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Tatbita Suhariyanto <tatbita.suhariyanto@ie.uad.ac.id>

[ESL] Submission Acknowledgement

1 message

Dr. Ihwan Ghazali <ihwan@utem.edu.my> Mon, Aug 15, 2022 at 3:17 PM
To: Tatbita Suhariyanto <tatbita.suhariyanto@ie.uad.ac.id>

Tatbita Suhariyanto:

Thank you for submitting the manuscript, "Environmental Impact Assessment of Brick Production in Indonesia" to Engineering Science Letter. With the online journal management system that we are using, you will be able to track its progress through the editorial process by logging in to the journal web site:

Submission URL: https://journal.iistr.org/index.php/ESL/authorDashboard/submission/48
Username: bita0502

If you have any questions, please contact me. Thank you for considering this journal as a venue for your work.

Dr. Ihwan Ghazali

Engineering Science Letter

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Tatbita Suhariyanto <tatbita.suhariyanto@ie.uad.ac.id>

[ESL] Editor Decision

admin admin <admin@journal.iistr.org> Wed, Aug 17, 2022 at 4:11 PM
To: Tatbita Suhariyanto <tatbita.suhariyanto@ie.uad.ac.id>, Hayati Mukti Asih <hayati.asih@ie.uad.ac.id>, Fadli Surya Ramadhan <ramadhan1800019122@webmail.uad.ac.id>, Ahmad Rijal Nasution <ahmad1800019140@webmail.uad.ac.id>

Tatbita Suhariyanto, Hayati Mukti Asih, Fadli Surya Ramadhan, Ahmad Rijal Nasution:

We have reached a decision regarding your submission to Engineering Science Letter, "Environmental Impact Assessment of Brick Production in Indonesia".

Our decision is: Revisions Required

Engineering Science Letter

2 attachments

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48K

B-4 hayati.docx
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Environmental Impact Assessment of Brick Production in Indonesia

Tatbita Titin Suhariyanto, Hayati Mukti Asih,
Fadli Surya Ramadhan, Ahmad Rijal Nasution
Industrial Engineering Department, Universitas Ahmad Dahlan,
Special Region of Yogyakarta

ABSTRACT

Brick is one of the building materials commonly used in building construction materials. The production activities of the brick industry have a lot of potential that can cause problems in the environment such as water, soil and air pollution. The purpose of this study is to analyze the potential environmental impacts in the form of emissions and waste from brick production activities by applying the LCA method to the brick production process and to identify the inputs and outputs of the brick production process. To gain a deep understanding, a small enterprise of brick manufacturer was selected as a case study. The results of this study indicate that electricity and cement are the biggest causes of each category of impact. The category of potential global warming impact is the largest with a total of 6.95 kg CO_2-eq. Although in all categories the percentages are more or less the same. This happens because the brick production process which almost entirely uses electrical energy in the production process and also the use of cement in large quantities has a major impact on the environmental impact.

1. BACKGROUND

Brick is one of the building materials commonly used in building construction materials. Brick is composed of a mixture of coarse sand, portland cement and water which is printed solidly or press [1]. The general shape of the brick is a rectangle with a standard size of 20-30 cm long, 8-10 cm thick and 14-18 cm high. In general, people use brick as a component of walls in buildings because it has several advantages over other building materials such as red brick. The advantages of bricks are that they are larger than red bricks, so they require less bricks and adhesive materials such as cement when carrying out construction, their waterproof nature minimizes leakage and is also lighter. However, bricks also have disadvantages, namely easy to crack,

In Indonesia, the brick industry is quite common, one of which is the SME located in Yogyakarta. The production activity of the brick industry has a lot of potential that can cause problems in the environment such as water, soil and air pollution. In order to overcome the problems that occur as a result of the brick production activities, the application of the life cycle assessment (LCA) method can be used to identify emissions and waste generated from the production activities of the brick industry. LCA is a method for analyzing and calculating

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The motivation of the study
A brief explanation of the method of the study
The contributions of the study

While the first item is well explained, the second and the third items are not mentioned in this abstract.

Also, consider writing 1-2 sentences in the last part of the abstract mentioning the recommendations (for reducing the emission, for the future researcher, etc.)

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the total environmental impact of the product life cycle [2]. LCA can be used to determine the potential for waste to be generated, the raw materials needed and also how much energy consumption is used [3]. LCA consists of four stages, namely the determination of objectives and scope, inventory analysis, impact assessment, as well as interpretation and analysis of improvements. [4]. In a previous study, Supriadi [5] stated that based on the LCA method, brick is a material that has a better impact on the environment than bricks in the process of making walls.

The scope of this LCA research is gate to gate which is the scope of the shortest life cycle analysis because it only reviews activities that are closest to discussing the process from the production stage. The scope is used to determine the environmental impact of a production step or process [6]. The purpose of this study is to analyze the potential environmental impacts in the form of emissions and waste from brick production activities at one of the MSMEs in Yogyakarta. The application of the LCA method is also expected to be able to identify inputs and outputs from the production process and find out critical points in the entire process.

2. RESEARCH METHODOLOGY

Research stagesconducted consisting of literature study, field observations, interviews, as well as data collection and processing. Environmental impact analysis of the brick production process is carried out using the LCA method, which consists of four stages, namely determination of objectives and scope, inventory analysis or life cycle inventory (LCI), environmental impact analysis or life cycle impact assessment (LCIA), and interpretation. LCA results can be applied to product development, strategic planning, public policy making, and marketing.

Determination of objectives and scope is the first stage in conducting an LCA analysis. This stage was made with the aim of determining the limits and scope of analyzing LCA [2]. In this study, the limitation of the system used is gate-to-gate which includes only the production process. This process starts from the distribution of the main ingredients for making bricks such as sand, water and cement, then the process of mixing the materials, molding the bricks, to marketing the finished bricks.

Furthermore, inventory analysis is carried out by collecting data and calculating the flow of raw materials and energy needed in the brick production process. From the results of inventory analysis, it will be obtained the amount or amount of the need for raw materials, energy and emissions generated from the production process. After performing LCI, LCA modeling was performed using GaBi software. From the software, the LCIA was carried out by selecting the CML 2001 method for the environmental impact category. This method is an impact assessment that limits quantitative modeling to an early stage in the cause-and-effect chain to limit uncertainty. Results are grouped into midpoint categories according to a common mechanism. In this study, only four impact categories were selected, namely GWP,

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We encourage the authors to utilize proofreading tools and grammar checkers to improve the English quality.

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ODP, ADE, and HTP. The results of the LCIA were analyzed and identified critical points for each category of environmental impact. Then, the last stage is the interpretation of the results and the design of improvement proposals.

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3. RESULTS AND DISCUSSION

Brick is the main material in a building. One of the uses of this material as a component for making walls. The functional unit determined in this study was brick with a weight of 1 kg. As presented in Figure 2 and Table 1, pBrick production begins with the process of mixing sand, cement and water. The raw materials are stirred using a mixer/molen machine. After that, the next process is the molding of bricks using an automatic brick press machine that uses a vibrating system. The advantage of using a vibrating brick machine is that it has more production capacity and is very easy to maintain. After the bricks are printed, the next process is to dry the bricks and arrange them neatly in the storage area. The output of this production process produces 1 kg of bricks and 0.05 kg of solid waste.

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From the data that has been collected in the LCI process, then the LCA model is designed using the help of GaBi software. This model describes ~~in detail~~ the inputs and outputs arising from the brick production process. Furthermore, the potential environmental impacts were analyzed using the 2001 CML method. There were four categories of impacts selected, namely GWP, ODP, ADE, and HTP. These four impact categories were selected according to the scope of the research (gate-to-gate).

Table 1.LCI

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Input				
Flow	**Quantities**	**Amount**	**Units**	**Origin**
Cement (Minerals)	Mass	1	kg	Estimated
Electricity ~~(Electric Power)~~	Energy	10.1	kwh	Calculated
Ground Water ~~(Water)~~	Mass	2.5	kg	Estimated
Limestone Sand 0-3.5 mm ~~(Limestone)~~	Mass	1	kg	Estimated
Output				
Flow	**Quantities**	**Amount**	**Units**	**Origin**
Concrete Brick	Mass	1	kg	Calculated
Other Waste (Production Residues in Life Cycle)	Mass	0.05	kg	Estimated

The biggest causes for each category of impact are electrical energy and cement. Cement is an important binder in the construction industry and is produced in large quantities worldwide. The cement production process requires a lot of heat energy. About 40% of the

total cost of the cement industry is used for fossil fuels, such as coal, where this fuel is usually used as a source of energy in the cement industry [7]. High cement production will cause environmental pollution, because the intensive use of natural resources will affect the work of residents around industrial areas [8]. The most important impact of the high energy consumption of the cement industry on the environment is exhaust emissions, especially exhaust emissions. Carbon dioxide emissions that affect climate change [9]. It is estimated that the cement industry accounts for 57% of global carbon dioxide emissions. The high emissions of the cement industry are driven by high global cement production and demand, and cement is expected to continue to grow [10].

As shown in Figure 4, there are four categories of environmental impacts derived from the LCIA results. The first category is GWP. This category focuses on the environmental impact of global warming. The brick production process in this study has an impact on GWP in 100 years. The most contributing impact is the use of electrical energy and cement with a total of 6.95 kg CO_2 eq, in electrical energy of 5.68 kg CO_2 eq and cement of 0.901 kg CO_2 eq. The second category is ODP. This category focuses on the environmental impact of the potential reduction or depletion of ozone caused by chemical compounds. The results of the LCIA diagram on the brick production process in this study show that the most contributing impact is cement with a total of 4.4e-8 kg R11 eq. Next, the third category is ADP. This category focuses on the environmental impact of the potential depletion of non-fossil natural resources. The results of the LCIA diagram on the brick production process show that electrical energy contributes the most by producing 2.35e-6 kg Sb eq, then cement produces 1.46e-6 kg Sb eq. The last category is HTP. This category focuses on the environmental impact of the potential environmental impact, which is pollution from the air that has a negative impact on human health. The results of the LCIA diagram on the brick production process in this study show that electrical energy produces 0.2 kg DCB eq while cement is 0.0925 kg DCB eq. The total amount of the two is 0.293 kg DCB eq. Based on the LCA results, proposalsThe recommendation for improvement given is to apply the concept of sustainable manufacturing to the brick production process. To reduce the environmental impact, the brick production process must conserve energy and use natural resources efficiently.

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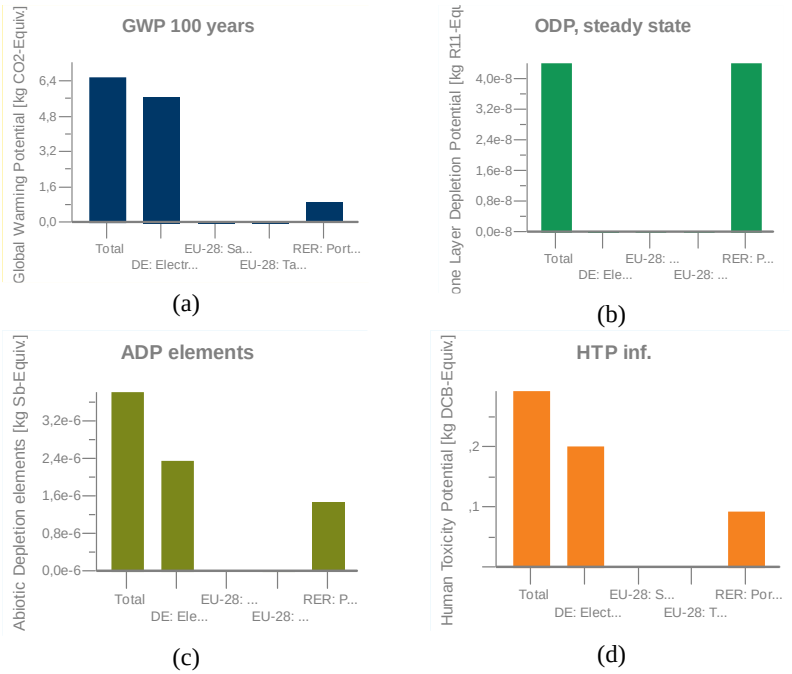

Figure 4. LCIA Diagram of GWP, ODP, ADP, and HTP

4. CONCLUSION

From the research that has been done on the production process of bricks using the LCA method, the results of the analysis of potential environmental impacts for the four categories, namely GWP, ODP, ADP, and HTP have been obtained. For example in the impact categoryGWP, the use of electrical energy and cement are the processes that have the biggest impact.This happens because the production process of bricks almost entirely uses electrical energy in the production process and the use of cement in large quantities has a major impact on the environment.

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