



ANALYSIS (HALAL AND HARAM) ALCOHOL ON BLACK STICKY RICE AND CASSAVA TAPAI USING CHEMICAL AND FIQH STUDIES

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Abstract

*Tapai is fermented with the fungus *Saccharomyces cerevisiae* which produces ethanol and other types of alcohol. Ethanol is mostly contained in khamar but based on the opinion of the MUI and Tarjih Muhammadiyah tapai is Halal. This study aims to analyze the alcohol in tapai black sticky rice and cassava based on chemical and fiqh studies. The type of this research is literature review with systematic mapping study. The data that has been obtained are then processed and analyzed based on two perspectives. Based on the analysis of the existing data, (i) Chemically, the limit for tapai consumption so as not to become intoxicating is when the alcohol content of the tapai is not more than 5%; (ii) Cassava Tapai in the market is not intoxicating when the alcohol content ranges from 0.5-5% but will have an effect on the body when it cannot tolerate; (iii) If the water in tapai is separated from the tapes and has an alcohol content of more than 5% then it is categorized as khamr, it identical to sake and soju; (iv) Tapai which is safe for consumption is tapai which is fermented for no more than three days to avoid syubhat.*

Key words: *halal and haram, tapai, chemical and fiqh studies.*

INTRODUCTION

Tapai is a traditional fermented food in several Southeast Asian countries and favored by the people of Indonesia (Marminah, 2012). Even some regions in Indonesia make tapai as souvenirs typical of the area. In Indonesia, there are two main types of ingredients that are commonly used as the basic ingredients for making tapai, namely tapai from cassava and sticky rice. The fungi used were *Endomycopsis fibuligera*, *Rhizopus oryzae* or *Saccharomyces cerevisiae* in yeast form (Calista, Priyanto, & Wijaya, 2019). Tapai has a characteristic sweet and slightly sour taste due to the alcohol it contains, has a fresh slightly sour aroma with a hint of alcohol, the texture is soft and watery (Hidayat, Padaga, & Suhartini, 2006).

Tapai is made by a fermentation technique resulting in an oxidation reaction of organic compounds in cassava/black sticky rice with yeast (N.M., 2015). The fermentation technique will produce ethanol and CO₂ (Berlian, Aini, &

Ulandari, 2016), then the active microorganism (yeast) converts carbohydrates into sugar and alcohol (Tetchi, Solomen, Celah, & Georges, 2012), it also causes the texture of the tapai to be soft and watery (Hasanah, Jannah, & Fasya, 2012).

Fermentation is a metabolic process of chemical changes in organic substrates with microbial activity that spoils the fermentation material (Asnawi, 2013). Fermentation is influenced by starch, type of microbe, temperature, pH, aeration and the addition of certain materials. The fermentation technique in making tapai has four stages, including: a) Enzymatic hydrolysis of starch molecules is broken down into dextrins and simple sugars; b) the sugar formed will be converted into alcohol (ethanol); c) Through the process of alcohol oxidation, *pediococcus* and *acetobacter* bacteria will convert alcohol into organic acids; d) The distinctive taste of tapai comes from the reaction between alcohol and organic acids that form esters (Azmi, Nghoh, Mel, & Hasan, 2010).

Fermentation has been discussed by the prophet Muhammad on HR. Ahmad narrated

Ibnu Umar, Rasulullah Shallallahu ‘alaihi wa sallam bersabda: *“Minumlah itu (jus) selagi ia belum keras”*. Sahabat bertanya, *“Berapa lama ia menjadi keras?”*. *“ia menjadi keras dalam tiga hari”*, Jawab Nabi ¹⁰.

Besides that there is a hadith from Abu Hurairah which is acknowledged by Abu Daud, An-Nasa'i and Ibn Majah which explains that when a friend brought a juice drink to the Prophet who was about to break his fast, the Prophet refused the drink and suggested throwing it away because bubbles had formed in the drink. (Ariani, 2015).

Dari an-Nu'man bin Basyir Radhiyallahu ‘anhu, ia berkata, *“Rasulullah Shallallahu ‘alaihi wa sallam bersabda: ‘Sesungguhnya dari gandum bisa dijadikan khamr, dari sya’ir bisa dijadikan khamr, dari anggur kering bisa dijadikan khamr, dari kurma bisa dijadikan khamr, dan dari madu bisa dijadikan khamr.’* Shahih Sunan Ibnu Majah (no. 2724), Sunan Ibnu Majah (II/1121, no. 3379), Sunan Abi Dawud (X/114, no. 3659), Sunan at-Tirmidzi (III/197, no. 1934).

Based on these hadiths, fermentation to produce khamr has been carried out by the Arabs since BC, although still in the traditional way (at room temperature). The Prophet taught us to avoid consuming fruit, seeds and honey as well as anything intoxicating the result of fermentation because it contains khamr. Khamr referred to in the fermentation technique refers to ethanol.

Ethanol (C₂H₅OH) is a type of alcohol that is generally used as an ingredient

for making khamr. Ethanol in Islam has two different laws depending on how it is made and the purpose of making ethanol. The initial law of pure ethanol is halal because it is the same as the initial law in the Sahih Sunan Ibnu Majah hadith (no. 2724), Sunan Ibnu Majah (II/1121, no. 3379), Sunan Abi Dawud (X/114, no. 3659), Sunan at-Tirmidzi (III/197, no. 1934) concerning dates, honey, grapes and grains.

Institutes for reviewing the halal and haram of a food from various countries have their own provisions on the alcohol content in a food product. For example, the Fatwa of the Kingdom of Saudi Arabia that alcohol cannot be more than 5%, Jabatan Kemajuan Islam Malaysia (JAKIM) alcohol cannot be more than 0.5% (Pauzi, Man, Mohd, Bin, & Jaafar, 2018), Majelis Ulama Indonesia (MUI) alcohol cannot be more than 1% (Patent No. 11, 2009), Tarjih Muhammadiyah alcohol cannot be more than 5% (Thaib & Latief, 2002).

Yulianti in 2014 examined the alcohol content contained in sticky rice tapai, black sticky rice and cassava tapai showed that the highest alcohol content was found in rice tapai with high levels of 11% (on day 3, 4, 5 and 6), black sticky rice with an alcohol content of 8.94% (on days 3, 4, 5 and 6) the lowest and an alcohol content of 6.92% tapai cassava (on day 3) (Yulianti, 2014). Based on a study conducted by Yulianti, the alcohol content in rice tapai and black sticky rice increased the longer the fermentation time, while in tapai cassava after reaching maximum fermentation on the third day the alcohol content continued to decrease. The decrease in alcohol content in cassava tapai was influenced by the fungus *Saccharomyces cerevisiae* which entered the stationary phase, i.e. the number of live microbes was equal to the number of dead microbes so that the *Saccharomyces cerevisiae* fungus would decrease and be unable to produce alcohol. (Hasanah et al., 2012).

The alcohol content contained in the sticky rice and cassava tapai exceeds the maximum level of alcohol consumption in the fatwah of MUI and Tarjih Muhammadiyah, but tapai sticky rice and tapai cassava are included in the category of halal food consumed (HalalMUI, 2019). Departing from the problem above, it is necessary to conduct an analytical study of halal and haram tapai black sticky rice and tapai cassava with the study of science and fiqh as the basis of science.

METHOD

The research used is a literature review with an analysis of relevant articles and books. The type of literature review research used is a systematic mapping study which begins with designing the stages of the research (Wendler, 2012). In the systematic mapping study, the selection of papers is not subjective by the researcher but uses certain keywords and filters (Dicheva, Dichev, Agree, & Angelova, 2015). The focus of the data used is experimental-based research with the keywords tapai cassava, alcohol and khamr, as well as sticky rice. This research using the literature review method aims to deepen knowledge from various sides and research that has been carried out and provide an explanation that is in accordance with scientific principles on the issues raised in this article.

RESULT AND DISCUSSION

Based on information on the nutritional value of cassava and black sticky rice per hundredth of a gram in tables 2 and 4, high in carbohydrates but low in protein. Foods with high carbohydrates and sugars easily produce alcohol in the fermentation process. In Korea and Japan, sticky rice is used as one of the fermented ingredients to produce liquor with an ethanol content of approximately 23% and 40% (Hill, 2020).

Taxonomic of Cassava	
Kingdom	Plantae
Phylum	Magnoliophyta
Class	Magnoliopsida
Subclass	Rosidae
Order	Euphorbiales
Family	Euphorbiaceae
Genus	Manihot
Species	M. esculenta

Tabel 1. Taxonomic Position According to Cronquist (1981) (Ferraro, Piccirillo, Tomlins, & Pintado, 2016)

Name	Amount	Unit
Energy	146	kcal
Protein	3.88	g
Total lipid (fat)	0.97	g

Name	Amount	Unit
Carbohydrate, by difference	33.01	g
Fiber, total dietary	1	g
Sugars, total including NLEA	0	g
Calcium, Ca	19	mg
Iron, Fe	0.35	mg
Potassium, K	369	mg
Sodium, Na	53	mg
Vitamin C, total ascorbic acid	23.3	mg
Vitamin A, IU	0	IU
Fatty acids, total saturated	0.97	g
Fatty acids, total trans	0	g
Cholesterol	0	mg

Tabel 2. Nutrition of Cassava/100 gram (Ravindran & Ravindran, 1988)

Taxonomic of Black Sticky Rice	
Kingdom	Plantae
Phylum	Spermatophyta
Class	Monocotyledonae
Order	Poales
Family	Oryza
Genus	Oryza
Species	Oryza satia var. glutinosa

Tabel 3. Taxonomic Position According to Cronquist (1981) (Norsalis, 2011)

Name	Amount	Unit
Energy	181	kcal
Protein	4	g
Total lipid (fat)	1.2	g
Carbohydrate, by difference	37.30	g
Fiber, total dietary	0.30	g
Calcium, Ca	9	mg
Iron, Fe	1.70	mg
Vitamin B1	0.06	mg
Vitamin B3	0.50	mg
Phospor	144	mg
Natrium	9	mg
Potassium	18.40	mg
Zinc	0.70	mg

Tabel 4. Nutrition of Black Sticky Rice/100 gram (AhliGiziID, 2019)

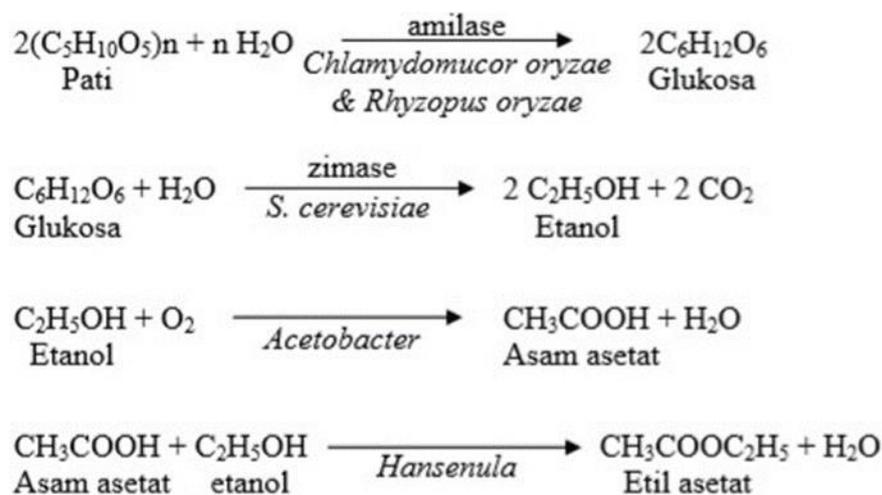
1. The Process of Making Cassava Tapai

First, the cassava is cleaned of skin and dirt so that it is clean, then weighed approximately 100 grams. Cassava is boiled until slightly soft for about 30 minutes and cooled at room temperature for about an hour. After an hour, the cassava is given yeast (*Saccharomyces cerevisiae*) 1 gram and placed in a closed plastic box and wait for fermentation to occur for 3-5 days..

The fermentation process in cassava must pay attention to the quality of cassava and yeast used. The cleanliness of cassava and yeast will also have an impact on the fermentation results. Cleanliness in cassava and yeast will result in but contains dangerous toxins (Hasanah et al., 2012). Cassava is a food that contains cyanide poison.

2. The Process of Making Glutinous Tapai

First, weigh the black sticky rice, approximately 100 grams. The black sticky rice is washed and then soaked overnight. After the soaking process wash again and separated from the water then steam the glutinous rice for about 30 minutes. The cooked black sticky rice is removed and doused with cold water and steamed again for about 30 minutes. Put the black sticky rice in the container until it cools down, when it's cold, sprinkle the black sticky rice with about 1 gram of yeast and mix it well with a mixer. Place the sticky rice in a closed plastic box and wait for fermentation for 2-3 days.



Picture 1. Chemical Reactions in the Tapai Fermentation Process

3. Alcohol in Tapai Sticky Rice and Cassava Chemical Study

In the process of making cassava and glutinous rice, yeast, cassava and sticky rice do not have much effect on the ethanol content produced (Dirayati, Gani, & Erlidawati, 2017). Ethanol content is only influenced by the duration of fermentation and the conditions in the fermentation process such as temperature and air.

Name	Percentage of Alcohol Level Per Day (%)					
	1	2	3	4	5	6
Black Sticky Rice Tapai	1.76	6.95	8.83	9.41	9.67	10.06
Cassava Tapai	0.84	7.12	8.76	6.88	5.93	5.90

Table 5. Percentage of Alcohol Concentration Against Fermentation Duration

Based on research conducted by (Hasanah et al., 2012; Yulianti, 2014) in table 5, on the first day of fermentation the alcohol content began to form in cassava tapai by 0.84% and increased for 6 days to 5.90% for cassava tapai. In contrast to the black sticky rice tapai, which continued to experience an increase in alcohol content every day on the first day of alcohol as much as 1.76% and on the 6th day it became 10.06%. Tapai cassava decreased in alcohol content after 4 days because the microbes were no longer able to produce alcohol.

The percentage of alcohol content on tapai is greater than the halal stipulation MUI and Tarjih Muhammadiyah which cannot be more than 1% and 5% (Majelis, Indonesia, & Mui, 2011). In the Minister of Health Regulation RI No. 86/Menkes/Per/IV77 Regarding liquor, alcoholic beverages are categorized into 3 groups based on the percentage content of ethanol. Category A 1-5%, Category B 5%-20%, Category C 20-55%. But Tapai is not included in liquor except for tapai black sticky rice squeezed from black sticky rice and hatching water from cassava tapai to be processed into ciu (Peraturan Menteri Kesehatan Republik Indonesia, 1977).

In the fermentation process of making tapai, ethanol and other derivative compounds such as ethyl acetate are formed (Sari & Fajar, 2018). Ethanol is widely used as a basic ingredient for making liquor, because ethanol does have intoxicating and toxic properties (Najiha & Nadiah, 2014). Besides being contained in fermented and khamr products, ethanol is also commonly found in fruits and grains with high carbohydrate and sugar content (Ahmad, Yang, Hani, & Abdullah, 2014).

Alcohol is widely found around us as contained in fruit, seeds, honey and various foods that are rich in carbohydrates and sugar. The alcohol contained in natural foods has levels ranging from approx 0 – 8% (Irawan, 2017), For example, grapes have an alcohol content of approximately 1% alcohol per fruit (Hawusiwa, Wardani, & Ningtyas, 2015). The alcohol is included in the category of natural alcohol with different contents in each type of food ingredient.

In khamr, the alcohol contained is not only ethanol but also methanol, buthanol and penthanol although in very small amounts. (Suzuki, Asanoi, Iijima, & Kitamono, 2008). Ethanol on its own cannot be a sufficiently intoxicating substance for a person. The higher the alcohol content in a food and beverage can be intoxicating, the alcohol content to be chemically intoxicating is above 5%(Mu'arif, 2013). Tapai cassava and tapai sticky rice are not intoxicating even though they have an alcohol content of more than 5%, the effect that occurs is stomach pain and dizziness when eaten because the digestive tract does not tolerate the effects of high alcohol (Berlian et al., 2016). This happens because the constituent compounds in tapai cassava and tapai sticky rice are different from the intoxicating compounds in liquor, but will be different when tapai water is separated separately from the tapai. Just as in the manufacture of soju, sake and ciu when separated the composition of the compounds also changes to be like compounds in liquor (Patent No. KR910004491B1, 1989).

There is no single surah in the Qur'an that discusses the prohibition of alcohol, so there is a need for an in-depth fiqh study of the law of consuming alcohol naturally or artificially. The fiqh law regarding alcohol is still a debate among ulama, although studies on alcohol have been carried out by many Muslim and non-Muslim scientists. Contemporary ulama in various countries agree that alcohol has two fiqh laws with a note that, (i) alcohol is not produced from the method of making khamr (*Fatwa Alkohol Majelis Ulama Indonesia.Pdf*, n.d.), (ii) the alcohol contained is not intoxicating if consumed in large quantities (Jamaludin, Ramli, & Mat, 2011), (iii) alcohol content not more than 5% (alcohol tolerance limit)(Mu'arif, 2013).

Fermentation has been alluded to in a hadith by Abu Daud, An-Nasai and Ibn Majah which explained that when a friend brought a juice drink to the Prophet who was about to break his fast, The Messenger of Allah refused the drink and suggested throwing it away because bubbles had formed in the drink (Ariani, 2015). The bubbles in the drink are the result of the fermentation process that occurs. Connected with,

Ibnu Umar, Rasulullah Shallallahu ‘alaihi wa sallam bersabda: “*Minumlah itu (jus) selagi ia belum keras*“. Sahabat bertanya, “*Berapa lama ia menjadi keras?*“. “*ia menjadi keras dalam tiga hari*“, Jawab Nabi¹⁰.

The hadith explains that fermentation for more than 3 days is the same as khamr.

The manufacture of tapai sold in the market is usually fermented for 3 to 7 days and is made in large quantities so that the alcohol content contained can vary depending on the amount of yeast and the length of fermentation (Hasanah et al., 2012). The initial average content of tapai cassava and sticky rice sold is around 1 – 3% but when in stores or on the market it will be more than a week after packaging. During the marketing period, the alcohol content will continue to increase even though it is placed in the cooler more or less 10°C. Fermentation continues when placed in cold temperatures even though it runs slowly (Fer, 2008a).

Majelis Ulama Indonesia dan Tarjih Muhammadiyah provide a clear law regarding tapai water and tapai does not include khamr except intoxicating (Majelis Ulama Indonesia, 2003; PP Muhammadiyah, 2003), but liquor from tapai water is included in the category of khamr when separated and is above 1% alcohol content. Based on a brief hadith study, tapai clashes with several hadiths about fermentation so that it is prone to halalness, but scholars do not equate fermentation with tapai because the object in the fermentation is fruit juice. Ulama in MUI assume that tapai is not as clear as pork and what is forbidden, then not all alcoholic foods are included in the haram category except intoxicating. It is based on HR. Muslim that "Every intoxicant is khamr and every khamr is haram" and explained by HR. David "Everything that confuses the mind and everything that intoxicates is haram" (Ramlan & Nahrowi, 2014).

The Prophet did not look at the ingredients that make up khamr, but saw the intoxicating effect of food or drink, based on HR. Ahmad and Abu Dawud "What if there is a lot of intoxicating then the least is also haram" (Shahih Sunan Ibni Majah no. 2736, Sunan Ibni Majah II/1124, no. 3392, and also narrated by An-Nasa'i with different lafazh VIII/300, 297) (Rosalina, 2017). According to pharmacists and doctors, there have been no related reports of drunkenness after consuming tapai (Fer, 2008b), even if the water in the tapai is separated from the tapai it will turn into liquor such as soju, sake and ciu from cassava (Hawusiwa et al., 2015). Based on the study of the hadith, 'illat prohibits khamr because it is intoxicating not alcohol or the compounds that make up a food product.

CONCLUSION

Islam has been clear about the halal and haram of a food, but as food technology develops, new studies are needed to determine the law of food that is dubious in its process and content. Tapai is a fermented food that has many devotees, especially in Indonesia, even in some areas tapai is a favorite dish during Eid al-Fitr. Ulama agree that tapai is not forbidden but the longer the fermentation process occurs, the water in the tapai will contain a high alcohol content as in liquor. Based on the Study of Fiqh and Chemistry it can be stated, tapai is not intoxicating but will have an effect on the body when it cannot tolerate alcohol.

1. If the water in the tapai is separated from the tapai and the alcohol content is more than 5% then it is included in the category of khamr because it can be intoxicating and its properties are identical to sake, soju and ciu.
2. Tapai that is safe for consumption is tapai whose fermentation is carried out for no more than 3 days to avoid doubts.
3. Consume safe tapai when the alcohol content is 0.5 -3% to avoid doubts.

REFERENCES

- AhliGiziID. (2019). Informasi Gizi Ketan Hitam.
- Ahmad, A. N., Yang, T. A., Hani, N. M., & Abdullah, W. N. W. (2014). Alkohol Dalam Makanan : Fatwa Semasa di Rantau Asia Tenggara. *Ulum Islamiyya Journal*, 14, 1-18.
- Ariani. (2015). *Pengetahuan Bahan Makanan dan Minuman Seri: Babi dan Khamr* (I). Malang: Gunung Samudra.
- Asnawi, M. (2013). *Karakteristik Tape Ubi Kayu (Manihot utilissima) Melalui Proses Pematangan dengan Penggunaan Pengontrol Suhu*. Malang: Fakultas Teknologi Pertanian Universitas Brawijaya.
- Azmi, A. S., Ngoh, G. C., Mel, M., & Hasan, M. (2010). Ragi Tapai and *Saccharomyces cerevisiae* as Potential Coculture in Viscous Fermentation Medium for Ethanol Production. *African Journal of Biotechnology*, 9(42), 7122-7127.
- Berlian, Z., Aini, F., & Ulandari, R. (2016). Uji Kadar Alkohol pada Tapai Ketan Putih dan Singkong melalui Fermentasi dengan Dosis Ragi yang Berbeda. *Jurnal Biota*, 2(1), 106-111.
- Calista, M. A., Priyanto, G., & Wijaya, A. (2019). *Pengelompokan Mikroorganisme dan Karakteristik Tapai Singkong yang Dibuat dari Berbagai Jenis Ragi*. Sriwijaya University.

- Dicheva, D., Dichev, C., Agree, G., & Angelova, G. (2015). Gamification in Education: A Systematic Mapping Study. *Journal Educational Technology & Society*, 18(3), 1–14.
- Dirayati, Gani, A., & Erlidawati. (2017). Pengaruh Jenis Singkong dan Ragi Terhadap Kadar Etanol Tape Singkong. *Jurnal IPA Dan Pembelajaran IPA (JIPI)*, 1(1), 26–33.
- Fatwa Alkohol Majelis Ulama Indonesia.Pdf.* (n.d.). Retrieved from <http://mui.or.id/wp-content/uploads/files/fatwa/No.-26-Standar-Kehalalan-Produk-dan-Penggunaan-Kosmetika.pdf>
- Fer. (2008a). Jangan Biarkan Jus Menjadi Khamar. *Khazanah*, p. 1.
- Fer. (2008b). Tape Ketan Beralkohol, Namun Tetap Halal. *Republika Khazanah*, p. 1.
- Ferraro, V., Piccirillo, C., Tomlins, K., & Pintado, M. E. (2016). Cassava (*Manihot esculenta* Crantz) and Yam (*Dioscorea* spp.) Crops and Their Derived Foodstuffs: Safety, Security and Nutritional Value. *Critical Review in Food Science and Nutrition*, 56(16), 2714–2727.
- HalalMUI. (2019). Tapai, Halalkah Dikonsumsi ? Retrieved February 28, 2020, from LPPOM MUI website: <http://www.halalmui.org/mui14/main/detail/tapai-halalkah-dikonsumsi>
- Hasanah, H., Jannah, A., & Fasya, A. G. (2012). Pengaruh Lama Fermentasi Terhadap Kadar Alkohol Tape Singkong (*Manihot utilissima*). *Alchemy*, 2(1), 68–79.
- Hawusiwa, E. S., Wardani, A. K., & Ningtyas, D. W. (2015). Pengaruh Konsentrasi Pasta Singkong (*Manihot esculenta*) dan Lama Fermentasi Pada Proses Pembuatan Minuman Wine Singkong. *Jurnal Pangan Dan Agroindustri*, 3(1), 147–155.
- Hidayat, N., Padaga, M., & Suhartini, S. (2006). *Mikrobiologi industri*. Yogyakarta: CV. Andi Offset.
- Hill, B. (2020). Tokki Soju (Nuruk).
- Irawan, M. (2017, June). Kandungan Alkohol dalam Tape. *Warta Pilihan*, p. 1.
- Jamaludin, M. A., Ramli, M. A., & Mat, D. (2011). Isu Penggunaan Alkohol Dalam Penghasilan Produk Gunaan Semasa : Analisis dari Perspektif Hukum Islam. *Islamic Law in Contemporary Community Conference*, (January), 1–12.
- Majelis, K., Indonesia, U., & Mui, L. (2011). *Analisis Proses Sertifikasi Halal Dan Kajian Ilmiah Alkohol Sebagai Substansi Dalam Khamr Di Lembaga Pengkajian*

Pangan , Obat-Obatan , Dan Skripsi Rahajeng Aditya Fakultas Teknologi Pertanian 2011 Analysis of Halal Certification Process and Scientific Stu.

Majelis Ulama Indonesia. *Standarisasi Fatwah Halal.* , Pub. L. No. Nomor 4 Tahun 2003, 655 (2003).

Marminah. (2012). *Perbedaan Kadar Protein Tape Singkong (Manihot Utilisima) Biasa dengan yang Diberi Penambahan Sari Buah Nanas (Ananas Comosus).* Surakarta: Fakultas Keguruan dan Ilmu Pendidikan Universitas Muhammadiyah.

Mu'arif. (2013). *Tanya Jawab Agama* (7th ed.). Yogyakarta: Suara Muhammadiyah.

N.M., S. (2015). Kadar Ethanol dalam Tape sebagai Hasil Fermentasi Beras Ketan (*Oryza sativa glutinosa*) dengan *S. Cerevisiae*. *Jurnal Virgin*, 1(1), 16–19.

Najiha, A. A., & Nadiah, W. A. W. (2014). Alkohol (Arak dan Etanol) dalam Makanan Halal. *Jurnal Intelek*, 9(1), 40–51.

Norsalis, E. (2011). Padi Gogo dan Sawah. *Jurnal Agroekoteknologi*, 1(2), 14.

Peraturan Menteri Kesehatan Republik Indonesia. *Minuman Keras dan Minuman Beralkohol.* , Pub. L. No. No. 86/Menkes/Per/IV/77, 1 (1977).

PP Muhammadiyah. (2003). Air Tape, Miras atau Bukan ? *Majalah Suara Muhammadiyah.*

Ramlan, & Nahrowi. (2014). Sertifikat Halal Sebagai Penerapan Etika Bisnis Islami dalam Upaya Perlindungan Bagi Konsumen Muslim. *Journal Ahkam*, 16(1), 145–154.

Ravindran, G., & Ravindran, V. (1988). Changes in the nutritional composition of cassava (*Manihot esculenta* Crantz) leaves during maturity. *Journal Food Chemistry*, 27(4), 299–309.

Rosalina, D. (2017). *Pelayanan Konseling Rehabilitasi Terhadap Pecandu Narkoba di BNN Kota Mataram.* Universitas Islam Negeri Mataram.

Sari, M., & Fajar, N. (2018). Analisa Kualitatif dan Kuantitatif Kandungan Alkohol Pada Tapai Ketan di Kota Batusangkar. *Journal of Sainstek*, 10(2), 33–36.

Suzuki, K., Asanoi, S., Iijima, K., & Kitamono, K. (2008). Sake and Beer Spoilage Lactic Acid Bacteria-A Review. *Journal of the Institute of Brewing*, 114(3), 209–223.

Tetchi, F. A., Solomen, O. W., Celah, K. A., & Georges, A. N. (2012). Effect of Cassava Variety and Fermentation Time on Biochemical and Microbiological Characteristics of Raw Artisanal Starter for Attiéké Production. *Innovative Romanian Food Biotechnology*, 10, 40–47.

Thaib, I., & Latief, H. (2002). Alkohol dan Zat Kimia dalam Obat-obatan, Kosmetika, Makanan dan Minuman. *Jurnal Tarjih*, 4.

Wendler, R. (2012). The maturity of maturity model research: A systematic mapping study. *Journal Information and Software Technology*, 54(12), 1317–1339.

Yulianti, C. H. (2014). Uji Beda Kadar Alkohol Pada Tape Beras, Ketan Hitam dan Singkong. *Jurnal Teknika*, 6(1), 531–536.

김동구. (1989). *Patent No. KR910004491B1*. Korea Selatan.