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Synergy of Innovation and Environmental Health: Implementation of "ASTOR: Anti-Smoke Incinerator"

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ABSTRACT

Air pollution from open waste burning is a major issue in many rural areas in Indonesia due to emissions of hazardous substances such as carbon monoxide, dioxin, and fine particles that significantly impact public health. To address this challenge, a community service program was implemented focusing on the development and implementation of innovative ASTOR (Anti-Smoke Incinerator) technology. The activity took place in Karangpule Village, Sruweng District, Kebumen Regency, which has long been vulnerable to the risk of air pollution from traditional waste burning. Through a series of equipment development, outreach, training, and the distribution of tools and manuals to village officials and the community, ASTOR was implemented as a practical solution. The results of the service showed a significant reduction in smoke emissions during the burning process and increased community knowledge about environmentally friendly waste management. The collaboration between appropriate technological innovation and community empowerment has proven to be an effective step in mitigating air pollution and encouraging the creation of a healthier and more sustainable village environment.

Keywords: ASTOR, anti-smoke, pollutionair, burningrubbish, Village Karangpule, environmental Health .

1. INTRODUCTION

Karangpule Village, located in Sruweng District, Kebumen Regency, covers approximately 190 hectares and is home to 3,060 people. This area is heavily influenced by the agricultural sector, with fertile rice fields and fields serving as the primary source of livelihood for residents. Basic infrastructure such as roads, electricity, and clean water has reached the majority of households, but much remains to be improved to improve the community's standard of living. In addition to limited transportation networks and water supplies, access to healthcare remains limited. Facilities such as community health centers (Puskesmas) and integrated health posts (Posyandu) are generally limited in capacity and unable to fully serve the community's needs (Sulistianto et al., 2021).

The majority of the population works in the agricultural sector as rice and corn farmers, or in intercropping and smallholder plantations. The remainder, in small numbers, are engaged in the service sector, small-scale trade, and micro- and medium-sized enterprises. Beyond this diverse potential, villages also possess a strong social strength in the form of a culture of mutual cooperation inherent in daily life. This is reflected in the high level of community participation in village activities and the tendency to embrace collective work as a solution to various socio-economic challenges (Rahayu et al., 2022).

However, in reality, Karangpule Village also faces several challenges. Waste management and infrastructure improvement are key issues that have not been fully addressed. Most household and agricultural waste is poorly managed due to limited modern waste collection and processing facilities. As is the case in many agrarian villages in Indonesia, waste management still relies on conventional methods, namely open burning in yards or vacant land (Sulistianto et al., 2021; Rahayu et al., 2022). This practice is a serious concern due to its environmental and health impacts, particularly air pollution from combustion emissions.

The practice of open waste burning is a highly hazardous activity for the health of local communities. Scientific studies and practical observations in various villages indicate that smoke from waste burning contains hazardous particles such as fine particulates (PM2.5 and PM10), carbon monoxide, carbon dioxide, volatile organic compounds, and heavy metals (Wulandari et al., 2023). Exposure to these pollutants, even at low concentrations, can have long-term impacts, including increased respiratory disorders such as asthma, acute respiratory infections (ARI), and the risk of lung cancer in vulnerable groups (children and the elderly) (Damayanti et al., 2022).

In addition to health concerns, open burning of waste also increases greenhouse gas concentrations, exacerbates climate change, and impairs air quality. Exhaust gases such as carbon monoxide and carbon dioxide, when inhaled repeatedly over long periods of time, can weaken the immune system, worsen asthma, and affect lung development and cognitive function in children (Utami, 2021; Rahayu et al., 2022). Smoke from burning waste is also known to contain pollutant compounds and particulates that irritate the respiratory tract and can trigger mental disorders such as anxiety and depression due to the persistent health impacts (World Health Organization et al., 2018).

Research in the Kebumen region indicates that routinely burning household waste 2-3 times a week can increase carbon monoxide exposure and respiratory tract infections (ARI) in the surrounding community, particularly children and the elderly (Damayanti et al., 2022). Wardani (2017) also showed that open waste burning increases CO2 concentrations in the air and the frequency of respiratory tract infections (ARI) in residents during the dry season. The root cause of this problem is generally limited access to education about

the dangers of waste burning and minimal supervision or enforcement of environmental regulations at the village level (Sulistianto et al., 2021).

Various articles and field surveys indicate that solutions to this problem require active public education, improved organic waste management facilities, and simple technological innovations that can be readily adopted by villagers. Research by Kurniawati et al. (2024) shows that environmentally friendly technology and educational outreach can increase public awareness and behavior regarding organic waste management (Kurniawati & Ali, 2024). Education also needs to be accompanied by community involvement in innovation, such as through the development of smoke-free waste incinerators.

A concrete innovation that has been implemented in several villages is the development of smoke-free stoves, as implemented by student groups or supervising lecturers in various regions (Globe, 2025). These stoves are designed to reduce smoke production and pollutant content through a dual ventilation system and simple filters. Test studies have shown that these stoves can reduce pollutant emissions by up to 60% compared to conventional combustion methods and improve air quality in the surrounding area (Globe, 2025).

The ASTOR device, developed by the Karangpule Village community service group, is an adaptation of this smoke-free combustion stove technology. The ASTOR design focuses on maintaining the flame with an optimal oxygen supply, allowing the resulting smoke to ignite immediately. This reduces emissions of particles and other pollutants. Similar research also emphasizes the importance of developing combustion capacity, the availability of economical local materials, and the ease of operation of the device for widespread adoption (Globe, 2025).

Adoption of technologies like ASTOR mustbeaccompaniedbycommunityeducation, integration into village programs, and regular environmental impact assessments. In addition to reducing air pollution, innovations combined with education on the 3Rs (Reduce, Reuse, Recycle) have the potential to reduce waste volume, improve environmental health, and strengthen village competitiveness in developing eco-tourism (Kurniawati & Ali, 2024). Integrating technology, education, and strengthening a climate of mutual cooperation will accelerate the achievement of clean, healthy, and sustainable villages in the future.

2. METHOD

Analysis data done through four stage, among them as following:

1. Interview And survey field
   The first stage was to interview the village head regarding the level of waste burning activity and the resulting pollution. These interviews were conducted to obtain data to serve as a reference for the implementation. survey field. After data obtained, survey field done to obtain accuracy of the data obtained through interviews. By doing this interview And survey, can produced factors Which causes of air pollution in Karangpule Village, the impact of air pollution in Karangpule Village, and deficiencies that can be overcome.
2. Construction and testing of anti-smoke waste incinerator/ASTOR (Anti-Smoke Incinerator).
   The next stage was construction and testing. Based on data obtained regarding environmental health and the level of waste burning activity in Karangpule Village, construction of a smokeless incinerator (ASTOR) began. Afterward, trials of the ASTOR innovation were conducted to determine its functionality.
3. The practice of burning waste using ASTOR for Karangpule Village officials.
   At this stage, socialization and practical use of ASTOR were conducted for Karangpule Village officials at the Karangpule Village Hall. The socialization was conducted to convey information to

all Karangpule Village officials regarding the ASTOR innovation. Then, practical use of ASTOR was implemented to demonstrate ASTOR's use and its impact. ASTOR.

4. Submission book guide And product ASTOR
   The handover of ASTOR guidebooks and products was carried out with the aim of providing innovation Which can utilized by all over device village And the Karangpule Village community. In addition, another aim of this handover is to provide an opportunity And step beginning for for device village For can increase the amount of ASTOR production to be given to the community.

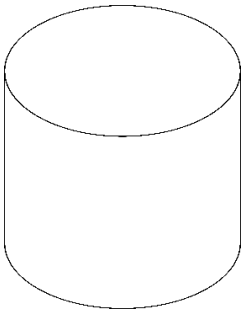
3. RESULTS AND DISCUSSION

In this study, it was found that there are still many people in Karangpule Village who are accustomed to burn rubbish in a way open, Which cause pollution air. Pollution This has the potential to threaten public health, because the smoke produced contains hazardous materials such as carbon monoxide (CO), dioxins, and fine particles (PM2.5) which can cause disturbance breathing And disease other. Habit This is problem Which significant, especially Because village the Not yet find solution Which effective For dealing with pollution caused by burning waste.

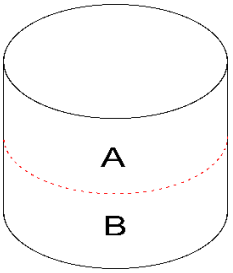
Through interviews with village officials, it was discovered that the level of waste burning activity is quite high. Furthermore, field surveys also confirmed that this practice spread wide in circles resident village. Collection data the strengthen The conclusion is that air pollution in Karangpule Village is mostly caused by uncontrolled waste burning practices.

"ASTOR (*Anti-Smoke Incinerator*)" waste incinerator innovation , designed to reduce smoke emissions from the incineration process. After several stages of development and testing, the ASTOR innovation has the potential to be used as a waste incinerator. show results Which positive. Product This can burn rubbish with emission very minimal smoke, so it can reduce the impact of air pollution. In order to achieve maximum results, the ASTOR manufacturing process goes through quite complex steps, including the following:

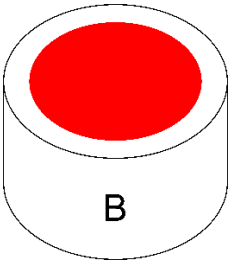
1. Get ready tool welding And 1 fruit Drum sized 200 liter.



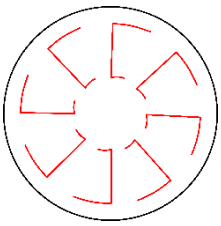
2. Split drum become 2 part The same long (drum A And drum B).



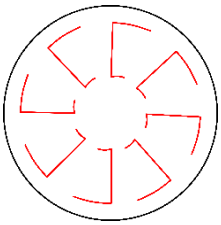
3. Cut valve on drum B leaving behind outskirts 3cm valve .



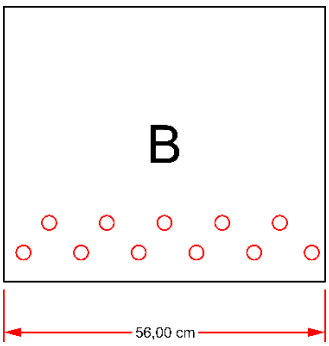
4. Give sign (like picture in lower This) on valve residue tube B Which Already cut off.



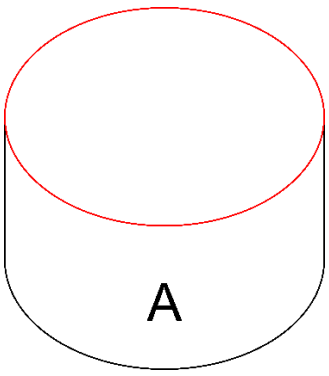
5. Cut all signs on valve.



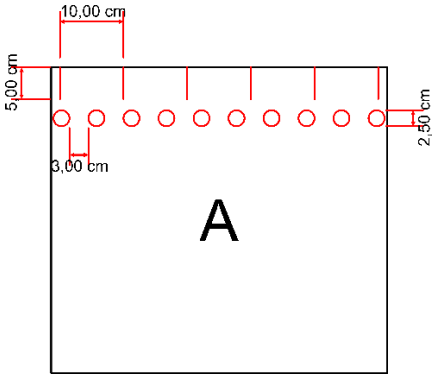
6. Make holes in the bottom of drum B with a diameter of 2.5cm for each hole and a distance of 3cm between the holes.



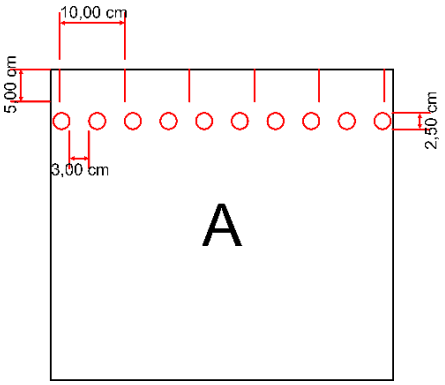
7. Cut finished valve on drum A.



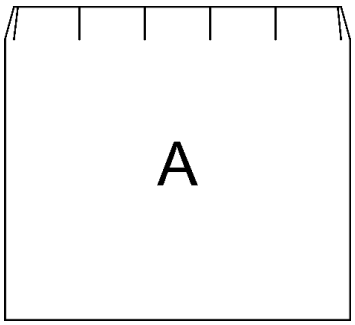
8. Give sign line (like on picture in lower This) on part on drum A with a length of 5cm and a distance of 10cm.



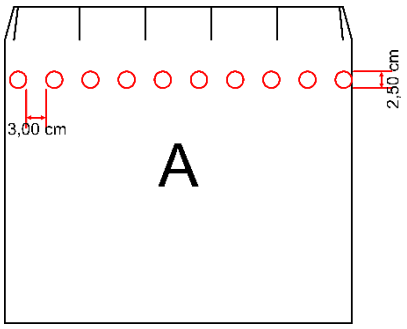
9. Cut all over sign line Which There is on top drum A.



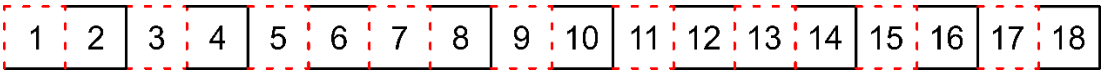
10. Bend all the cut lines at an angle towards the inside of the drum. A so that it forms a cone.

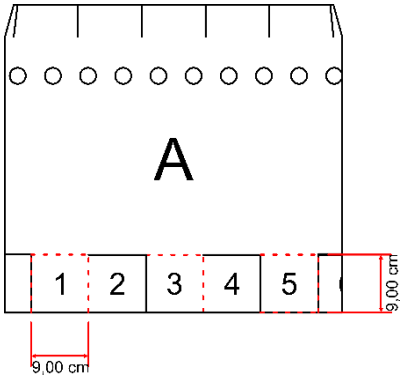


11. Make a hole part on drum A with diameter each hole 2.5cm And distance between holes 3cm.



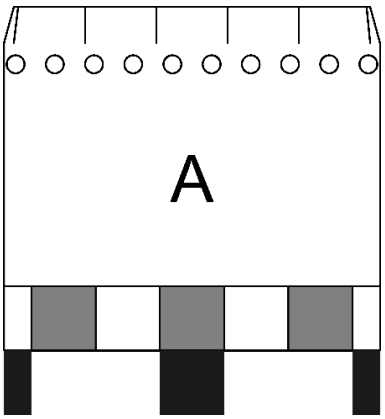
12. Mark a line (as in the picture below) on the bottom of the drum. A so that it forms like a square.
    Information:
    a. Box 1, 7, and 13 used to make legs
    b. Box 3, 5, 9, 11, 15, 17 used For make ventilation



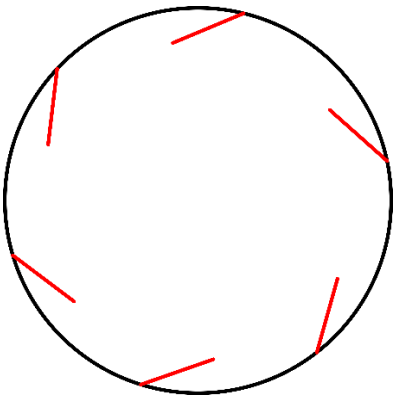


13. Buckling until become like picture in below. Description:
    a. Buckling part numbered 1, 7, 13 to lower so that functioning as legs.
    b. The rest buckling box numbered 3, 5, 9, 11, 15, 17 to part in as ventilation.

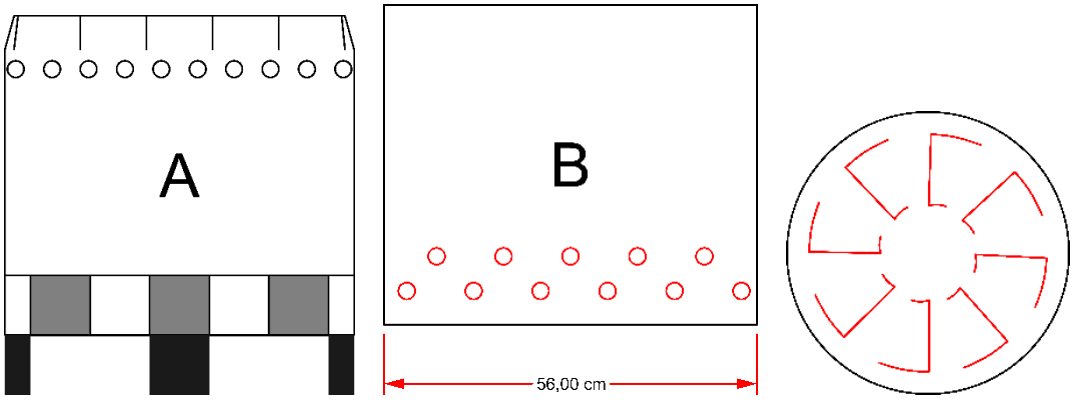
Looks Outside



Looks In



Following is method installation every part on the product ASTOR:



1. Put it down Drum A
2. Put it down valve to in Drum A
3. Put it down tube B hang on part on tube A so that looks like the image below:

With design thus, furnace burning This own method Work alone by maintaining the size of the flame to burn off the smoke that is created. During the combustion process, air will enter through the vents at the bottom of the outer drum (Drum B). which has entered through the cavity down on drum B will rotate automatically consistent on the vents at the bottom of the drum A. Then, the air comes out of the air circulation. happen on ventilation part lower drum A will distributed to on going to ventilation sections on drum A Which on Finally will go out And return to rotation air Which occurs in the vents at the bottom of

drum A.

ASTOR field trials were conducted several times,withconsistentresults:wasteincineration can be carried out more environmentally friendly. Based on these results, the UMP community service participants of Karangpule Village held a socialization session with Karangpule Village officials on August 26, 2024. The event provided information on the importance of maintaining environmental health, the impacts of air pollution, and how to make and use waste. ASTOR.

The results of this innovation demonstrate that efforts to reduce air pollution in Karangpule Village can be achieved with simple yet effective technological solutions. ASTOR is a highly relevant innovation in addressing the air pollution problem caused by waste burning. This innovation not only reduces smoke but also provides a concrete example of how appropriate technology can be implemented at the local level.

Socialization carried out to village officials is also an important step in ensuring the sustainability of use. ASTOR in the community. Through education about the impacts of pollution and how to use it ASTOR, it is hoped that the public will be more aware of the importance of maintaining environmental cleanliness and switching to more environmentally friendly methods in waste management.

In addition, the submission of guidebooks and products ASTOR for village officials is the first step to involve the community more broadly. With this guide, it is hoped device village can multiply product ASTOR And distribute it to the community, thereby minimizing the practice of openly burning trash. This innovation has the potential to be a long-term solution to the village's air pollution problem.

4. CONCLUSION

This study identified that the practice of open waste burning in Karangpule Village causes significant air pollution, potentially endangering public health. Data Which collected through interview And survey field show that air pollution, which is produced from smoke from burning rubbish, contains dangerous substances such as carbon monoxide, dioxin, And particle fine (PM2.5). Smoke This can cause various problem health, including disturbance breathing, disease cardiovascular, And impact other negatives .

To address this problem, the community service team developed and tested ASTOR (Anti-Smoke Incinerator), A innovation Which designed Forreduceemissionsmokefromwaste incineration. The experimental results showed that ASTOR effectively reduced the volume of smoke emitted. produced, make it as solution Which more friendly environment compared to using traditional waste incineration methods. Socialization and training on ASTOR usage for village officials, along with the distribution of products and manuals, aim to ensure effective implementation and expand the benefits of this technology. Thus, ASTOR offers a practical solution that can reduce air pollution and improve environmental health in Karangpule Village.

5. REFERENCES

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