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Temperature Distribution in bio stove using Saw Dust: An integrated project-based learning

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ABSTRACT

This paper aims at developing the potential of cellulose-based energy generation using pyrolysis, gasification, and combustion methods with biodegradable waste media. The cellulose-based material used in this study was sawdust. The sawdust was heated using a biomass stove, which was then analyzed in terms of heat conduction and propagation as well as temperature distribution. To ensure the effectiveness of sawdust as the main material in the biomass stove, sawdust particles were pressed and compacted under various pressure conditions. This experiment was integrated with the Project-Based Learning method through the following steps: (1) determination of projects testing, (2) project design, (3) project implementation schedules, (4) project completion and progress monitoring, (5) reports and presentations of project results, and (6) project evaluation. The results provide new findings that the denser sawdust particles correlate with the greater temperature and propagation rate. This can be obtained from the measured temperature distribution. Areas close to the heat source tend to have the same heat propagation. The density of the sawdust particle is the main key point for producing better pyrolysis and gasification process, in which it correlates with long combustion energy. Integrasi This finding opens a new concept and can be used as a reference for other researchers who develop research related to renewable energy from waste, especially when using a biomass stove. This study also gives ideas for the need for developing project-based learning using the burning of sawdust using biomass stove as a tool for the teaching and learning process.

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1. INTRODUCTION

Garbage has been a common problem nowadays. The amount of waste keeps increasing in line with population growth and urbanization. The escalation of solid waste in final disposal becomes a severe problem that needs a prompt solution (Solid waste management: Issues and challenges in Asia ©APO In *Asian Productivity Organizastion (APO)*. www.apo-tokyo.org , 2007). The waste sources are domestic waste, commercial waste, ash, animal waste, biomedical waste, construction waste, industrial waste, sewers, biodegradable and non-biodegradable waste, and hazardous waste (Demirbas, 2011). However, if these wastes are properly processed, they can become substantial energy and economic potency that humans can utilize.

Organic waste included in biodegradable waste is potential, for example, sawdust waste which can be used as a renewable energy source. It can be reused through a cellulose-based energy generation process using pyrolysis, gasification, and combustion methods. Pyrolysis refers to a process of decomposition of materials at a certain temperature without a mixture of air, and the resulting products are solids (charcoal/charcoal), gas (fuel gas), and liquid (bio-oil) (Subagyono *et al.*, 2021). Gasification means a partial combustion process with a little air mixture (20 - 40%) to convert solid fuels into high-temperature fuel gases but this method still produces pollutants as an output (e.g., CO2 and other impurities) and relatively contains low chemical conversion efficiency (Sepe *et al.*, 2016). Combustion is a complete mixture of oxygen in various industries that produce high CO2 emissions.

An effort to reuse sawdust waste can be realized through various tools, and the most widely used is Biomass Stove for energy generation. Although electric stoves have already existed, many people in rural areas have difficulties using them. Thus, many people use biomass stoves (Wang *et al.*, 2015) due to their abundant sources like wood, briquettes, coal, and waste. Various studies found that sawdust fuel could substitute charcoal and firewood. Other researchers tried to create an innovative Biomass Stove by utilizing sawdust. They improved the design and the performance to produce a biomass stove, which has been known as an effective, efficient, low-cost, and comfortable equipment only by utilizing sawdust as its fuel (Owusu *et al.*, 2020).

The development of the usefulness of sawdust waste as a fuel source can be applied in a learning process. In this context, a contextual problem is an effective means of learning to develop students' potential skills to face all kinds of new demands that arise in the current era. These skills are needed in the 21st century: collaboration, communication, critical thinking, and creativity (4C) (Adler-Beléndez *et al.*, 2020). Those skills, of course, cannot be realized in a short time, but it requires an appropriate learning method for habituation. Project-based learning can be put forward as a learning method that can translate the problem into a learning context to foster students' collaboration, communication, critical thinking, and creativity (Pipatjumroenkul *et al.*, 2019).

This learning focused on a problem in the main project in learning to facilitate students exploring problems, conducting research, and interpreting data by comparing existing theories with real experiences in the learning process. The learning environment was designed to give students plenty of time to learn by collaborating and transforming their ideas as a group. The role of lecturers was no longer teaching but directing, inspiring, challenging, and encouraging students to carry out projects, making sure the learning process comfortable.

The research results of Silva *et al*. (2021) explained that sawdust can be converted into energy through the process of pyrolysis and gasification without additional energy from the outs t is a renewable material that has a

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fairly high energy potential, is cheap, and is environmentally friendly (El-Shafay *et al*., 2020).

Research on testing the temperature distribution of biomass stoves is through project-based learning (PbL). The current PbL was carried out by students. This method is different from the existing PbL. The difference can be found, starting from project problems that are in line with research. The process and completion of research were carried out using PbL. There are two benefits to the use of current PbL. First, students gained experience in testing temperature differences on mass bio stoves and improving analytical and critical thinking skills. Second, lecturers as makers of the research-based projects get the benefit of completing research and testing with students as controlled subject variables.

Based on these problems, there is a need to integrate project-based learning to know the heat conduction propagation pattern in the Biomass Stove of sawdust waste material as a medium for energy generation.

2. LITERATURE REVIEW

2.1. Syngas Production from Sawdust

The potential of biomass in Indonesia is very large, reaching 32.6 GW. Sawdust is one of the biomass from wood waste. Various studies (Yang *et al*. 2012) showed that sawdust was the potential for renewable energy. The energy value per mass of sawdust is 17 MJ/kg when viewed from a very competitive price compared to Liquefied petroleum gas (LPG) with a value of 30 MJ/kg (Kan *et al*., 2013). Sawdust contains many chemical compounds such as cellulose, hemicellulose, and lignin (Kazmi *et al*., 2019). The compound has the potential to become syngas through gasification and pyrolysis processes (Hu *et al*., 2016).

Syngas is a synthetic gas containing 30-60% of carbon monoxide (CO), 25-30% of hydrogen (H2), 0-5% of methane (CH4), 5-15% of carbon dioxide (CO2), water vapor, smaller amounts of the sulfur compounds hydrogen sulfide (H2S), carbonyl sulfide (COS), ammonia, and other trace contaminants (https://netl.doe.gov/research/coal/energy-systems/gasification/gasifipedia/syngas-composition). The synthesis gas is defined as a gas with H and CO as the main components of fuel. Raw syngas contains mainly significant amounts of CO2 and H2O as well. Since syngas is usually used at higher pressures for synthesizing chemicals and fuels the N2 contents must usually be minimized in syngas. Bio-syngas, however, are biomass produced, chemically identical to syngas.

The synthesis gas is defined as a gas with H and CO as the main components of fuel. The flammability limit of the syngas and the laminar flame velocity is the major syngas properties. Syngas can be produced from the gasification of biomass/coal or reforming of natural gas, and the yield is measured by the mass produced in the product (in cubic meters per the mass of the feedstock).

Various experiments have been carried out to produce syngas from sawdust (Bahri *et al*., 2019). The Fischer-Tropsch technique is one of the commercially accessible methods of manufacturing clean synthetic fuel from syngas and others. The process to produce syngas using require energy from the outside (Yang *et al*., 2012). The lack of this process requires additional fuel to produce syngas. The current trend is how to produce syngas with integrated energy from the source of bio-mass materials used (Mujiyono *et al*., 2020). This method used the concept of using syngas from sawdust gasification to flame and subsequently as a heat source for the next sawdust gasification process. Optimization of this method requires the study of variables that affect the syngas process of compacted sawdust.

One of the important variables is the temperature of the gasification process in the compacted sawdust to produce syngas. Varying temperature distributions at sawdust points radial distances measured

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from the heat center. Meanwhile, other references indicate temperature propagation in porosity-dependent biomass (MacLean, 1941; Vasubsbu *et al*., 2015). In the case of compacted sawdust, the porosity is identical to the degree of density. The higher porosity correlates to the lower density level. Further studies are needed to study the temperature distribution and heat propagation of compacted sawdust so that it can be used as a basis for determining the effectiveness of the gasification process.

2.2. Project-Based Learning

Currently, the use of project-based learning as a learning model is increasingly showing its acceleration in terms of quantity, diversity, and quality. Project-based learning is a learning model that uses an inquiry-based instructional method by involving all students' abilities in reconstructing knowledge by completing and developing a product in real-time (Guo *et al*., 2020). Another opinion states that project-based learning is a dynamic learning process by providing a broad capacity in facilitating students to learn and understand basic content at the highest level of Bloom's. Project-based learning becomes a platform for inquiry model learning which often leads to an increased understanding of how learners apply the knowledge gained in real practice (Chua & Islam, 2021).

The increasingly massive implementation of project-based learning is also in line with future demands for the quality of 21st-century graduates who can master the field of study and adaptive abilities such as collaboration, problem-solving, and the demands of 21st-century human resources. Various studies have shown that Project-based learning can increase the ability of students both in the aspect of mastery of the field of study (Young *et al*., 2021) as well as supporting aspects that are soft skills such as independence; motivation (Ahtee & Poranen, 2009), attitude (Linder *et al*., 2006), problem-solving, creativity and innovation, and critical thinking ability. Various studies have also formulated that Project-based learning can be applied to various characteristics of subjects or subjects, whether theoretical, laboratory, or practical learning in various fields (Young *et al*., 2021).

The implementation of project-based learning includes the main stages in the form of preparation, implementation, and evaluation. Although various studies use several different steps nevertheless the synthesis carried out by formulating that broadly there are six steps of project-based learning (Damayanthi *et al*., 2021) providing important questions, designing projects, writing project implementation schedules, monitoring, implementing product evaluation projects, and ending with the implementation of learning experience evaluations.

Most of the implementation of project-based learning is oriented to improve the ability of students to master hard skills and soft skills. Today, some studies are limited (Berman *et al*., 2021; Sabura Banu, 2020), initiating the creation of a new force in the form of Project-based learning integration in solving problems in the fields of social, science or research in the laboratory. This initiation needs to be welcomed with research in various fields so that it further proves the new paradigm of project-based learning integration in solving research problems, including in the field of technology.

3. MATERIALS AND METHODS

3.1. Design

The tools are designed to test the temperature distribution on the biomass stove which has been developed from a series of previous studies (Mujiyono *et al*., 2020). The biomass stove design consists of 6 main components, the reactor tube, output, heater element, thermocouple, and monitoring box. It was done in 3d modeling using Autodesk Inventor software and testing simulation with Ansys. The minimum stress

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simulation results were 0.388 MPa and a maximum of 193 MPa. The yield strength value of ST 37 was 294 MPa based on a thickness of 3 mm and a set pressure of 1 bar.

The advantage of biomass stove testing analysis is to find out the temperature distribution in bio stove which uses variations of biomass sawdust materials, density variations, and sawdust grain sizes that were not owned by previous test equipment. The previous test equipment was only able to measure the temperature distribution in the combustion process from briquette-shaped sawdust. Meanwhile, the new test tool can measure solid-shaped sawdust in the gasification and pyrolysis process (**Table 1**).

3.2. Materials

The biomass stove material in each component was varied. The reactor tube used austenite stainless steel of 304 with 3 mm thickness. The gas output material used stainless steel. The heater element was designed in a circle with an electric working system that functioned as a resistance heater. The real-time heat meter used a thermocouple integrated into the monitor box that can be set as needed. The installation position of the thermocouple was arranged in a centrifugal circle; Thus, the value and the temperature propagation can be monitored. The heat was maintained to have no direct contact with the thermocouple.

Sawdust materials depended on cellulose, hemicellulose, lignin, and pectin. When Cellulose ($C_6H_{10}O_5$) is exposed to heat without oxygen, it produces synthetic gases. The sawdust is pressed with various pressure conditions.

The sawdust used in this study was a type of teak wood. Based on testing this ingredient has a cellulose composition (47.5%), lignin (29.9%), and other ingredients (12%). This composition is relevant to the composition of the standardized teak wood material.

3.3. Experimental Work

Research procedures are the following:

(i) Preparing temperature distribution test equipment on the biomass stove,
(ii) Preparing materials in the form of sawdust with a 2 mm mesh pass,
(iii) Putting sawdust into the test equipment,
(iv) Pressing sawdust with a pressure of 60 bar and a pressure variation of 70 bar and 80 bar,
(v) Turning on the heat source at a temperature of 400°C and repeating at various temperatures of 500°C, 600°C, and 700°C, respectively,
(vi) Analyzing temperature, time, temperature distribution diameter, and height of heat distribution

The experiment stages were integrated into the energy conversion course in the mechanical engineering study program. It adopted a project-based learning syntax consisting of determining test projects, designing project completion, preparing project implementation schedules, completing projects and monitoring progress, making reports and presentations of project results, and evaluating project processes and results.

Table 1. Excess test equipment.

Characteristic	New Test Tools	Old Test Equipment
Sawdust forms	Solids	Briquettes
What to measure	Temperature distribution	Energy
Thermochemical conversion	Suitable for gasification and pyrolysis processes	Suitable for combustion processes

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Experiments were directed at students who took energy conversion courses. The number of students involved is in one class with a total of 16 students consisting of 14 males and 2 females. There are 4 testing groups with 4 students in them. The testing experiment was carried out from October to November 2021 by spending 6 meetings. The first meeting was designing project completion, the second and the third meetings were preparing project implementation schedules and completing projects, the fourth and the fifth meetings were completing projects and monitoring progress, and the sixth meeting was making reports and presentations of project results as well as evaluating project processes and results.

The determination of the testing project was intended to know the effectiveness of the temperature propagation pattern in the biomass stove testing equipment. It resulted in a testing project to determine the pattern of heat propagation based on temperature variations and sawdust amounts. The detailed selection of experimental testing projects with the control variables is shown in **Table 2**.

Students and lecturers carried out the planning of the test project steps. The form of the test project was listed in the lab sheet as the guideline for testing the sawdust temperature distribution. The testing scheduling phase was carried out before the lecture (07.00 - Western Indonesian Time (WIB). The stages of project completion, discussions, and presentations were performed by students during the course (12.00 WIB). Conclusions were drawn mutually to see the phenomenon of the temperature propagation pattern in the compacted sawdust in the biomass stove.

4. RESULTS

The temperature propagation rate in the biomass stove from sawdust was analyzed with four determining variables and varying temperatures. It also included three measuring variables: sawdust, density, and pressure. The alternative use of the experimental selection was based on the pyrolysis process, occurring at temperatures above 250°C.

The temperature propagation pattern was tested and calculated with a maximum measurement time of 5 hours. The testing process began with compacting sawdust with a pressing machine. The sawdust mass was varied in the volume of the biomass stove in the reactor of 12,858.3 cm^3. Mass variations in sawdust density are presented in **Table 3**.

Table 2 shows that the bigger the pressure, the greater the density of sawdust in the biomass stove reactor. The high mass was influenced by the sawdust particles that were getting closer. Thus, they covered the sawdust gaps with oxygen. The gasification process by minimizing the O_2 content can increase the gasification temperature and time.

After the compaction process was done, the tests were carried out (**Table 1**). The students as the project performer tested the entire specimen. The test in 5 hours was done with four biomass stoves with different pressure conditions (i.e. 60, 70, and 80 bar). Measurements were carried out per second with 5 thermocouples in a centrifugal circle on the reactor wall with a 2 cm distance of the thermocouples.

Tabel 2. Project experiment.

Experiment of PbL	Pressure Test Project		
	1	2	3
Group 400°C	80 bar	70 bar	60 bar
Group 500°C	80 bar	70 bar	60 bar
Group 600°C	80 bar	70 bar	60 bar
Group 700°C	80 bar	70 bar	60 bar

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Table 3. The difference between sawdust mass and pressure.

Testing experiment	Mass (kg)
400°C, 80 bar	2.305
400°C, 70 bar	2.115
400°C, 60 bar	1.925
500°C, 80 bar	2.305
500°C, 70 bar	2.115
500°C, 60 bar	1.925
600°C, 80 bar	2.305
600°C, 70 bar	2.115
600°C, 60 bar	1.925
700°C, 80 bar	2.305
700°C, 70 bar	2.115
700°C, 60 bar	1.925

Figure 1 illustrates the project-based learning test of temperature propagation patterns on a biomass stove. **Figures 2, 3, 4, and 5** are the test results in temperature propagation patterns with variations in sawdust pressure and heating temperature.

The experiments in **Figures 2, 3, 4, and 5** showed propagation variation. In **Figure 2a**, the diameter of the propagation as measured by a mechanical measurement device was 20 cm, and the propagation height was 12 cm. In **Figure 2b**, the diameter of the propagation began to decrease to 15 cm in diameter with the height of the vines shortening to 13 cm in length. In **Figure 2c**, the diameter of the propagation was 1 cm larger than the previous test and was the same height as the previous height. The difference between this measurement and the constant variable was the temperature of 400°C. The different pressure variations showed that the greater the sawdust pressure, the smaller the diameter and height of heat propagation.

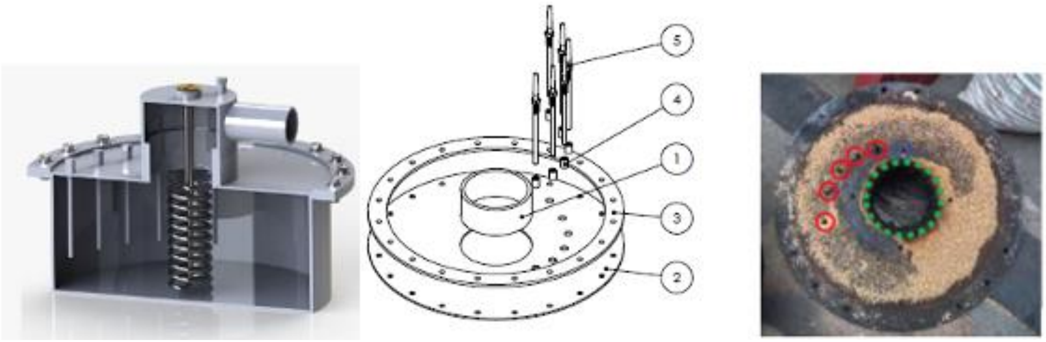

Figure 1. The schematic and test result.

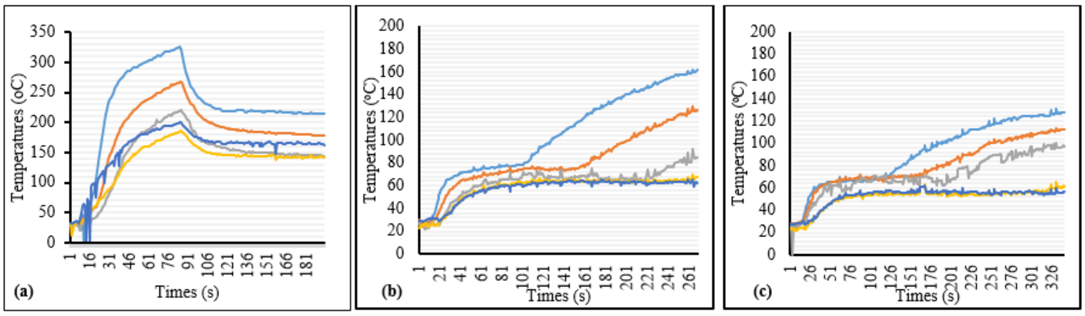

Figure 2. The temperature propagation rate, (a) 400°C/80 bar, (b) 400°C /70 bar, dan (c) 400°C /60 bar.

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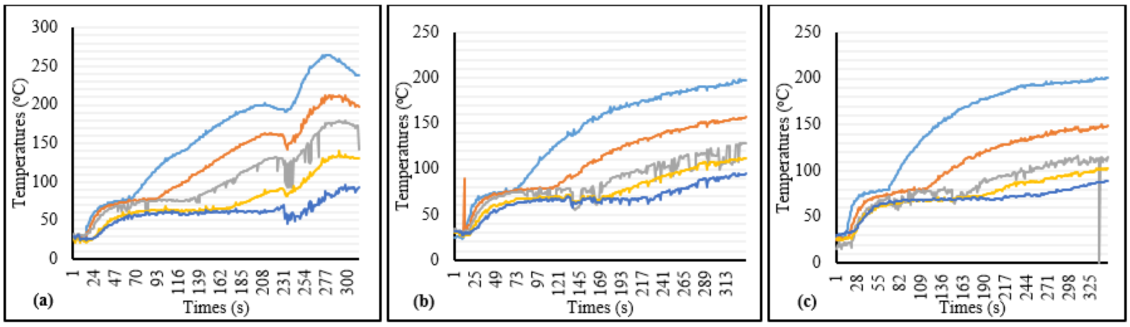

Figure 3. The temperature propagation rate, (a) 500°C /80 bar, (b) 500°C /70 bar, dan (c) 500°C /60 bar.

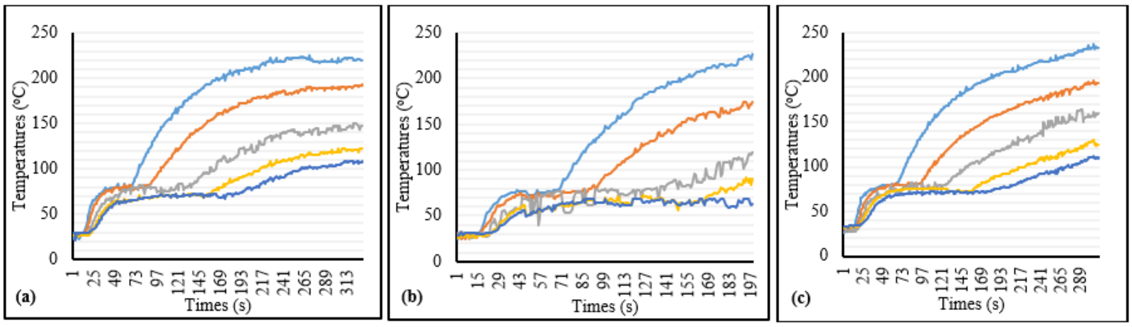

Figure 4. The temperature propagation rate, (a) 600°C /80 bar, (b) 600°C /70 bar, dan (c) 600°C /60 bar.

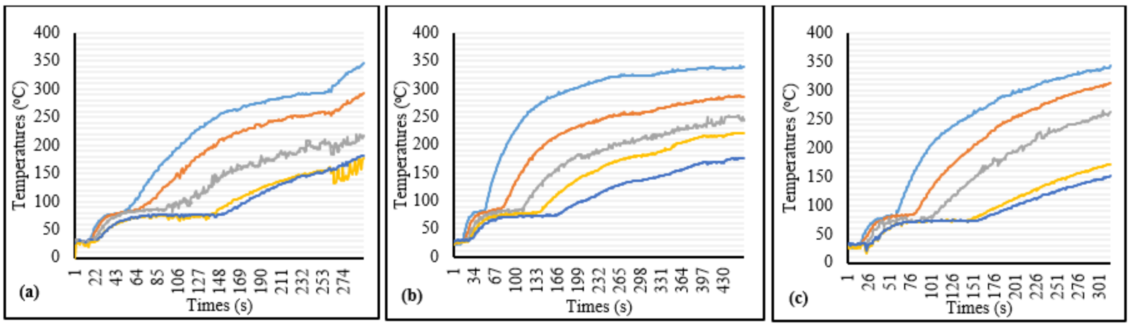

Figure 5. The temperature propagation rate, (a) 700°C/80 bar, (b) 700°C/70 bar, dan (c) 700°C/60 bar.

Tests for measuring propagation and high temperature with a temperature of 500°C experienced different phenomena. In **Figure 3a**, the heat propagation was 16 cm, and the propagation height was 13 cm. This result is still lower than the test in **Figure 3**. In **Figure 3b**, the propagation was 18 cm with a height of 14 cm. **Figure 3c** showed that the temperature propagation increased at a diameter of 18.5 cm with a propagation height of 13.5 cm. Compared to the previous temperature, this propagation pattern was more effective and supported the acceleration toward the gasification process.

The propagation pattern and high propagation temperature at 600°C showed varied results. At this temperature, the average propagation obtained an increase in diameter. **Figure 4a** showed a large propagation diameter reaching 20 cm with a height of 14 cm, while **Figure 4b** experienced a decrease in the diameter of 18.5 cm and a propagation height of 14 cm. An increase in diameter of 19.5 cm and a propagation height of 13.5 cm occurred in **Figure 4c**.

Tests for propagation patterns and high temperatures at 700°C indicated various temperature changes. In **Figure 5a**, the

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diameter of the propagation was getting bigger until it reached 23 cm and a height of 14 cm. In **Figure 5b**, the propagation and high-temperature results were the same as in the previous test. For **Figure 5c**, the diameter of the maximum temperature propagation reached a diameter of 24 cm and 14 cm for the height of the propagation.

All tests based on measurements with a thermocouple that is 2 cm from the heat source showed different results. Based on the comprehensive examination, it can be concluded that the denser the compacted sawdust particles, the greater the temperature propagation rate which was proven by the measured temperature distribution. Areas close to the heat source tend to have the same heat propagation. The effect of sawdust particle density has been the key to producing pyrolysis in gasification with long combustion energy.

Based on the results in **Figures 2,3, 4, and 5**, it can also be observed that there is a pattern of temperature propagation rate that increases linearly with density at a distance of 24 cm from the heat source. It means that there is the same trend in all treatment temperatures. However, at a distance less than 24 cm from the source of the treatment temperature, it tended to increase the temperature propagation rate which was less stable. It is caused by the sawdust factor which has heterogeneous characteristics as in metal. This phenomenon can be further studied to determine the root cause of its heterogeneity of propagation results below a distance of 24 cm. Several causative factors that can be identified include chemical composition, moisture content, and size dimensions of items.

Analysis of project-based learning-based temperature propagation pattern testing contributed to the implementation of the study. Testing efficiency is obtained from the implementation time, cost, and more concise efforts which empower students as a project-based testing completion method. Research on temperature propagation testing by dividing several test specimens can be a motivation for students to test. The results of student analysis are then presented in a discussion forum to maximize communication skills

5. DISCUSSION

This study revealed the rate of temperature propagation in powdered media (i.e., compacted sawdust in the biomass stove process). Various literature and research results have described the thermal conductivity of different pressed wood particles (Mason *et al*., 2016). However, the rate of temperature propagation for powdered materials, especially wood, has not been widely defined in various studies. It answers the fundamental question of whether there is a difference in the rate of temperature propagation in the variation of sawdust density until it reaches a stable maximum temperature (holding time).

The next question is whether a similar trend existed regarding the temperature propagation rate at a sawdust density towards heat source variations. The results showed different patterns of heat propagation in a sawdust based on variations in sawdust pressing pressure (80, 70, and 60 bar). The various temperatures (400, 500, and 600°C) tend to influence the rate of heat propagation to reach a stable maximum temperature (holding time) and the escalation of pressing pressure of sawdust.

Visually, the higher density (more pressing power) of sawdust resulted in a wider area of heat propagation. This is in line with research results that the denser material has a faster heating rate. However, this preliminary study raises new questions that need to be studied further including (a) whether the heating rate is always consistent with the density (pressing pressure) of sawdust, (b) the required temperature of the heat source to obtain the rate of heat propagation to gain the optimal gasification (c) the effect of sawdust size (mass) on the rate of heat

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propagation, (d) the shape of the heating rate diagram for sawdust in the biomass stove.

Each material has a specific thermal conductivity (MacLean, 1941; Vasubsbu *et al*., 2015). The common question is sawdust's optimal density (pressing pressure) to produce the most optimal heating rate until a stable gasification temperature is reached. It becomes a fascinating issue for further discussion after the findings on the sawdust heating rate in the biomass stove.

As previously stated, the study found a linear relationship between thermal conductivity and sawdust density (MacLean, 1941). A similar relationship is reported by Mason *et al*. (2016) for several wood species. However, some woods present higher thermal conductivity than expected due to their density, i.e., the Mediterranean spruce. It may be due to differences in anatomical features such as porosity or the amount and type of extractives that affect the thermal conductivity of wood.

In the field of engineering and mechanical engineering vocational, the findings of this study will be beneficial in explaining the pattern of heat propagation of various materials, mainly sawdust. Through this experiment, students in the learning process will be able to prove the heating rate of powder materials through direct practice and the lectures' explanations. The prototypes or learning media to conduct experiments is an influential element in improving the learning quality.

Novelty from the scientific side can be explained that density affects the distribution of sawdust temperatures that are inscribed in the bio stove (as seen in **Figures 2** to **5**). This opens up a new roadmap for research as well as learning projects to find out more about the characteristics of stove biomass through variations in the grain size of sawdust, the chemical composition of sawdust, and the dimension of the biomass stove.

Another novelty of this research is the application of project-based learning in solving real engineering problems. The results showed that by integrating investigations through six syntaxes of project-based learning, findings could be produced in the form of heating rates of sawdust materials on biomass stoves. The integration is carried out through the following steps: determining a test project (until a problem formulation is produced as the basis for project implementation), designing project completion steps (with guidance and lecturers approval), preparing a project implementation schedule (taking into account the involvement of various parties including industry), project completion and progress monitoring, preparation of reports and presentation of project results, and project evaluation of processes and outcomes. It is in line with the characteristics of project-based learning that emphasizes the importance of solving real problems in the field. In addition, the application of project-based learning in various subjects has proven effective in enhancing students' competencies in mastering hard-skilled material as well as improving personal abilities or soft skills (Muzana *et al*., 2021; Younis *et al*., 2021).

This finding triggers the need for further studies (see **Figure 6**), including how to: (a) implement project-based learning models based on actual problems for a broader class, (b) implement project-based learning integrated with industrial problems, (c) implement project-based learning based on real problems in the industry through theoretical, laboratory, practical, and field practice courses, (d) know the effectiveness of project-based learning based on real problems in increasing student competencies in mastering material (hard skills) and personal competencies (soft skills). Those areas will be crucial to producing an effective integration pattern of project-based learning to solve various technologies and vocational education problems.

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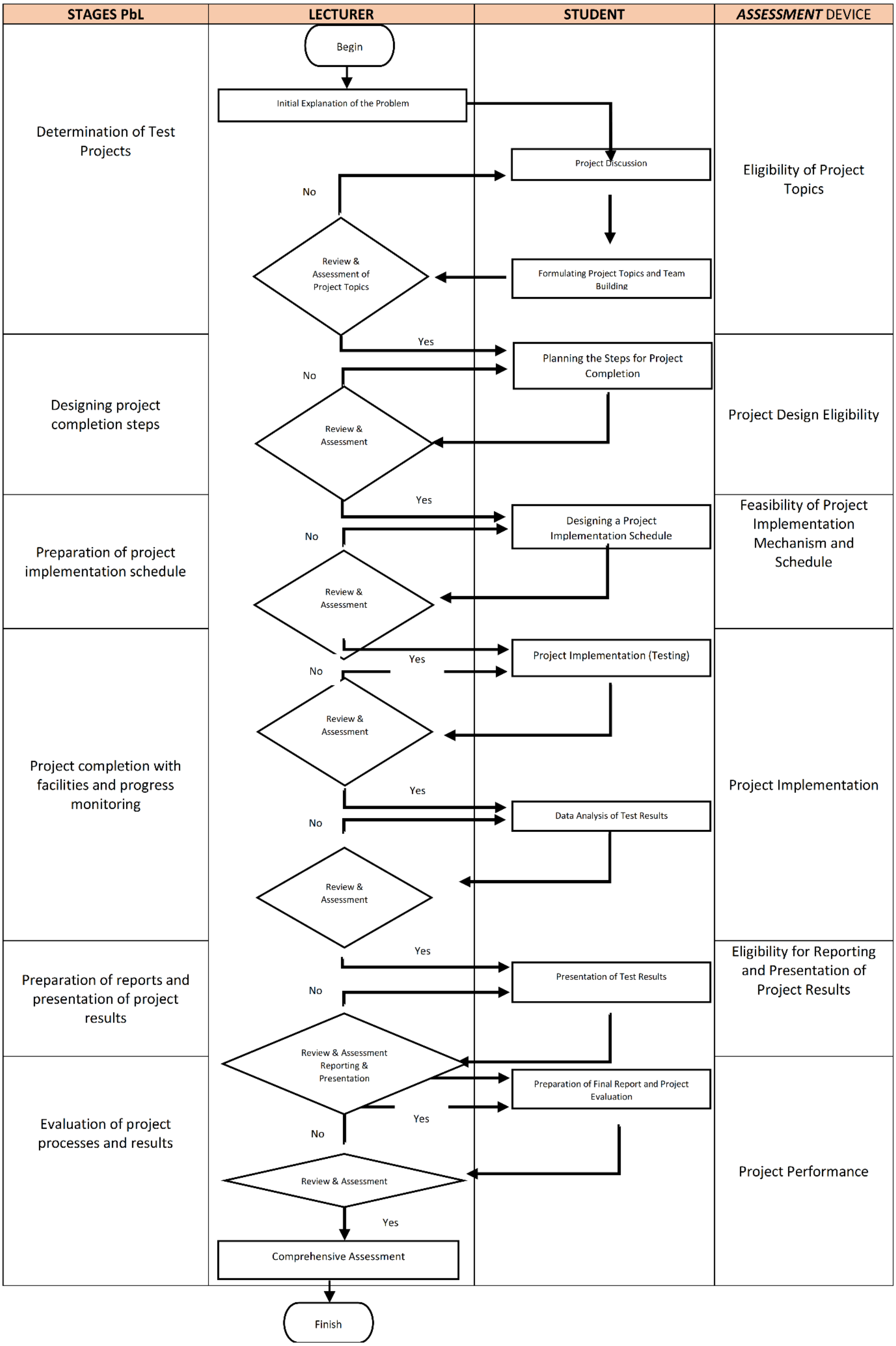

Figure 6. Designed project.

6. CONCLUSIONS

The results of the research on the pattern of sawdust temperature propagation using the project-based learning method concluded that sawdust density affects the temperature propagation rate at a distance of more than 20 cm from the center of the heat treatment source. Besides, Project-Based Learning effectively tests innovations, such as testing the temperature propagation pattern on compacted sawdust. The testing implementation of the integrated sawdust propagation pattern with Project-based Learning can effectively enhance the learning quality. The implication of this research is a comprehensive and advanced study on the determining factors of gasification and pyrolysis processes in compacted sawdust. The results of this research provide preliminary information about the conversion of energy from biomass through gasification and pyrolysis processes without using additional energy from other sources. Another implication is the need to apply project-based learning to test other product innovations in the engineering and vocational fields.

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8. AUTHORS' NOTE

The authors declare that there is no conflict of interest regarding the publication of this article. The authors confirmed that the paper was free of plagiarism.

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