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The Application of Hebel Incinerators as a Waste Management Solution in Sindangpalay Village

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Abstract: The issue of household waste management remains an environmental challenge due to the increasing volume of waste generated and the continued practice of open burning, which has the potential to cause air pollution and public health hazards. This community service initiative aims to implement an aerated concrete incinerator as an alternative solution for more effective, economical, and sustainable household waste management in Sindangpalay Village. The activity was carried out using a Participatory Action Research (PAR) approach, actively involving the community in every stage of the process—from problem identification, program planning, and implementation to monitoring and evaluation. This included field observations, environmental outreach and education, participatory construction of the incinerators, training on equipment use, and the implementation of waste management using lightweight concrete incinerators. The results of the activity showed that the use of lightweight concrete incinerators helped reduce the volume of household waste, curbed open burning practices, and increased community awareness and participation in more environmentally friendly waste management. In addition, this participatory approach helps encourage changes in community behavior regarding waste sorting and the simple application of the 3R principles (Reduce, Reuse, Recycle), making the use of lightweight concrete incinerators an effective tool for supporting sustainable community-based waste management.

Keyword: Insinerator Hebel, Pengelolaan Sampah, Participatory Action Research, Pemberdayaan Masyarakat, Lingkungan Berkelanjutan.

INTRODUCTION

The problem of household waste is still one of the environmental issues that are widely found in various regions. The increase in population and community activities has an impact on the increasing volume of waste produced every day, while the waste management system has not been implemented optimally. This condition causes some people to still apply improper waste disposal methods, such as littering carelessly and burning open because it is considered easier and more practical. However, the practice of open burning can have a negative impact on the environment and public health due to the smoke emissions produced. Purwanta (2021) stated that the waste burning process that does not meet technical standards has the potential to cause imperfect combustion, resulting in black smoke that can pollute the environment. In addition, Rhohman et al. (2019) explained that the low effectiveness of waste management is influenced by several factors, such as inadequate combustion device design, suboptimal air supply, and the absence of a waste sorting process before incineration.

Similar conditions also occur in the partner community environment, where household waste management is still carried out with a simple method and has not been optimally organized. Some people still burn garbage in the yard area of their houses or accumulate temporary garbage before the transportation process is carried out, causing the environment to look less clean and cause an unpleasant smell. In addition, the limited waste processing facilities and infrastructure and the low level of public awareness in sorting waste are the main factors that hinder the effectiveness of waste management in the environment. Annisa et al. (2025) stated that waste management problems in the community are generally influenced by limited facilities and low public awareness, so solutions are needed that not only focus on technical aspects, but also include educational approaches. This opinion is strengthened by Adawiyah et al. (2025) who explain that the success of community-based waste management is not only determined by the availability of facilities, but also influenced by the level of community participation and knowledge in preserving the environment.

One of the alternative solutions that can be applied in an effort to overcome this problem is the use of a simple incinerator made of hebel. The selection of hebel materials is based on the relatively economical cost of manufacturing, the availability of materials that are easy to obtain, and its ability to withstand hot temperatures well so that it is suitable for use as a medium for small-scale waste burning in the community. The application of this tool is expected to be able to help reduce the volume of household waste while suppressing open burning practices that have the potential to produce excess smoke and pollute the environment. Dewi et al. (2024) stated that the mini incinerator is able to reduce the volume of waste by more than 65% through a high-temperature combustion process and can reduce the impact of environmental pollution compared to the open combustion method. In addition, Makalalag et al. (2025) explained that the use of small-scale incinerators made of simple materials such as hebel and mortar is able to reduce the volume of waste by 80–90% and contributes to increasing public awareness and participation in better waste management.

In addition to functioning as a technical solution, the implementation of incinerators also needs to be accompanied by education and community empowerment activities to support the sustainability of waste management in the community. Gucella et al. (2025) stated that the application of simple incinerator technology accompanied by educational activities is able to increase public awareness about the dangers of open waste burning and encourage changes in community behavior in household waste management. Furthermore, Fadilah et al. (2025) explained that the success of waste management programs is not only influenced by the use of technology, but also by the active involvement of the community from the early stages of program implementation so that it can foster a sense of ownership of the facilities provided. In addition, Toha Yusup et al. (2025) stated that the implementation of simple incinerators can

increase community participation in environmental management while reducing community dependence on waste transportation services.

Other research also shows that the use of hebel-made incinerators has the potential as an alternative to household waste management that is more environmentally friendly. Roosinda et al. (2025) stated that low-smoke hebel incinerators are able to increase public understanding of waste management while helping to reduce the volume of household residual waste. In addition, the ash from the combustion process can still be reused so that it provides added value for the community. Based on the results of these studies, the implementation of community service activities through the implementation of incinerators made of hebel is considered necessary as an effort to help the community in overcoming the problem of household waste more effectively, practically, and sustainably. Through this activity, it is hoped that the community will be able to increase independence in waste management so that a cleaner, healthier, and more comfortable environment is created.

METHOD

The method of implementation in this community service activity applies *the Participatory Action Research* (PAR) approach. The *Participatory Action Research* (PAR) approach is used by directly and actively involving the community at every stage of the activity, starting from problem identification, program preparation, activity implementation, to the evaluation process. This approach is seen as effective in increasing public awareness and participation in community-based waste management. Annisa et al. (2025) stated that the application of the PAR approach is able to encourage changes in community behavior through active involvement in waste management activities so as to create a more effective and sustainable environmental management system.

This community service activity was carried out in Sindangpalay Village, Cibeureum District, Sukabumi City on April 16 – May 05, 2026 with the target of the community at the household level and environmental administrators (RT/RW). This program is held as an effort to help the community in dealing with household waste problems through the implementation of incinerators made of hebel as an alternative to effective, economical, and environmentally sound waste management.

The implementation of activities is carried out systematically and in a structured manner, starting from the stage of problem identification to program evaluation. The stages of implementing the activity are explained as follows:

Problem Observation and Identification Stage

The initial stage of the activity was carried out through field observations, interviews, and discussions with the community and village officials to obtain information about the condition of household waste management in the community. Based on the results of observations, it is known that some people still practice open waste burning and have not sorted waste optimally. This condition causes the environment to look less clean and has the potential to cause air pollution due to smoke produced from the waste burning process.

In addition to identifying problems faced by the community, at this stage a mapping of local assets and potentials that can support the implementation of the program is also carried out, such as the culture of mutual cooperation, the level of community participation, and the availability of local land and materials that have the potential to be used in the process of making incinerators. This approach is in line with the concept of local asset-based community empowerment which emphasizes the importance of active community involvement in solving environmental problems independently and sustainably.

Program Planning and Incinerator Design Stage

The program planning stage is prepared based on the results of problem identification and analysis of community needs in the local environment. At this stage, the implementation team together with the community designed an incinerator made of hebel with a simple, economical, and easy-to-apply concept on a household scale. The selection of hebel material is based on its characteristics which have good resistance to hot temperatures, are easy to obtain in the surrounding environment, and have a relatively affordable cost so that they are suitable for use as the main material in the construction of a simple community-based incinerator.

The incinerator is designed with a base size of about 300 x 200 cm and a building height of approximately 250 cm. The main structure of the device consists of a combustion chamber, chimney, air vent, and combustion control door. The combustion chamber functions as a household waste incinerator, while the chimney is designed to help the air circulation process while reducing smoke accumulation in the combustion area so that the combustion process can take place more effectively.

In addition, the air ventilation system placed at the bottom of the incinerator functions to increase the oxygen supply during the combustion process so that combustion can occur more optimally. The design of the tool is also equipped with a combustion control channel which aims to make it easier for the public in the process of operating, supervising, and cleaning the tool after use.

The main materials used in the Incinerator construction process include hebel, mortar, support iron, iron plates, and chimney pipes. The selection of materials is carried out by considering aspects of resistance to hot temperatures, development cost efficiency, and ease of equipment maintenance process. With a simple design and the use of materials that are easy to obtain, incinerators made of hebel are expected to be able to become an appropriate alternative technology that can be applied independently by the community in supporting more effective and sustainable household waste management.

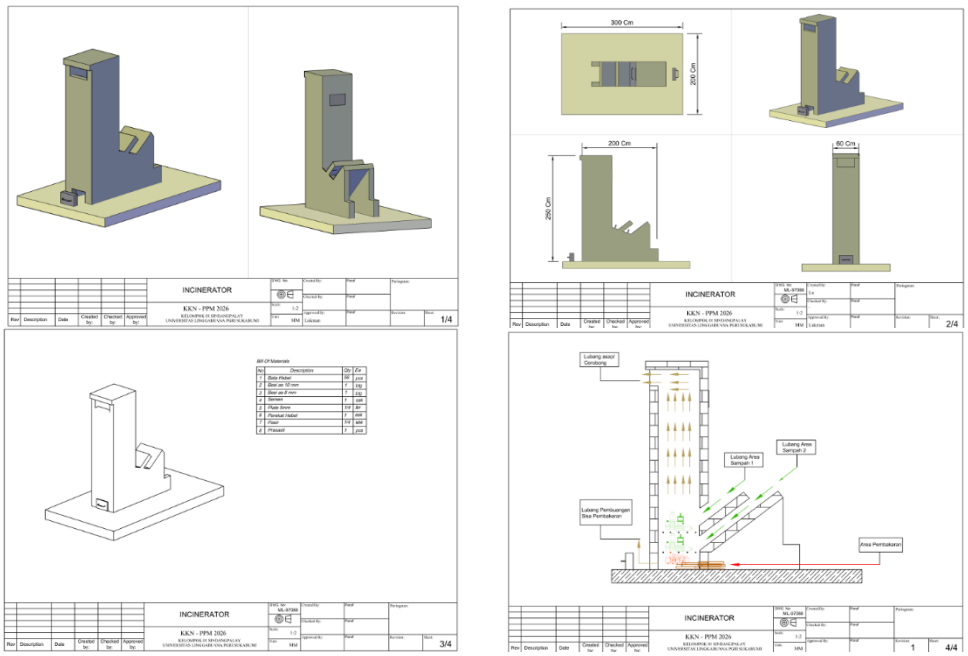

Figure 1 Simple Incinerator Design Made of Hebel

Socialization and Education Stage

The socialization stage was carried out through counseling activities to the community about the importance of sustainable waste management, the negative impact of open burning of waste on the environment and health, and the introduction of hebel-made incinerator

technology as an alternative to more environmentally friendly waste management. In addition, the community was also given education regarding the importance of sorting organic and inorganic waste before the incineration process was carried out to increase the effectiveness of waste management.

Socialization activities were carried out interactively through the delivery of materials, discussions, and question and answer sessions with the community. Educational approaches in waste management are considered to have an important role because the success of the program is not only influenced by the use of technology, but also by the level of awareness and participation of the community in preserving the environment (Siti Robiatul Adawiyah et al., 2025).

Incinerator Manufacturing and Training Stage

This stage is carried out through the process of building an incinerator made of hebel in a participatory manner with the community. The development process is carried out by applying the principle of mutual cooperation so that the community not only plays a role as an object of activity, but is also directly involved in the process of making an incinerator. Community involvement in the process aims to increase the sense of ownership of the facilities built so that the sustainability of the program can be better maintained.

In addition to the development process, the community was also given training on the procedures for proper and proper use and maintenance of the Incinerator. This training aims to improve the knowledge and skills of the community in operating the Incinerator independently so that the waste management program can run sustainably. Hendriawan Makalalag et al. explained that community involvement in the process of building and operating the Incinerator is able to increase public awareness and participation in community-based waste management.

Program Implementation Stage

The implementation stage of the program is carried out through the direct application of the use of incinerators made of hebel in the management of household waste in the community. Waste processed through incinerators is residual waste that has gone through the previous sorting stage, so that it can minimize the potential for environmental pollution and increase the effectiveness of the combustion process.

The application of hebel-made incinerators is expected to be able to help reduce the volume of household waste while suppressing the practice of burning waste openly which has the potential to produce excess smoke emissions. Anggita Permata Dewi et al. (2024) stated that the use of mini incinerators is able to reduce the volume of waste by more than 65% and reduce the impact of environmental pollution when compared to the open burning method.

Monitoring and Evaluation Stage

The monitoring and evaluation stage was carried out to assess the effectiveness of the program in helping to reduce the volume of household waste and increase public awareness about the importance of good and sustainable environmental management. Monitoring activities are carried out through direct observation of the use of incinerators in the community and simple interviews with the community after the program is implemented.

The evaluation process was carried out by reviewing the level of community participation, changes in behavior in waste management, and the effectiveness of the use of incinerators in reducing the volume of household waste. The results of the evaluation are then used as consideration in efforts to improve and develop community-based waste management programs in the next activity. In addition, mentoring activities are also carried out to ensure the sustainability of the use of the Incinerator and assist the community in overcoming various obstacles that arise during the program implementation process.

RESULTS AND DISCUSSION

The implementation of community service programs through the application of incinerator technology in Sindangpalay Village has shown significant results both from the technical aspects of management and changes in community behavior. The results of this activity were analyzed based on the stages *of the Participaory Action Research* (PAR) method that had been implemented.

In the early stages, identification shows that most people still burn waste openly without emission control. In addition, household waste sorting has not become a habit, so organic and inorganic waste are mixed. This condition reinforces previous findings that low environmental awareness is a major factor in waste management problems at the community level. However, the existence of community habits since the identification stage has resulted in a relatively high level of program acceptance.

Figure 2 Initial Condition of the Waste Management System

Furthermore, at the socialization and education stage, there is an increase in public understanding of the negative impact of open burning on health and the environment. The interactive discussions and counseling carried out were able to change the perception of the public who previously considered burning as a practical solution to be more critical of its impact. This shows that the educational approach in PAR is effective in building environmental awareness, in line with the findings of Sari et al. (2024) that participatory-based education is able to increase pro-environmental behavior.

At the stage of training and tool making, the community showed high enthusiasm in assembling the Incinerator. Direct involvement in the manufacturing process not only enhances technical skills, but also fosters a sense of ownership towards the applied technology. The direct impact can be seen in the fairly high level of adoption of tools, where people are starting to switch from open burning methods to the use of low-smoke waste burning (incinerators).

Figure 3 Socialization and Construction of Incinerators

The results of the implementation show that the use of incinerators is able to reduce the volume of household waste significantly. In addition, based on field observations, the smoke produced is relatively less than conventional combustion. Although no quantitative laboratory

measurements were carried out, visual indications and public perception showed a decrease in air pollution in the surrounding environment. This finding is consistent with the findings of research by Maulidia et al. (2025) which states that this technology is able to increase combustion efficiency and reduce pollutant emissions.

From the social side, there has been a significant change in behavior. People are getting used to sorting simple waste before burning, and are more concerned about the environmental impact in their daily activities. In addition, initiatives have emerged from several residents to integrate the use of incinerators with the 3R (*Reduce, Reuse, Recycle)* concept such as utilizing organic waste for compost and reducing the burning of inorganic waste.

Figure 4 Results of Incinerator Technology Implementation

However, there are several obstacles in the implementation of the program. First, not all communities have consistency in using tools, especially in the early stages of implementation. Second, the limited number of tools causes the use to still be limited to certain groups. Third, there is still a perception that the use of tools takes more time and effort than open combustion. This shows that behavior change requires continuous process behavior and cannot be achieved instantaneously.

The mentoring and monitoring stage is the key in overcoming these obstacles. Assistance that is carried out periodically is able to increase the consistency of the use of tools and strengthen community commitment. In addition, the existence of reflective discussions in the PAR approach allows the community to evaluate the practices that have been carried out and correct the shortcomings together.

The results of the evaluation show that this program has succeeded in increasing community participation, reducing open burning practices, and encouraging the formation of better environmental awareness. This success confirms that the combination of simple technological innovations such as incinerators with participatory-based community empowerment approaches is an effective strategy in sustainable waste management.

CONCLUSION

The application of Incinerator technology through community service programs in Sindangpalay Village has proven to make a positive contribution to household waste management. This program is not only able to help reduce the volume of waste and reduce the practice of burning open waste that is less environmentally friendly but also plays a role in reducing the potential for air pollution in residential areas.

The *Participatory Action Research* (PAR) approach applied in this activity is considered effective in increasing public participation and awareness of the importance of sustainable environmental management. Active community involvement from the planning stage to

program evaluation is able to foster a sense of ownership of the activities carried out so as to support the sustainability of technology application at the community level.

In addition to having an impact from the technical aspect, this program has also succeeded in encouraging changes in people's behavior towards being more concerned about the environment. This can be seen from the implementation of waste sorting activities and the application of the 3R (*Reduce, Reuse, Rcycle*) principle in household waste management. However, continuous assistance efforts are still needed to overcome various obstacles, such as the consistency of the use of tools and the limitations of available supporting facilities.

In general, the integration between the application of appropriate technology and the community empowerment approach is an effective strategy in realizing a sustainable waste management system. Therefore, the program has the potential to be replicated and developed more widely as an innovative, adaptive, and environmentally sustainability-oriented community-based waste management model.

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