

## GREEN ORGANIC COMPOST MACHINE (GOCM)

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### *Abstract*

This project aims to design a shredder for garden waste such as dry leaves that can be used by households and in educational institutions. The garden waste that has been crushed by the compost machine will become compost. In addition, identify the content of the composition in the compost fertilizer such as nitrogen, phosphorus and carbon. Observations are carried out around the Port Dickson Polytechnic area and around the residential area to identify problems that occur, for example, there are many dry leaves scattered around the Port Dickson Polytechnic and cause hygiene problems and can cause environmental pollution when burning the dry leaves. The problem faced is that the manual composting process takes a long time compared to composting using a Green Organic Compost Machine (GOCM). Scientific research is done to get information from various sources for information and produce good ideas to get complete information, including searching the internet, making observations and making questionnaires and gathering information. The research methodology was also implemented using a questionnaire and data analysis using SPSS software. Based on the findings of the study, it was found that 94.8% of respondents agree that GOCM has a good design, 94.8% agree that GOCM can save time and 92.2% agree that this machine has the potential to be marketed.

**Keywords:** Composting, Garden waste, Organic waste, Sustainability.

## INTRODUCTION

Compost is a fertilizer that is processed using garden waste such as dry leaves. Compost is very useful for planting in terms of soil restoration and soil fertilization. Garden waste that has become compost can benefit the population in terms of air pollution due to the burning of dry leaves. Nowadays, air pollution is increasing in Malaysia due to the burning of garden waste such as dry leaves.

This innovation is implemented to design a composting machine that can destroy various types of landscape waste. It also aims to innovate existing composting machines into smaller forms that are easier to use by households and educational institutions. In addition, it is implemented to identify the composition content in the compost produced such as pH value, Potassium, Ammonia Nitrogen and Phosphorus.

The provision of the Green Organic Compost Machine (GOCM) is one way to reduce the number of leaves that are burned or thrown away to reduce pollution. It can also reduce the population from being infected with dangerous diseases. The provision of the GOCM can also speed up the process of making compost from dry leaves. Thus, this can not only speed up the time of compost production but also make it easier for users to use the compost for agriculture. In addition, the compost machine is built in terms of user-friendly by placing wheels and handles on the machine to easily move the compost machine from one place to another without experiencing difficulties.

In general, composting is a very effective method in preserving the environment. So, by practicing composting we not only help fertilize plants but also maintain environmental sustainability for future generations. In making a composting machine, selecting the right materials or components is very important so that the machine can function optimally and make it easier for residents to use the machine.

## **LITERATURE REVIEW**

According to Shiyang Fan, Anran Li, *et.al* (2021) composting is an effective process for treating organic solid waste (OSW). There is growing interest in recovering and reusing heat from composting, in the context of climate change and fossil fuel depletion.

According to Elsa Sulistiani and Ageng Saepudin Kanda S (2024) air pollution is an important problem that can threaten human life. Causative factors Air pollution comes from the incomplete combustion of fuel which is produced through factory machines, power plants and motor vehicles.

According to Sandeep B, Keerthiprasad K.S, *et.al*, (2023) composting machines are an important tool to reduce the amount of waste sent to landfills. By composting organic waste such as food scraps and yard trimmings, composting machines can create nutrient-rich soil amendments that can be used to fertilize garden beds, lawns, and houseplants. Composting also helps reduce pollution from methane emissions, which are produced when organic waste decomposes in landfills.

In addition, composting can help preserve important topsoil, which is increasingly depleted due to intensive agricultural practices and urbanization. Composting machines are a cost effective and sustainable way to reduce environmental impact and create valuable soil amendments. Now the work is on composting machines that can help us provide fertilizer and at the same time effectively treat waste materials while maintaining environmental friendliness.

According to Scott Gamble, Robert Rynk, *et.al*, (2022) after the biological requirements of the composting process are met, producing compost largely becomes a matter of moving, mixing, and otherwise manipulating materials in an operating system. The typical sequence of operations is receiving raw materials, mixing raw materials, composting, curing, and storing the product.

The main nutrients required by microorganisms involved in composting are the C:N Ratio Carbon (C), nitrogen (N), phosphorus (P), and potassium (K). Microorganisms use carbon for both energy and growth, while nitrogen is essential for protein production and reproduction. The ratio of carbon to nitrogen is referred to as the C:N ratio. The appropriate C:N ratio is important to ensure that other required nutrients are present in sufficient amounts. For active composting, the raw materials being mixed should provide a C:N ratio of 25:1 to 30:1, although initial C:N ratios of 20:1 to 40:1 consistently provide good composting results. For C:N ratios below 20:1, the available carbon is used up completely without stabilizing all the nitrogen which can cause excessive ammonia production and cause unpleasant odors to be present. If the C:N ratio exceeds 40:1, the composting process slows down dramatically because not enough N is available for the growth of microorganisms.

## **RESEARCH METHOD**

In the process of producing this project, several sketches were made, and a sketch was obtained that will be used to produce the Green Organic Compost Machine (GOCM). For the selection of materials for this project, aluminum plate was chosen as the main material in the

production of the GOCM product because aluminum does not rust. The size for the design selection chosen is a square measuring 2ft x 2ft x 3ft which is not too big and not too small, suitable for use in garden communities that are not too big and educational institutions.

The questionnaire was created via the Google Form platform and distributed to employees in the agricultural division. A total of 116 respondents were collected with various types of improvement suggestions. Data analysis was done using SPSS software on the respondents' responses.

The experiment that was conducted was by doing a soil test, NPK soil test kit. The soil test kit is a quick test kit to qualitatively detect the content of ammonia nitrogen, phosphorus and potassium in the soil and soil pH. This test was carried out on compost using the manual method and the GOCM method. For the manual method, 2 types of methods were carried out, including the method of making compost using EM4 and making compost using rice water. A comparison of the resulting data between EM4 compost, rice water compost and GOCM compost was carried out.

RESULTS AND DISCUSSION

The following are the results of soil tests that were carried out on both types of compost methods, namely GOCM, and the manual methods, namely EM and rice water. This test was carried out 3 times to obtain the average value for all types of compost. From the data collected through the NPK Test Kit, the compost fertilizer produced contains pH, Potassium, Phosphorus and Ammonia Nitrogen content that is suitable for plant growth. The data content values that can be seen can provide an indication of the effectiveness of compost fertilizer in fertilizing the soil.

Table 1. Average NPK test results

|            | pH   | Potassium | Phosphorus | Nitrogen Ammonia |
|------------|------|-----------|------------|------------------|
| GOCM       | 6.0  | 80        | 200        | 0                |
| EM4        | 8.33 | 120       | 120        | 0                |
| RICE WATER | 7.0  | 240       | 240        | 5.33             |



Figure 1. NPK test kit

Based on the results of the questionnaire and experiments conducted on the Green Organic Compost Machine product, it was found that 60.3% of respondents strongly agreed and 34.5% agreed, while 5.2% of respondents disagreed with the design of this product being suitable for use on construction sites.

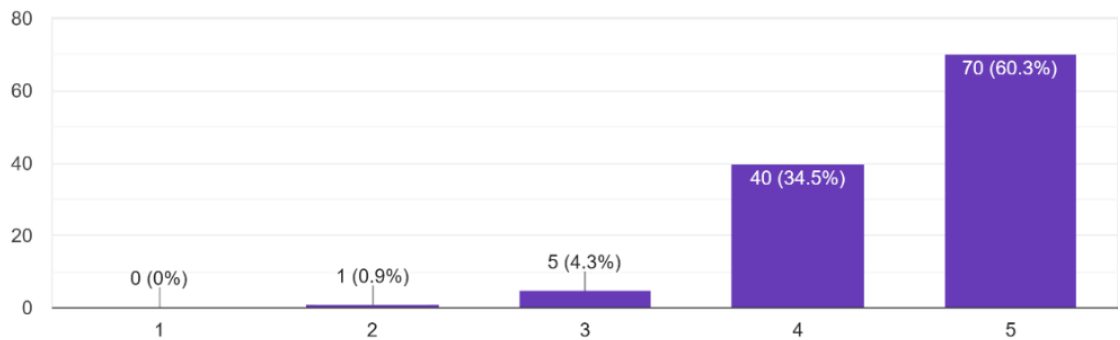


Figure 2. Percentage of respondents' feedback on designs that are suitable for use in the field

Refer Figure 3, 66.4% of respondents strongly agreed and 28.4% agreed, while 5.2% of respondents disagreed that this product could save time in producing compost.

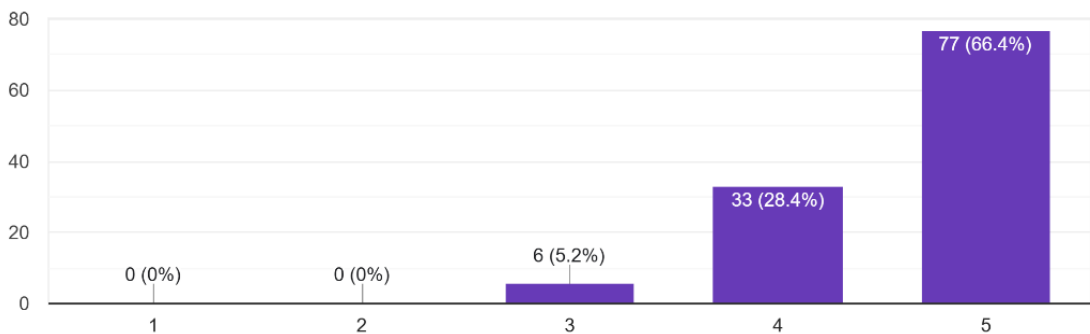


Figure 3. Percentage of respondents' responses on saving time in producing compost

It was found that 63.8% of respondents strongly agreed and 32.8% agreed, while 3.4% of respondents disagreed that this product could reduce labor in compost production.

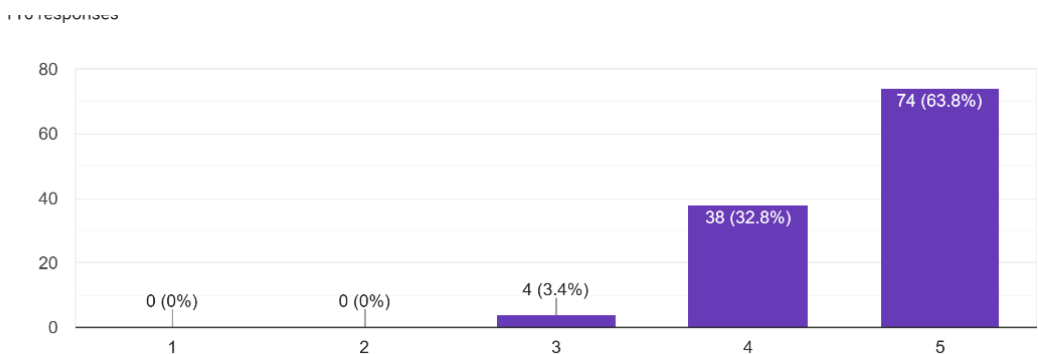


Figure 4. Percentage of respondents' responses to the reduction of labor in compost production

Based on the results of the questionnaire and tests conducted on the Green Organic Compost Machine product, it was found that 73.3% of respondents strongly agreed and 23.3% agreed, while 3.4% of respondents disagreed that this product could make the work of producing compost easier.

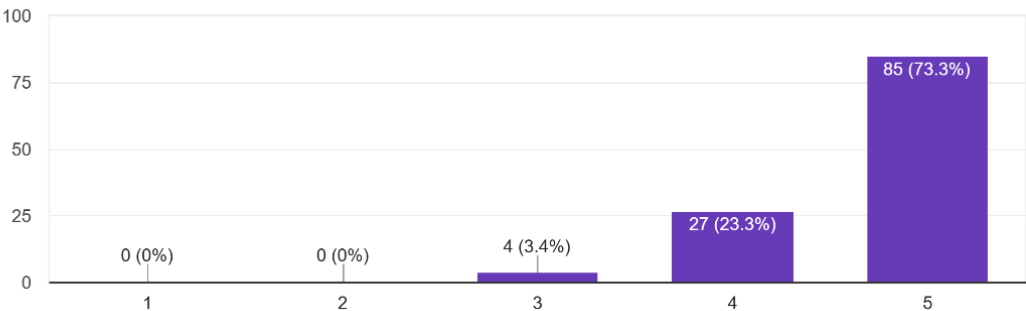


Figure 5. Percentage of respondents' responses to the simplification of the work of producing compost fertilizer

Figure 6 shows that 62.9% of respondents strongly agreed and 31.0% agreed, while 6.0% of respondents disagreed that this product is an ergonomic product and Figure 7 shows that 62.9% of respondents strongly agreed and 29.3% agreed, while 7.8% of respondents disagreed that this product could reduce hazards to workers.

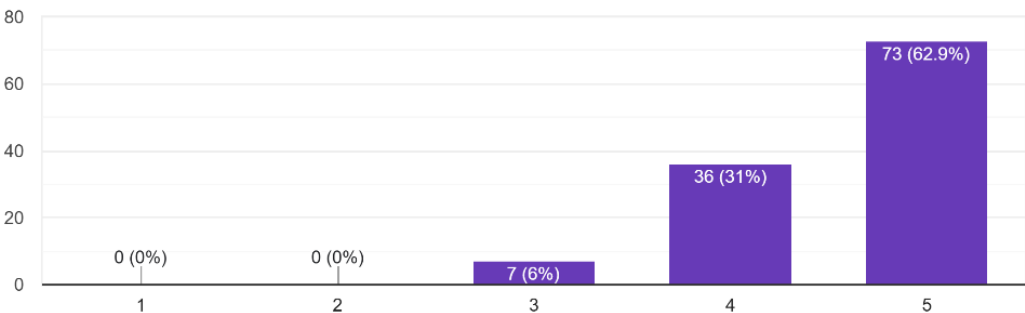


Figure 6. Percentage of respondents' feedback on ergonomic products

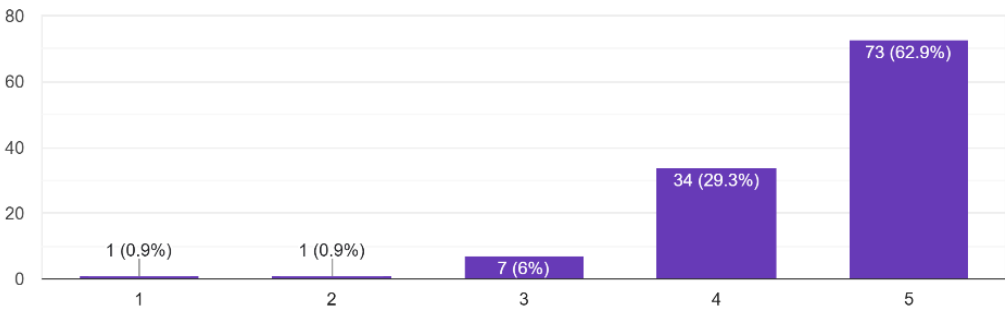


Figure 7. Percentage of respondents' responses to hazard reduction for workers.

Figure 8 shows that 60.3% of respondents strongly agreed and 30.2% agreed, while 9.6% of respondents disagreed that this product has an Eco-friendly concept and is suitable for use at home/institutions. Figure 9 shows that 63.8% of respondents strongly agreed and 28.4% agreed, while 7.8% of respondents disagreed that this product could be marketed.

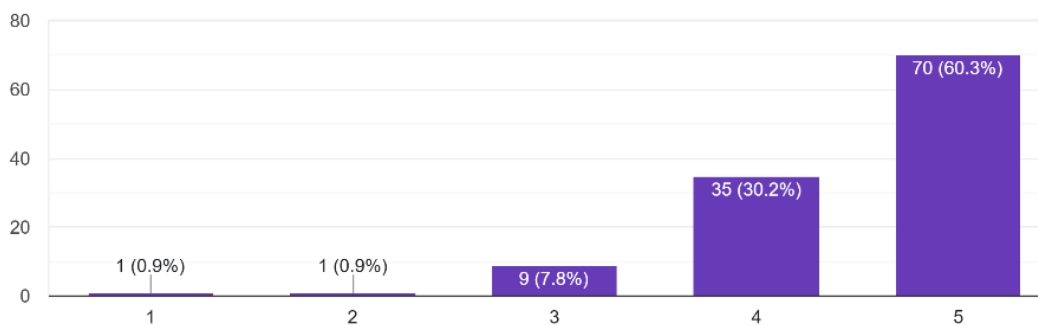


Figure 8. Percentage of respondents' responses to hazard reduction for workers.

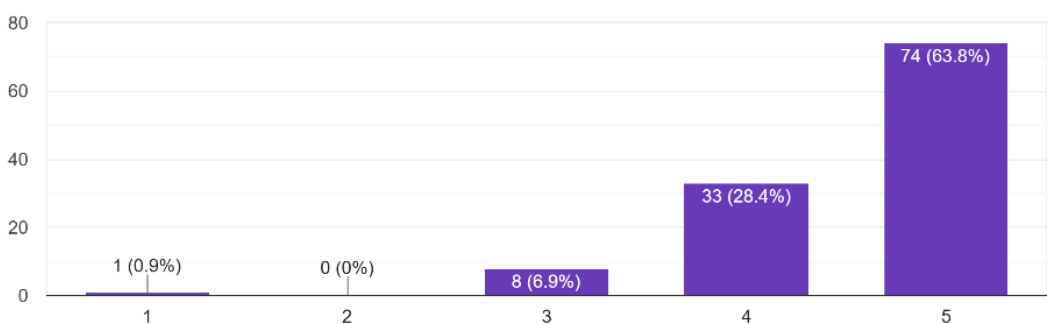


Figure 9. Percentage of respondents' responses to hazard reduction for workers.

Referring to Figure 10, it was found that 40.5% of respondents strongly agreed and 36.2% agreed, while 23.3% of respondents disagreed that this product has a reasonable price. Referring to Figure 11, it was found that 78.4% of respondents strongly agreed and 20.7% agreed, while 0.9% of respondents disagreed that this product could reduce pollution due to open burning of garden waste.

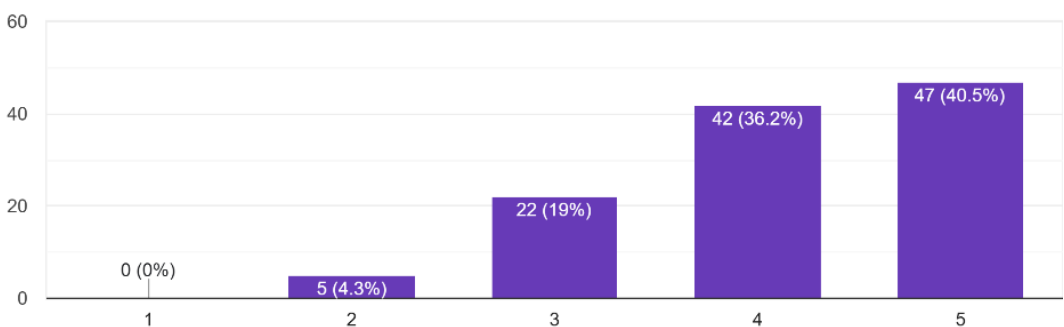


Figure 10. Percentage of respondents' responses to hazard reduction for workers.

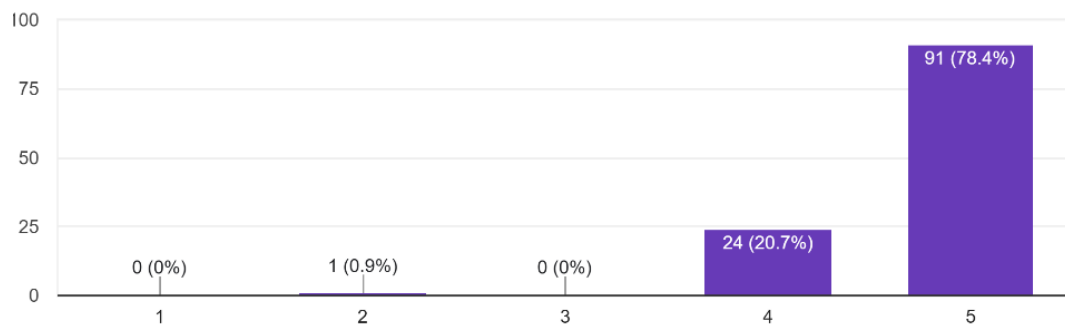


Figure 11. Percentage of respondents' responses to hazard reduction for workers.

Based on the average mean that can be seen, which is 4.56, it shows that GOCM products receive good feedback from relevant parties such as farmers. As a result of the research, it was found that GOCM products are suitable for use by all users.

|                |         | Statistics                              |                  |                           |                      |                            |                                  |                                          |                  |                                 |                         |
|----------------|---------|-----------------------------------------|------------------|---------------------------|----------------------|----------------------------|----------------------------------|------------------------------------------|------------------|---------------------------------|-------------------------|
|                |         | Reka bentuk sesuai digunakan dilapangan | Menjimatkan masa | Mengurangkan tenaga kerja | Memudahkan pekerjaan | Satu produk yang ergonomik | Mengurangkan hazard pada pekerja | Sesuai digunakan di rumah atau institusi | Boleh dipasarkan | Mempunyai harga yang berpatutan | Mengurangkan pencemaran |
| N              | Valid   | 116                                     | 116              | 116                       | 116                  | 116                        | 116                              | 116                                      | 116              | 116                             | 116                     |
|                | Missing | 0                                       | 0                | 0                         | 0                    | 0                          | 0                                | 0                                        | 0                | 0                               | 0                       |
| Mean           |         | 4.55                                    | 4.61             | 4.60                      | 4.70                 | 4.59                       | 4.54                             | 4.49                                     | 4.54             | 4.20                            | 4.78                    |
| Median         |         | 5.00                                    | 5.00             | 5.00                      | 5.00                 | 5.00                       | 5.00                             | 5.00                                     | 5.00             | 4.00                            | 5.00                    |
| Mode           |         | 5                                       | 5                | 5                         | 5                    | 5                          | 5                                | 5                                        | 5                | 5                               | 5                       |
| Std. Deviation |         | .623                                    | .586             | .558                      | .531                 | .605                       | .727                             | .752                                     | .703             | .867                            | .477                    |
| Sum            |         | 528                                     | 535              | 534                       | 545                  | 532                        | 527                              | 521                                      | 527              | 487                             | 554                     |

Figure 12. SPSS Data Analysis

## CONCLUSION

The Green Organic Compost Machine can be a machine that will make it easier for every user to produce organic fertilizer. Not only that, but it is also hoped that the existence of this user-friendly machine can foster the community to reduce air pollution that occurs thus reducing garden waste that is scattered and unorganized in housing or educational institutions. It is in line with the goal of empowering communities to act on climate change and environmental conservation driven by the community.

## ACKNOWLEDGEMENT

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