

PERCEPTUAL STUDY OF PLASTIC WASTE BRICKS FOR SHARIA APARTMENT IN INDONESIA

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Abstract. Bricks from plastic waste have the potential to become the wall material for apartment units because they are lightweight and have an interlock system that makes it easy to dismantle and reuse. Sharia Apartments in Indonesia exist because of the market potential for the majority of Muslims who are interested in a halal lifestyle. This article identifies Muslim perceptions of the application of plastic waste brick to sharia apartment residential units. The perception is carried out by comparing three plastic waste brick product companies. The method used is through questionnaires and interviews based on regional demographics. It was found that plastic waste brick can be received positively by Muslim respondents with the average index is above 2.53 in three aspects (*habl min allah, habl min alam dan habl min nas*), but its use is limited to particular spaces such as prayer room which gets a negative perception index with a value of 2,34. based on the comparison of material preferences, the three plastic waste brick products get balanced results.

Keywords: Plastic waste brick, recycle, sharia apartment, muslim, perception.

1. Introduction

The use of plastics is now increasingly widespread in various kinds of single-use products. It causes the accumulation of waste and environmental pollution because plastic is a material that is difficult to decompose. Innovations to reduce plastic waste are increasingly being encouraged, one of which is making plastic waste bricks. Based on the project developed "Conceptos Plasticos," the use of plastic waste bricks is limited to simple housing [1]. This plastic brick waste has a lightweight and has an interlocking model that allows changing the wall layout to be easier to rearrange, so that it is expected to be used in tall buildings such as apartments, apartments are chosen based on considerations of private space ownership so that the owner has the flexibility to change the layout and interior.

In Indonesia, the Muslim population reaches 87.18% [2]. Also, the presence of a halal lifestyle increases the potential for new properties for Muslim residents, one of which is sharia apartments. Sharia apartments are apartments that use Islamic law as their reference. The Islamic law or the Islamic legal system (Sharia) explained how a Muslim should live his life and determine his

relationship with the social and physical environments [3]. In the scope of planning according to sharia, the principle of Islamic housing is to make the house a part of the worship area. The application of plastic waste bricks is possible for apartment buildings, but because this material comes from garbage and every plastic waste brick company has a different material composition and appearance, it will be of particular concern. Do Muslim residents accept this material as part of the sharia apartment. This study was conducted to determine the perceptions of prospective users of sharia apartments when using used plastic as a wall material in the apartment.

2. Literature Review

This study uses potential users' opinions through basic references in three aspects, *habl min Allah, Habl min Nas, Habl min alam*. It also contains a comparison between three plastic waste bricks from different companies due to the respondent's preference for plastic waste bricks.

2.1. Plastic Waste Brick

Plastic waste bricks are bricks made from plastic waste that is cleaned, melted, and moulded into bricks. This material has several variations of a plastic mixture. This plastic is classified into plastic that is suitable for recycling bottles and plastic that is not suitable for recycling bottles. Currently, there are three companies have plastic waste brick production systems with different basic compositions.

1. Precious Plastic, this plastic waste brick is made by a company based in the Netherlands, the primary material is HDPE plastic which is usually used in bottle caps, this plastic produces plastic waste bricks with bright colours (figure 1) [4].



Figure 1 : Bricks by Precious Plastic [4]

2. Conceptos Plasticos, this plastic waste brick is made by a company based in Colombia. The primary material is made from various types of waste, both recycled and non-recycled categories. This mixture of various plastics produces a monochrome grey plastic waste brick (figure 2) [1].



Figure 2 : Bricks by Conceptos Plasticos [5]

3. K-Briq, This plastic waste brick is made by a company based in Scotland. The main material is recycled plastic, while the secondary plastic is from the non-recycled category. The plastic mixture produces a lighter faded colour (figure 3) [6].



Figure 3 : Bricks by K-Briq [6]

Plastic waste bricks, when compared to light bricks commonly used in apartments, have a lighter weight. The light brick produced by Falcon weighs 5.4 kg. When compared to the dimensions of plastic waste bricks, light bricks are equivalent to 2.6 kg [7] while the plastic waste brick produced by precious plastic weighs 1.5 kg. the difference reaches 1.1 kg [8].

2.2. Muslim Perception On a Residential

Home is a place to live, a place to socialize, and a place that requires natural factors to create a good and healthy environment. A Muslim makes a house not limited to the relationship between humans and nature but also related to God. Because in Islam, humans are required to continuously improve their potential in developing science and technology to manage and create a society that has a good relationship with Allah, other humans, and nature (*habl min Allah, habl min nas, and habl min alam*) [9].

1. *Habl min Allah* relates to the relationship between man and God as creator,

“Your praying in your room [specifically for prayers] is better than your prayer in your room, your prayer in your room is better than your prayer in your house, and your prayer in your house is better than your prayer in the mosque of your people then your prayer in the mosque of your people is better than your prayer in the mosque which (general) ” [10].

In this hadith, the Prophet Muhammad answered Ummu Humaid's question about praying in the mosque for women. He explained that the prayer area in the house is the best place of prayer for women. when an area is used as a place of prayer, the area must have a pure (Tahir) character and be far from impurity (*Najasah / Unclean*), because the purity of a place is one of the prerequisites before praying [11].

2. *Habl min Nas*, human relations in the house are formed because of family members.

“And Allah has given you a place to abide in your houses, and He has given you tents of the skins of cattle which you find light to carry on the day of your march and on the day of your halting, and of their wool and their fur and their hair (He has given you) household stuff and a provision for a time” (QS. An-Nahl (16) :80).

This verse of the Qur'an explains that Allah made the house a place that gives peace and tranquility with the family, and Allah created the earth and its contents to be used as a home for those who move around, other than that as decoration in the house until death and a certain time. The elements of beauty, benefit, and security are perceptions that support good housing for a Muslim. However, what needs to be considered is that the element of beauty that is present must not show the element of boasting.

It can be said building exists not seen as monuments or symbol visible to all and from all sides but beauty in building must represent characteristic of humbleness in Islam [12].

3. *Habl min alam* is the relationship between human attitudes towards nature. Included in housing because nature is an inseparable part of human life.

“Mischiefs have appeared in the land and the sea because of what the hands of the mankind have earned, that He may make them taste a part of that which they have done, so that they may return (turn to Allah)” (QS AL-Rum (30) : 41)

The verse of the Qur'an explains that Allah presents cause and effect in the world, when humans destroy nature, disasters will come and with the presence of these disasters, humans should repent and return to the right path by protecting nature.

In Islam the purpose of nature is for man to study nature in order to discover God and to use nature for the benefit of mankind. All activities that destroy nature and harm mankind are forbidden. Destruction of the natural balance is discouraged [13].

3. Research Methods

This study uses potential users’ opinions through basic references in 3 aspects, *habl min Allah*, *Habl min Nas*, *Habl min alam*. The research was carried out in 2 stages, stage 1 based on a questionnaire to identify early Muslim perceptions of plastic waste bricks. Stage 2 is in-depth interviews with questions (broken down into subquestions).

In stage 1, questions are made with 2 variations of questions. The first variation question uses a likert scale with scale 1-4 to indicate the final perception value for each aspect criterion. The second variation of the question is to use a comparison based on the opinion of the respondent.

Total Score of Each Criterion = Score Achievement x Number of Respondents

Table 1. Score Calculation

Positive question			Negative question		
Scale 4 (S4)	4 x 50	200	Scale 4 (S4)	4 x 50	200
Scale 3 (S3)	3 x 50	150	Scale 3 (S3)	3 x 50	150
Scale 2 (S2)	2 x 50	100	Scale 2 (S2)	2 x 50	100
Scale 1 (S1)	1 x 50	50	Scale 1 (S1)	1 x 50	50

Total ideal score for each statement (highest score) = 200 (Strongly agree)

The lowest score = 50 (Strongly disagree)

Table 2. Perception Index

Perception Value	Interval value	Score	Performance	Perception
1	1.00 -1.75	50 - 87	strongly disagree	very negative
2	1.76 - 2.50	88 -125	disagree	negative
3	2.51 -3.25	126 -163	agree	positive
4	33.26 - 4.00	164 - 200	strongly agree	very positive

This study aimed to determine the perception of Muslims in Indonesia on the use of plastic waste brick walls in sharia apartments. The selected potential respondents are Muslim only, then they are grouped into primary respondents with an age range of 22 to 32 years (due to the potential housing market for young people is in the age range of 24-30 years with a transition age probability of 2 years [14]) and secondary respondents who are more than 33 years old.

The mapping was chosen with the distribution of residence's domicile and various professions. The sampling technique used was accidental sampling, i.e. anyone who found survey info and according to the respondent's criteria could be used as a sample. Sampling was carried out on 6 - 16 April 2021. The questionnaire was distributed through several social media which were linked to the google form as an online survey tool and a total of 50 respondents who met the criteria were received.

Respondents in the interview were selected based on the relevance of those who work in the residential sector because they are able to influence the decisions of the apartment unit owners. The various of occupancy is intended to get a wider perception of various possibilities, such as architects who usually design standard apartment units, interior designers who emphasize the aesthetics of space, landscape designers if the apartment unit has a natural concept, while interior consultant owners are chosen because they have a business perspective.

4. Results and Discussions

4.1 Stage 1: Questionnaire Survey

The demographics of the respondents were as follows:

Table 3. Respondents Demographics data

Indicator	Result
Religion	100% Islam
Age	92% 22-32 Years old 8% over 32 years old
marital status	51% married 49% single
Based on location of residence	71.1% of the island of Java (5 provinces, 15 cities) 13.3% of the island of Sumatera (4 provinces, 5 cities) 6.7% of the island of Borneo (2 provinces, 2 cities) 8.9% from other regions (3 provinces)
Occupation	32% architecture and construction 12% government 22% education 8% health 12% work for companies in other fields. 14% did not mention

The first stage concentrates on mapping perceptions of plastic waste bricks to the interest, which is divided into several question sections as follows; (a) knowledge of sharia apartments and the use of waste as a material (b) perception of opinion based on plastic waste brick material, (c) Use of plastic waste brick material in sharia apartments

A. Knowledge of sharia apartment and the use of waste as material

Respondents on average are aware of the existence of sharia apartments, but regarding how to apply sharia principles in housing is classified as low because 34% think it is just a term. 36% percent know briefly, while 24% know and 6% know very well in terms of financing and development.

Judging from this knowledge, 53.1% assessed that what is offered by sharia apartments is currently at the level of financing only, 20.4% development in an environment that supports the Muslim community's activities. Meanwhile, only 6.1% believe that sharia apartments apply sharia applications (figure 4).

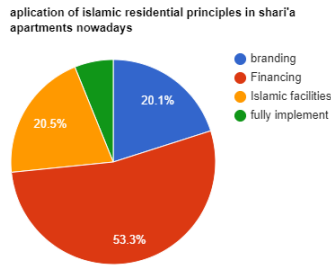


Figure 4 : Islamic residential principles level that exist nowadays.

Perception of the use of waste as material in sharia apartments is positive because only 4% said they disagreed and the index reaching 3.14. From these data, environmental issues are the main reason for respondents because 64% strongly agree and 28% agree that using waste materials shows concern for the environment with index 3.38. This shows that the level of public awareness of waste is quite high.

Table 4. Waste material perception index

Question	S1	S2	S3	S4	Score	index
Using recycle waste materials in Sharia Apartments	4%	6%	40 %	50 %	168	3.14
Using recycle waste materials in Sharia Apartments is great reason to care for the environment	2%	6%	28%	64%	177	3.38

B. Perception of opinion based on plastic waste brick material.

In this section, the researchers introduced plastic waste bricks produced by three companies and give an example of rendering material use in apartment units, 1. Precious Plastic, 2. Conceptos Plasticos 3. K-briq. These three bricks were chosen because they have different appearances and material compositions. This gives the respondent an idea if plastic waste bricks are used in apartment units. This limitation also becomes the user's knowledge to understand what areas can be maximized with plastic waste brick material.

1. Habl Min Allah

The assessment is based on the aspects of cleanliness and purity because purity is one of the requirements for a place to live and pray in Islam. based on purity Respondents have negative perceptions because the index is 2.02 , However, what should be noted is that respondents have a perception that this material is free from impurity (unclean/najasah), as evidenced by the positive index level reaching 2.96. Supported by the index 2.77 in statement the waste brick material is clean and hygienic.

However with this result, the use of plastic waste bricks in the prayer room must be reconsidered, This is supported by the question of the plastic waste brick material's feasibility in the prayer area, although 66% of respondents agree but the index is 2.34 which is negative (table 6).

Table 5. Perception Index in terms of pure and clean materials

Statement	S1	S2	S3	S4	Score	Index
waste brick material is clean and hygienic	2%	16%	54%	28%	154	2.77
Plastic waste bricks are considered as pure materials	4%	16%	56%	24%	126	2,02
Plastic waste bricks are materials that is still dirty	34%	42%	14%	10%	150	2.67
Plastic waste bricks are considered as impure materials (unclean/najasah)	44%	40%	10%	6%	161	2.96

2. *Habl Min Nas*

Perceptions are based on the material benefits of human needs and responses from various aspects. The use of plastic waste bricks has a perception of humility, with index 2.67 from the survey results. This is in accordance with the advice in Islam which prohibits boasting and living in humility.

Perceptions of the application of brick use in various areas, including bedroom and bathroom partitions, have an index above 2.93. This shows a high benefit of using plastic waste bricks, but the perceived value of its use in prayer room is lower than perceived use in other areas.

Table 6. Perception Index in terms of application and humbleness value

Question	S1	S2	S3	S4	Score	Index
Plastic waste bricks are used for prayer room partition	14%	20%	42%	24%	138	2.34
Plastic waste bricks are used for bedroom partition	4%	12%	48%	36%	160	2.93
Plastic waste bricks are used for bathroom partition	6%	10%	44%	40%	159	2.90
building with plastic trash bricks shows humility	6%	20%	42%	32%	150	2.67

The percentage in term aesthetic appearance of three types of plastic waste brick production has a value that is close to each other at the most preferred brick point, 33.2% Precious Plastic with index 3.20, 34.1% Conceptos Plasticos with index 3.25 and 32.7% K-Briq with index 3.17. This shows that the preferences of each individual can vary depending on taste and cannot be generalized (figure 5). The consideration chosen by the respondents was dominated by the colour and type of texture produced in each type of brick. From these data, it can be stated that the aspects of the beauty of plastic bricks are equally acceptable to respondents.

Table 7. Perception Index in terms of aesthetic

Question	S1	S2	S3	S4	Score	Index
Precious Plastic waste bricks has high aesthetic value	2%	8%	38%	52%	170	3.20
Conceptos Plasticos waste bricks has high aesthetic value	2%	4%	42%	52%	172	3.25
K-Briq waste bricks has high aesthetic value	2%	4%	48%	46%	169	3.17
Plastic waste bricks are more beautiful than light bricks (Autoclaved Aerated Concrete)	-	10%	54%	36%	158	2.88

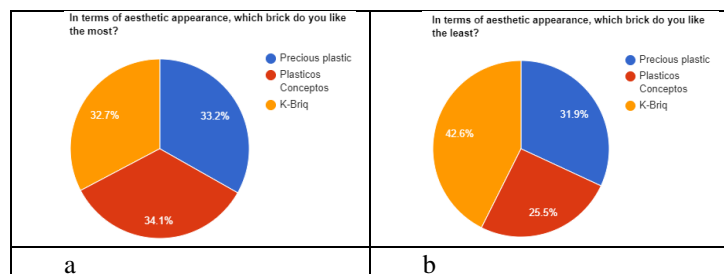


Figure 5: preferences comparison (a) most preferences (b) least preferences

From the safety aspect, respondents have doubts about the strength of the material and the interlock system. All indices in the perception of material strength are negative.

Table 8. Perception Index in terms of material strength

Question	S1	S2	S3	S4	score	Index
Plastic waste bricks is a strong material	4%	30%	52%	14%	138	2.34
Plastic waste bricks are not easy to collapse	4%	36%	52%	8%	128	2.08
Plastic waste bricks are not easy to break down	4%	34%	44%	14%	134	2.24

From the aspect of *habl min nas*, the respondents' perceptions meet the criteria of humility, usefulness and beauty, while from the security aspect there is a need for further introduction so that this material is better known.

3. *Habl Min Alam*

Perceptions based on the effect on the environment, plastic waste bricks are considered an excellent way to recycle, index 3.33. This utilization is considered very positive because it turns waste into valuable goods with a disagreement rate of below 10% with index 3.28.

The use of energy used in making plastic waste bricks is considered not in vain because respondents have a positive perception with index 2.77. Meanwhile, Respondents worried about material perceptions in the health aspect although index 2.53 is positive but is within the lower threshold. In a comparative survey of 3 plastic waste bricks, the Conceptos Plasticos was considered the most environmentally friendly plastic waste brick and was chosen by 44.7% respondents because the materials used were more diverse. This shows that the respondents takes environmental issues into consideration in choosing building materials.

Table 9. Perception Index in terms of environment issue

Question	S1	S2	S3	S4	Score	Index
Plastic waste bricks are a good product because they recycles waste	2%	4%	36%	58%	175	3.33
Plastic waste bricks are a good product because they can be reused	2%	4%	40%	54%	173	3.28
Plastic waste bricks are a bad product because they will still end up being waste	34%	44%	18%	4%	154	2.77
Plastic waste bricks are a bad product because they waste energy in the production process	38%	38%	18%	6%	154	2.77
Plastic waste bricks are not healthy for the residential environment because made from waste	36%	26%	30%	8%	145	2.53

C. *Use of plastic waste brick material in sharia apartments*

Perceptions of interest in using plastic waste bricks for Sharia apartments are negative, 24% strongly agree 36% agree, 14% less disagree and 26% disagree that have index result 2.10. But based on opinion questions of advice and expectations regarding plastic waste bricks shows a positive trend because the majority of respondents wanted further research on their effects, safety and appearance (figure 6). So it can be said that the use of used plastic waste brick material is acceptable if there has been research within a certain period of time.

Table 10. Perception Index in terms of application in Sharia Apartements

Question	S1	S2	S3	S4	Score	Index
If Sharia Apartments use Plastic waste bricks	26%	14%	36%	24%	129	2.10

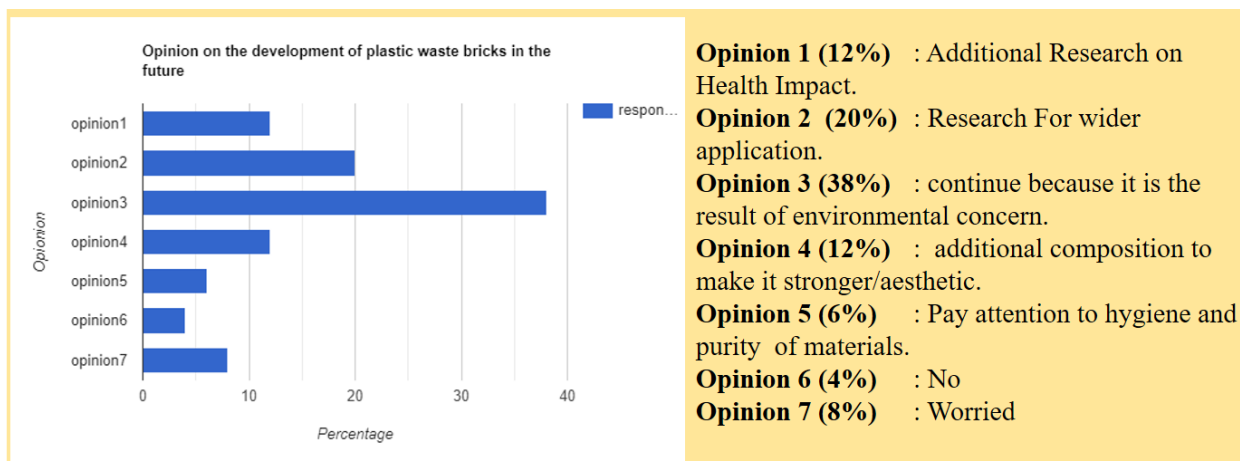


Figure 6: Suggestions/hopes for plastic waste brick

4.2 Stage 2 : Interview - Respondens

Table 21. Respondent Data

Name	Occupancy	location
Respondent 1	Architect	Sumedang, West Java
Respondent 2	Interior Designer	Bandung, West Java
Respondent 3	Landscape Designer	Lampung, Lampung
Respondent 4	Owner Interior Consultant	Jakarta , Jakarta

The use of plastic waste bricks is approved as a part of innovation that deserves to be taken into account, based on the value of using plastic waste bricks ranging from 40-60%, this reason was chosen because of the need for community adaptation to new materials, the most influencing factor is the raw material used is waste. Which has an image as dirty material mixed with various other kinds of waste because waste collection in Indonesia is still centered on collectors and scavengers. Regarding purity, respondent 1 confirmed that the use of this material should be limited to areas that have a little touch area such as the kitchen. Respondent 4 approved the use of any place but limited to the musholla area, while Respondents 2 and 3 approved the placement in all rooms.

"Even though the material is pure, people definitely imagine the material from rubbish, and all garbage in Indonesia is mixed" respondent 1.

From the available brick options, Large dimensions were chosen by three respondents as the right choice because they were able to reduce the cost of experts and speed up processing time, besides that with large dimensions the maintenance of plastic waste bricks was considered easier, Meanwhile, respondent 3 chose a small brick with a better dimension because it affected the diversity of designs produced. Regarding colour, two respondents chose Conceptos Plasticos bricks as an option because in an apartment, colours that are close to monochrome are considered neutral when combined with other furniture. Meanwhile, the other 2 chose coloured plastic waste bricks because they had more varied variants that could be adjusted between spaces.

In terms of safety, respondents 2 and 3 expressed concern in case of fire because it was feared that plastic material would easily melt and make it difficult to evacuate fire, while the perception of the interlock system all agreed that interlocks like lego had strong bonds between bricks. The

safety statement on plastic waste bricks is more of a concern in the health sector because it is not known what effect it can have in a certain period of time.

The use of energy in making plastic waste bricks is considered reasonable because in the manufacture of any material it requires energy but if in the future more costs are needed, respondent 1 chooses to use other materials that are more cost-effective. Meanwhile, respondent 2 explained that the use of energy in making plastic waste bricks is not a problem because it produces a more beautiful environmental view.

"All materials must use energy, but when that energy can reduce the amount of waste, it makes the environment look nicer. The energy is not wasted." respondent 2

All respondents agree that the most environmentally friendly plastic waste brick is Conceptos Plasticos, because they use 100 percent of plastic waste, both recyclable and non-recyclable. In another situation, respondent 1 stated that he chose only recyclable materials for plastic waste bricks because it was safer from a health perspective. Respondent 3 also stated a different concept that plastic waste bricks can be mixed with other materials not just plastic waste to have different strengths.

5. Conclusion

The perception of the Muslim community about plastic waste bricks is positive, the level of acceptance is from medium to high with index above 2.53. This perception is influenced by the activities that take place in it, the appearance produced and the level of waste content used for plastic waste bricks. People have the perception that plastic waste brick is clean, hygienic and free from *najasah* with index 2,67 - 2,96 but have not yet reached in purity and acceptance in the musholla (prayer) area because the index is negative. Variations of bricks are needed to achieve a positive perception that matches the user's personality because from a comparison of 3 plastic waste bricks, all get almost the same percentage. Doubts arise in the perception of security because it is considered a new material and the index around 2,08-2,34. In conclusion, the use of plastic waste bricks has an average potential for use in sharia apartments, but further introduction and research is needed for public reference.

References

- [1] E. Jiménez, J. K. O. Sanchez, and P. Gil, "Recycled Material Converted in Housing," *aim2flourish.com/*, 2016. <https://aim2flourish.com/innovations/recycled-material-converted-in-housing> (accessed Apr. 08, 2021).
- [2] Kemenag Indonesia, "Penduduk Menurut Wilayah dan Agama yang Dianut," 2013. <https://pkub.kemenag.go.id/files/pkub/file/file/Data/zuqi1368036766.pdf> (accessed Apr. 10, 2021).
- [3] H. Babangida and K. State, "Integrating Islamic Design Principles for Achieving Family," *J. Islam. Archit.*, vol. 5, no. June, pp. 9–19, 2018.
- [4] Design Wanted, "Precious Plastic just released a brick made from 100% recycled plastic to empower people to build constructions just like with LEGO (but a whole lot bigger).," *designwanted.com*, 2020. <https://designwanted.com/architecture/precious-plastic-brick/#:~:text=Precious Plastic just released a, but a whole lot bigger>. (accessed Apr. 07, 2021).
- [5] E4C Solutions Library, "Bloqueplas," *Engineering for change*, 2019. <https://www.engineeringforchange.org/solutions/product/bloqueplas-2/> (accessed Apr. 18, 2021).
- [6] R. S. Aouf, "Kenoteq launches brick made almost entirely of construction waste," *Dezeen.com*, 2020. <https://www.dezeen.com/2020/03/02/kenoteq-k-briq-brick->

- construction-waste/ (accessed Apr. 10, 2021).
- [7] Falcon, “Jenis Produk,” *htp-falcon.com*, 2021. <http://www.htp-falcon.com/id/products> (accessed Apr. 09, 2021).
- [8] Recycle Rebuild, “Recycledbrick,” *www.recyclerebuild.org*, 2020. <https://www.recyclerebuild.org/recycledbrick> (accessed Apr. 09, 2021).
- [9] A. Kodir and W. Sanjaya, “Human Nature Based On Al- Qur’an As The Basic Of Education Development,” *J. Pendidik. Islam*, vol. 1, no. 105, 2015.
- [10] F. Fitriahani, “Hadis Tentang Keutamaan Bagi Wanita Salat Di Rumah: Studi Fiqh Al-Hadīts,” *J. Stud. Insa.*, vol. 1, no. 2, p. 105, 2013, doi: 10.18592/jsi.v1i2.1082.
- [11] Moh. Arsyad Bahar, “Evaluasi Terhadap Aspek Kebersihan Dan Kesucian Dalam Perancangan Arsitektur Masjid,” *J. Islam. Archit.*, vol. 2, no. 1, pp. 36–45, 2012.
- [12] Z. B. Yusof, “Islam and Architecture,” *Islam Built Environ.*, vol. 1, no. June 2011, pp. 11–18, 2011.
- [13] A. A. Malik, D. Sheikh, and M. Zia-, “Role of Islam towards Peace and Progress Role of Islam towards Peace and Progress,” *Res. J. Humanit. Soc. Sci.*, no. November 2012, 2012.
- [14] R. A. Pitoko, “21,62 Persen Pembeli Rumah di Bawah Usia 30 Tahun,” *Kompas.com*, Jul. 21, 2016. <https://properti.kompas.com/read/2016/07/21/190000821/21.62.Persen.Pembeli.Rumah.di.Bawah.Usia.30.Tahun> (accessed May 21, 2021).