, *1*(1). https://doi.org/10.31962/jiitr.v1i1.4.

Rosyadi, F. A., Prasavitri, K. P., & Widjaja, T. (2014). Optimasi Proses Produksi Etanol dari Molases Menggunakan Teknik Fermentasi- Ekstraktif. *Jurnal Teknik ITS*, *3*(2). https://doi.org/10.12962/j23373539.v3i2.6459.

Saragih, M. D. S., Bakti, D., & Safni, I. (2018). Uji Preferensi Spodoptera litura (Lepidoptera: Noctuidae) Terhadap Beberapa Tanaman Leguminosa dan Palmae. *Jurnal Pertanian Tropik*, *5*(2). https://doi.org/10.32734/jpt.v5i2.2997.

Sriyanti. (2003). *Studi Komparatif Kadar Gula dan Alkohol Tape Singkong dari Varietas yang Berbeda*. Universitas Muhammadiyah Surakarta.

Sucitawathi, D., Dewi, N. L. Y., & Joniarta, I. W. (2019). Responsivitas Kebijakan Lokal Dalam Menghadapi Dinamika Sosial Di Desa Tradisional Bali Aga: Kasus Desa Tenganan Pegringsingan, Karangasem Bali. *Jurnal Administrasi Negara*, *9*(2). https://doi.org/10.33005/jdg.v9i2.1632.

Sudarma, N., & Parwata, I. M. O. A. (2017). Determination Ethanol In Arak With Gas Chromatography. *Bali Medika Jurnal*, *4*(2). https://doi.org/10.36376/bmj.v4i2.10.

Sukadana, Bandem, & Tenaya. (2012). Technical Appraisal of Continuous Destilator Type as Alternative Fuel Producer from Basic Materials of Arak Bali. *Jurnal Energi Dan Manufaktur*, *3*(2).

Sukadana, I. G. K., & Tenaya, I. G. N. P. (2016). Performansi mesin berbahan bakar etanol hasil destilasi arak Bali. *Jurnal Energi Dan Manufaktur*, *9*(1).

Sulihono, A., Tarihoran, B., & Agustina, T. E. (2012). Pengaruh Waktu dam Jenis Pelarut Terhadap Ekstrak Pektin dari Kulit Jeruk Bali (Citrus Maxima). *Jurnal Teknik Kimia*, *4*(18). https://doi.org/10.29103/jtku.v6i1.467.

Syartanti, N. I. (2021). Legalization of Arak Bali in Online News Headlines: Critical Discourse Analysis. *Humaniora*, *33*(3). https://doi.org/10.22146/jh.68220.

Udin, J., Nurlaelah, I., & Priyanto, A. (2020). Pengaruh Kadar Konsentrasi Saccharomyces Cereviciae Terhadap Sifat Organoleptik Dan Sifat Kimia (Alkohol Dan Gula) Pada Brem Cair Ipomea Batatas L. *Edubiologica Jurnal Penelitian Ilmu dan Pendidikan Biologi*, *8*(1). https://doi.org/10.25134/edubiologica.v8i1.2982.

Vacl, J. (2019). Motivation of Participation in Beer and Brewery Festivals in the Czech Republic. *Kvasný průmysl*, *61*. https://doi.org/10.18832/kp2015028.

Waisnawa, I. G. N. S., Arsani, I. A. A., Rajendra, I. M., & Sudana, I. M. (2022). Inovasi Teknologi Dan Optimalisasi Proses Destilasi Untuk Produksi Arak Tradisional Bali. *Bhakti Persada: Jurnal Aplikasi Ipteks*, *8*(1). https://doi.org/10.31940/bp.v8i1.69-76.

Winarno. (2002). *Kimia Pangan dan Gizi*. Gramedia Pustaka.

Yeni, R., & Khairunnisa, A. S. (2021). Environmental communication on ecotourism development: a case study of Subak Sembung, Bali. *E3S Web of Conferences*, *316*. https://doi.org/10.1051/e3sconf/202131604011.

Yusliana, Sarwendah, Laia, H. C. G., Daely, P. J., & Chiuman, L. (2019). Uji Daya Hambat Antibakteri Air Perasan Daging Buah Nanas (Ananas comosus (L) Merr Var. Queen) Terhadap Bakteri Salmonella typhi. *Scientia Journal*, *8*(1). https://doi.org/10.5281/scj.v8i1.388.