

Identification of Critical Point in the Design of Halal Logistics System for Granular Organic Fertilizer

Qurtubi^{1*}, Andik Bagus Prasetyo¹, Melinska Ayu Febrianti¹, Nasruddin Faisol²

¹*Department of Industrial Engineering Universitas Islam Indonesia, Indonesia*

²*Department of Quantity Surveying Universiti Teknologi MARA, Malaysia*

*Corresponding author. Email: qurtubi@uii.ac.id

ABSTRACT

A product is considered as halal not only reviewed from the production process but also its logistics perspective. Logistics bridges the gap between the production point and the customer's purchase point, hence this halal product's logistics is highly important to ensure the halal product's integrity at the consumption point. There are several different opinions from Fiqh experts in determining the halal process in manufacturing organic fertilizer. Therefore, the methods of observation, interview, and document analysis are performed to identify the critical point and halal logistics system that could be applied by the company, which produces organic fertilizer. From the result of the research, it can be identified the existence of five critical points in the logistics process for manufacturing the Granular Organic Fertilizer (POG), which are material purchasing, composting, mixing, drying, and distribution. Hence, the halal logistics process covers material purchasing by altering the akad/agreement or naqlul yad, composting using bacillus bacteria, mixing using dolomite, drying with a temperature of $\leq 100^{\circ}\text{C}$, and distribution by employing a salam trading system (bai'as-salam).

Keywords: Halal Logistics, Organic Fertilizer, POG, Critical Point

1. INTRODUCTION

A product can be entitled halal, not only by considering its production process but also its logistics process. Tieman stated that logistics could bridge the gap between production point and customers' purchase point, therefore the logistics of halal products is crucially important to ensure the halal product's integrity at the consumption point [1]. According to Jaafar et al., halal logistics should be able to apply the principles of halalan toyyiban in the entire activities of the product's supply chain [2]. All activities started from raw material to end-product that landed on customers' hands. It can be notified that the halal logistics process is a logistics system that separates halal products from non-halal ones at every stage of the process, to avoid the possible contamination of materials and to ensure the consistency of halal handling at each process as expected by Moslem customers.

According to Jaafar et al, the raise of the Moslem population in the world indirectly influence the enormous demand for halal products [3]. Similar demands

are not only requested by the Moslem's countries but also non-Moslem countries. The Moslem's customers are willing to pay more if it is related to faith, in which the Moslems must consume hygiene, safe and qualified products. As suggested by Zailani, future market demand and competitive opportunities in halal service have become major boosters in promoting halal logistics [4].

Organic fertilizer is a non-food product, thus its logistics process triggers many arguments. The raw material of organic fertilizer is animal waste (cow or chicken) and sugar factory waste (blotong). Different opinions are delivered by fiqh experts in determining the halal law in organic fertilizer manufacturing. Some say, due to the raw material that is originated from animal waste, then it is concluded as dirt/najis, yet several experts suggest otherwise. Jafaar et al. stated if the product has direct contact with the non-halal product, its halal status could be affected, unless if it is isolated entirely [3]. Therefore, maintaining the halal condition of a product involves certain procedures in processing, storing, and managing such products.

Fitri and Kashim stated in their research that according to the analysis by the author of law, the use of fertilizer from animal waste is a must, because it does not cause any negative effects and harm to humans, animals, and the environment. Furthermore, it can give a better effect and quality to the plant [5]. Then, this research is important in defining the law of organic fertilizer production with animal-waste raw material, by identifying the possible critical points. This research aims to design the logistic system for organic fertilizer, particularly for granular types to earn halal acknowledgment.

2. METHODS

This research was taken place in one of the organic fertilizer companies in Indonesia, in East Java Province, to be exact. This company produces granular-type organic fertilizer with a production capacity of 200 tons/day. Three types of strategies were employed in the qualitative data collection procedures [6], among others observation, interview, and document collection. The observation was performed by examining the individual behavior at the site. The interview was conducted by involving the participants in a focus group discussion, as well as a direct interview with the experts. The collected and analyzed documents were pictures of the production process from the production floor. Fig. 1 illustrates the research flow.

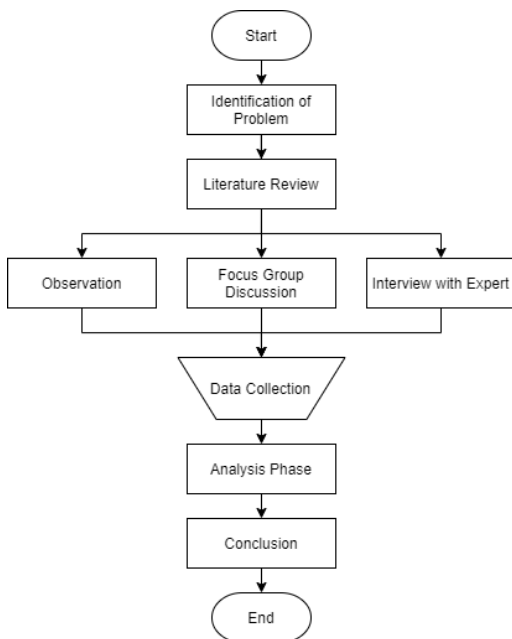


Figure 1 Research flow

3. RESULTS AND DISCUSSION

3.1 Logistics System Of Granular Organic Fertilizer

The first stage is raw material purchasing, in which the raw material of this fertilizer is animal waste and factory waste. The animal wastes that are used are dung and chicken manure. Factory waste that is utilized is the result of the purification sedimentation of sugar essence originated from a sugar company. After the purchase, the raw materials then are stored. The storage is divided into two stages, which are the storage for raw materials that are still unseparated from the inorganic materials, and storage for clean raw materials, which are separated from inorganic substances and later ready for the production process.

The production process includes eight processes, which are milling, filtering, mixing, granulation process, drying, cooling, filtering, and packing. A crusher machine is employed for the milling process that has a function to crush the clotted raw material to maintain soft texture. Later, the filtering is executed to separate the fine texture material from the course materials to preserve the uniform size of raw materials. This process is supported with a 5-mm rotating screen. Next, the mixing process by involving the main material (organic fertilizer) with additional substances (filler), which is dolomite by using the mixer machine. The next process is granulation by employing the pan granulator with 45 degrees tilt and a rotary speed of 20 rpm. After the granulation, the drying process is initiated by using a rotary drier, hence the water level of granular organic fertilizer could be reduced vastly. The cooling process uses a rotary cooler to catch the production target. Next, the filtering process is carried out to equate the size of granular organic fertilizer to 2-5 mm. The final process is packaging by using a semi-automatic process, in which the fertilizer with proper size could be sacked automatically. The fertilizer is packed in a 40 kg sack to be stored in the finished goods warehouse.

Figure 2 illustrates the logistic system of Granular Organic Fertilizer in a company.

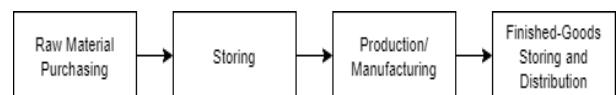


Figure 2 Logistics system of granular organic fertilizer

The packed product is stored in the warehouse by skipping the inspection process. The forklift is used to distribute the goods from the production floor to the

warehouse. After stuffing the warehouse with 500 tons of fertilizer, the production company offers the sampling process to distributors. Once the sample is received, the production company will wait for the order letter to initiate the delivery order (DO). The activity of distribution is used by utilizing the trucks accommodated by the distributor. In the distribution process, the production company only loads the sacks of fertilizer to trucks. Once they are loaded, the distributor will responsible for the products. The payment will be performed later, soon after the production company hands over the granular organic fertilizer to the distributor.

3.2 The Determination Of Critical Point

By referring to the above explanation of the logistics system for granular organic fertilizer in a production company, later the critical points could be determined, which cause the fertilizer tends to be non-halal. The determination of critical points is presented in Fig. 3.

3.2.1 Raw Material Purchasing (Critical Point 1)

From the perspective of material, animal waste for a raw material refers to critical matter. Since it is included in the category of najis, as stated by Al-Ghazali, who divided najis into three categories. The first category covers matters besides animals and plants. In which, everything is considered as pure or halal unless there is the existence of mixture or dirt sourced from the blood, alcohol, etc. The second category is animal, which is considered as clean unless dog and pig as well as everything that is born of them. If the animals die, they are classified as dirt and carcass, unless for five things, which are the human body, fish, grasshopper, fruit caterpillar, and all animals with no blood circulation, such flies and beetle. The third category is the plants, such as marijuana plants or leaves, since this kind of plant is poisonous and could cause delusion and classified as najis [7]. Sugar company waste is included as a critical point since it is included as a processed-ingredients that should be identified for the waste formation, whether it is contaminated by dangerous material or not. According to Islam law, legal trade transactions should meet the following conditions, such as clean and it is forbidden to trade najis materials. The material must give benefit or beneficial.

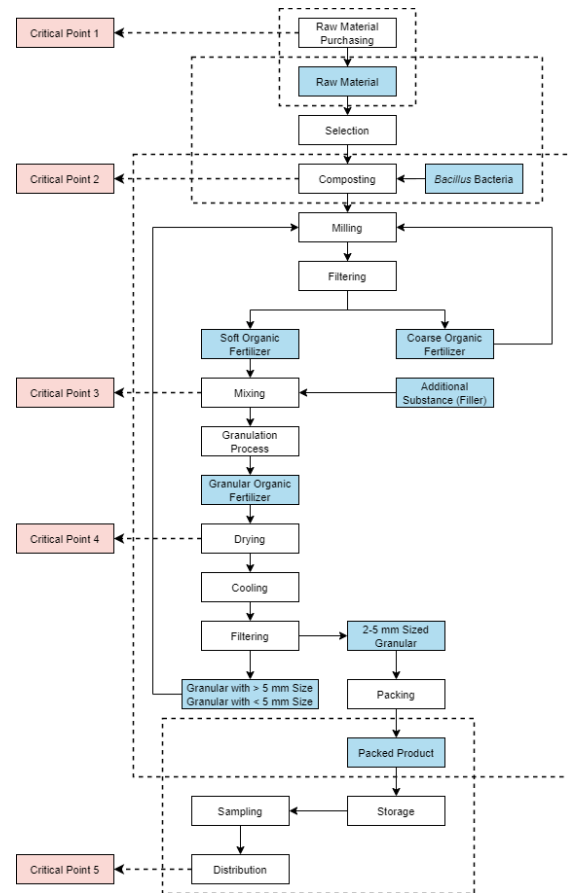


Figure 3. The determination of critical point

The material must be transferable, one’s own and has been owned, someone else’s yet already released by the owner, clear in shape, substances, and size [8]. Based on that explanation, if the raw material is included as najis materials, the trade transaction is considered invalid.

3.2.2 Composting (Critical Point 2)

During the process of storing the raw material, the process of composting exists. In this process, the transformation of shape, discoloration, and odor alteration has occurred. Before the composting, raw material contains weed seeds, saprolytic bacteria, carrier of a disease, and microorganism parasite that could harm both animal and human. After the composting, all dangerous substances will be eliminated [9]. Besides, the composting process includes the additional substances expose, which is bacillus-bacteria type microbe, used to decompose the dirt to be the compost. Bacillus bacteria should be notified of their halal condition and effect when being exposed to plants, soil, or human.

3.2.3 Mixing (Critical Point 3)

The additional substance for the mixing process is agriculture chalk of dolomite. Dolomite is a critical substance that its origin should be identified, as well as its effect when being exposed to plants and humans.

3.2.4 Drying (Critical Point 4)

The drying process is performed by heating the fertilizer with a temperature of less than 140°C. It must be ensured for the stable content of fertilizer, it is not transformed into harmful substances that could potentially decrease the quality of a product. Hence, research should be conducted regarding that matter.

3.2.5 Distribution (Critical Point 5)

In this distribution process, the trade agreement is the critical point, since it involves three parties, which are a customer as the buyer, production company as producer, and distributor as the middleman/broker. Transportation in distribution is excluded from the critical point since it is already packed safely and designated only for the homogenous material.

3.3 The Discussion on Critical Point

3.3.1 Raw Material Purchasing

Material for Granular Organic Fertilizer is originated from sugar company's waste and animal waste (from cow and chicken). The purification of sugar essence is initiated by the addition of chalk milk and flowed with the SO₂ gas, later continuous sedimentation is persisted. Both Ca(OH)₂ dan SO₂ gas are not considered as *najis* substances and harmless for plants and humans, hence they are allowed for the formation process of granular organic fertilizer, yet it is forbidden for consumption purposes, as cited from *mazhab* of Hanafiyah and Dhahiriyah below:

Meaning: "Everything with benefits is halal by Syara' and tradeable." [10].

In obtaining the waste from the sugar company, the regular trade system could be employed by considering the Islamic syar'i. While, the second raw material, which is cow dung or chicken manure triggers controversial issues among Islamic *ulama* related to their trading process, particularly as delivered in *mazhab* of Syafi'i and Hanafi [8]. Referring to *mazhab* of Malikiyyah, the trading of animals droppings is allowed and halal, since they are not considered *najis* [11]. Based on the principle of *mazhab* Hanafiyah and Dhahiriyah, associated with *ushul fiqh* theory, it is allowed to trade beneficial *najis* material in terms of pre-

serving the earth from destruction, such as the utilization of organic fertilizer is one of the efforts to preserve the earth from the pollution of animal wastes [8]. *Mazhab* of Hanafi highlighted:

Meaning: "They stated: It is allowed to trade oil exposed with najis and use it, unless for consumption. As it is allowed to trade waste, which is blended with dirt and uses it, as well as animal droppings or fertilizers that considers as najis. It is the corpse, untanned skin of the corpse, pig, and wine that are forbidden to trade." [12].

In the case of purchasing cow dung and chicken manure, the company utilizes them as fertilizer for plants, not for consumption. Hence, in the context of raw material purchasing for the making of granular organic fertilizer in the form of animal droppings and sugar waste, it is allowed and considered halal. Yet, it comes to different treatments if one would like to practice the circumspection in Syariah law (*ihthyath*) and to adjust with community's perspective (*muwafaqah an-nas*) that commonly follow *mazhab* of Syafi'i who comprehend that animals droppings are disgusting and considered *najis* [11]. Therefore, in the context of raw material purchasing for the making of granular organic fertilizer in the form of cow dung and chicken manure, it is found as haram and not allowed in Islam Syariah.

In this case, according to *ulama*, the above issue could be tackled by adjusting the *akad*/agreement, in which the payment is designated to the service of waste distribution, not for the materials. Therefore, the law for the service of transporting the waste as the fertilizer raw material is valid and allowed. The second alternative is practicing *naqlul yad*, defined as the method to change the *akad* to remuneration [10]. It is mentioned in the book of Hasyiyah al-Bajuri for allowing the ownership of *najis* material with dirham as putting down a certain position. The owner of the material could say, I am putting down my right towards this material with the remuneration of a certain amount of money.' Then the other person could say, 'I accept.' [13]. Hence, the trading of cow dung and chicken manure is considered valid and appropriate if it is conducted by using *naqlul yad* agreement/*akad*, in which its implementation is based on pronouncing *ijab* and *qabul*. Later, all parties approve the material transaction. The ownership can be also transferred with grants and alms.

3.3.2 Composting

The additional substance used in the composting process is *bacillus* microbe that categorized as a microscopic organism with one-thousandth millimeters in

size and can only be seen using a microscope. The experts say that bacillus is classified as a living creature, yet it is still unclear whether the microbe is an animal or plant. If it is classified as a plant, then it is halal and not included as *najis*, since all plants are halal. If the microbe is assumed as an animal, it is not included as an animal with *najis* categorization, then the designated microbe is assumed as halal. The absence of specific *dalil*/law about a certain animal that categorized as haram, then it is considered as halal. A microbe is halal as long as harmless and separated from material with haram substances. When the bacteria are grown in media with *najis*, the bacteria should be separated and purified [14]. Yet, if it grows in the media that is mixed with haram substances, then it is categorized as haram [15].

It can be notified that *bacillus* microbe is harmless for plants. Rheinheimer stated that *bacillus* is included as a reducer microorganism so-called decomposer [16]. In making the granular organic fertilizer, the *bacillus* bacteria is used to decompose the raw material to compost, which contains the ammoniac compound required by plants. Therefore, it could be concluded that *bacillus* bacteria are allowed to be included in the making of organic fertilizer.

3.3.3 Mixing

The process is explained as the procedure to mix the raw material with additional substance (filler). The filler used for the mixture process is agriculture chalk, which is dolomite. Dolomite provides valuable nutrition for plants and adjusts soil pH as required by plants [17]. Dolomite is included in the halal mineral that is safe for plants, hence it is allowed to be used as material for making the organic fertilizer and is good for plants.

3.3.4 Drying

The drying process involves 140°C temperature to heat the granular organic fertilizer, by using a rotary drier as the heat source, with a temperature of more than 400°C. The drying process is employed to decrease the water level, rapidly, which is below 20%. But, the good bacteria/microbe that supports the plants also perish, either natural microbe or those being added in the process of composting. Therefore, in this case, the quality and the goodness of fertilizer will be decreased, since it no longer contains the microbe needed by the soil and plants. The temperature should be lowered, 100°C maximum. Since according to the production manager of the company, *bacillus* bacteria could still survive at the temperature of 100°C at most.

3.3.5 Distribution

Although it is originated from the raw material, determined as *najis*, yet it is exposed to stages of production to become beneficial products for communities, therefore trading is allowed. In the *fiqh* Syafi'iyah principles, this problem is included in the *istihsan* category, the tendency of law understanding by considering that the second law is better than the existing practices originated from the original law [18]. Although the material is considered *najis*, yet it is advantageous and gives benefits to all peoples, besides there is still no replacement of this fertilizer for its ability in replacing the soil nutrient, hence the trading of granular organic fertilizer is allowed.

The distribution process by the production company involves three parties. In Islamic syar'i, the distribution can be categorized as *bai'assalam*. In running the *bai'assalam*, the production company performs it less perfectly. By sending the unpaid goods, the company could be easily aggrieved. To avoid the presence of mistrust, salam trading could be carried out as illustrated by Figure. 4.

3.4 The Design Of Halal Logistic System For Organic Fertilizer

According to Jaafar et al, halal logistics could be referred to the application of the *halallan toyyiban* principles along the supply chain activities, which means that all the activities ranging from the source of supply, storage, transportation, manufacturing, handling, and distributing should adhere to the concept of *halallan toyyiban* as underlined by Islamic law. Figure 5 illustrates conceptual framework of halal logistics [2].

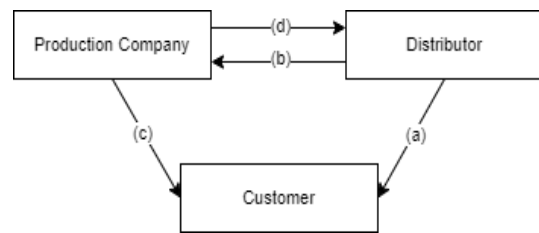
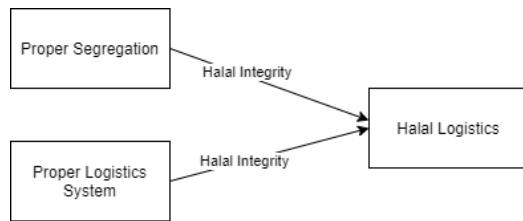


Figure 4 Distribution in *bai'assalam* with description (a) Customer performs purchasing to distributor; (b) The distributor sends the delivery order document and pays a certain amount of money as arranged; (c) The production company sends the goods to the customer; (d) The production company sends the document of the goods delivery.



To equip the detail in the halal logistics process, a Standard of Operational Procedures (SOP) must be formulated. It is arranged for each process for making the granular organic fertilizer that could fulfill the principles of *halalan tayyiban*. The recommended SOP could be seen in Table 1.

Figure 5. Conceptual framework of the halal logistics

Table 1. Standard of operational procedures in halal logistic system for organic fertilizer

No	Process	Standard of operation	Person in charge
1.	Raw Material Purchasing	<ol style="list-style-type: none"> To find the supplier that fit the criteria and has the material which meets the specification To maintain good collaboration with the supplier. To perform the transaction with the <i>naqlul yad</i> system or adjusting the <i>akad</i> by paying the service of material transportation (instead of the material). The distribution process involves the homogenous transportation system, avoid mixing the goods with other types of materials. To ensure the delivery of raw material to the production company. 	Head of Division of Purchasing (Purchasing)
2.	Production	<ol style="list-style-type: none"> To perform the selection of inorganic substances that are mixed with raw materials (organic). To conduct the composting for 3-10 weeks (depending on the age of raw materials). Composting involves the <i>bacillus</i> bacteria to help the raw material's decomposing. To perform the raw material milling by using the crusher machine. Filtering is performed by using a 5 mm rotating screen. To carry out the mixing process of raw material with the filler of dolomite, a maximum of 20% dolomite is contained in the fertilizer. The granulation process employs a granulator pan with a tilt of 45 degrees and a rotation of 20 rotaries/minute. The drying process uses the rotary drier machine with a maximum temperature of 100 °C to maintain water levels around 8% – 20%. The cooling process utilizes the rotary cooler. The filtering process is conducted to maintain a size of a particle to 2-5 mm by using the rotating screen machine. In the packing process, the fertilizer is weighted for 40kg/sack, later stitched and ready to be stored in the finished goods warehouse. 	Head of Division of Production (Manufacturing)
4.	Warehousing	<p>Raw Material Warehouse:</p> <ol style="list-style-type: none"> To perform the goods storing arrangement by using the forklift. To carry out the checking to ensure that the utilization of the materials complies with the First In First Out system. To perform the goods transportation to the mixing division for initiating the production process. <p>Finished Goods Warehouse:</p> <ol style="list-style-type: none"> To perform the goods storing arrangement by using the forklift. To conduct the checking and calculation towards the existing goods in the warehouse. To guarantee the safety of granular organic fertilizer from perilous contamination that is might harm the plants. To perform the sampling test to the distributor when the numbers of goods reach 500 tons. 	Head of Division of Warehouse (Warehousing)

No	Process	Standard of operation	Person in charge
		5. To initiate the process of transportation of goods to the customer.	
5.	Distribution	1. To initiate the negotiation with the potential customer or distributor. 2. To make the invoice that includes the detailed name of goods, number of goods, the price, date of order, and deadline of payment. 3. After payment, the 3-ply receipt should be prepared, 1 ply for archive, 1 ply for the customer, and another ply for warehouse. 4. To receive the confirmation from the warehouse and the customer if the goods have been received, which indicates that the completion of the transaction.	Head of Division of Selling (Marketing)

4. CONCLUSION

The critical points in the manufacturing of granular organic fertilizer are identified in the raw material purchasing, composting, drying, and distribution. From the above-mentioned five critical points, it is identified the specific conditions that could be tailored for the logistic process in manufacturing the organic fertilizer to make it halal. For the raw material purchasing, the *akad* could be altered (the payment is subjected to the service of material transportation or by using the *naqlul yad* system. *Bacillus* bacteria are allowed to be employed in the process of composting since they are harmless for soil and plants. In the mixing process, it is allowed to use dolomite for filler since it is not considered as *najis* and is safe for plants. The drying process must involve a below 100°C temperature to maintain the existence of *bacillus* bacteria in the organic fertilizer. While the distribution process derives *bai'as-salam* trading system. Later, it is obtained the design of the halal logistics system, which is presented in the form of a flowchart. The standard of operational procedures could be recommended also to the production company.

Future research could observe the halal marketing strategy since the topic is less discussed in this research, regarding strategy that could attract the customers to purchase the organic fertilizer. Besides, this report could be employed as basic of reporting on Halal Assurance System to earn halal recognition or halal certificate.

REFERENCES

- [1] Tieman M 2011 The application of Halal in supply chain management: in-depth Interviews J. Islam. Mark. 2 186–95
- [2] Jaafar H S, Omar E N, Osman M and Faisol N 2013 The Concept of Halal Logistics - An Insight The 5th International Conference on Transport and Logistics (ICLT 2013) (Beijing, China)
- [3] Jaafar H S, Endut I R, Faisol N and Omar E N 2011 Innovation in Logistics Services - Halal Logistics The 16th International Symposium on Logistics (ISL) (Berlin, Germany) pp 844–51
- [4] Zailani S, Iranmanesh M, Aziz A A and Kanapathy K 2017 alal Logistics Opportunities and Challenges J. Islam. Mark. 8 127–39
- [5] Fitri B B M and Kashim M I A M 2018 The law determination uses the fertilizer from the animal manures Fikiran Masy. 6 136–47
- [6] Creswell J W and Poth C N 2016 Qualitative Inquiry and Research Design: Choosing Among Five Approaches (United States of America: Sage Publication)
- [7] Al-Ghazali 2000 Halal dan Haram Dalam Islam (Kuala Lumpur: Jasmin Enterprise)
- [8] Mukhlisin A and Saipudin S 2017 Sistem Jual Beli Pupuk Kandang Prespektif Imam Syafi'i dan Imam Hanafi (Studi di Kampung Sulusuban Kecamatan Seputih Agung) J. Mahkamah Kaji. Ilmu Huk. dan Huk. Islam 2 327–50
- [9] Hartatik W and Widowati L R 2006 Pupuk Organik dan Pupuk Hayati (Jakarta: Balittanah Kementerian Pertanian)
- [10] Al-Zuhaily W 1997 al-Fiqh al-Islamy wa Adillatuh Juz 5 (Beirut: Dar al-Fikr)
- [11] Misbach M N, Ryandono M N and Prasetyo A 2019 An Overview of Islamic Law Against Buying and Selling Sand-Land with A Liberation System Airlangga Int. J. Islam. Econ. Financ. 1 6–19
- [12] Al-Jaziri A 1972 al-Fiqh 'ala al-Mazahib al-Arba'ah Juz 2 (Beirut: Dar al-Fikr)
- [13] Prayuda W R, Syafrudin and Al Umami R I 2021 Jual Beli Kotoran Ternak Ayam dalam Perspektif Hukum Islam Al-Mustashfa J. Penelit. Huk. Ekon. Islam 6
- [14] Faridah H D and Sari S K 2019 Utilization of Microorganism on The Development of Halal Food

Based on *Biotechnology J. Halal Prod. Res.* 2 33–43

- [15] Indonesian Ulama Council 2010 Fatwa from Indonesian Ulama Council No. 10 of 2010 about The Utilization of microbe and Microbial Products in Food Products
- [16] Rheinmer G 1980 *Aquatic Microbiology: 2nd Edition* (Chichester: John Wiley & Sons)
- [17] Gellings C W and Parmenter K E 2016 Energy Efficiency in Fertilizer Production and Use Efficient Use and Conservation of Energy: *Encyclopedia of Life Support Systems* pp 123–36
- [18] Jamaludin M H and Buang A H 2013 Syariah Courts in Malaysia And the Development of Islamic Jurisprudence: The Study of Istihsan *Int. J. Nusant. Islam* 1 1–12