

Environmental Management in Coal Mining Companies Utilizing Wooden Pallet Waste with Wood Chipper Machines for Hydrocarbon Spill Absorbent in Maintenance Activities

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ABSTRACT

Wooden pallets often accumulate as waste, potentially causing environmental problems such as pest infestation, soil and water pollution, and large-scale waste accumulation. Efficient waste management methods such as recycling are needed to reduce these impacts, especially in industrial environments. This study aims to explore the potential utilization of wood pallet waste as a hydrocarbon spill sorbent through processing with wood cutting machines at PT AMM Jobsite Mifa Bersaudara. This research involves the collection and processing of wood pallet waste using a wood chipper machine. The process includes sorting, cleaning, crushing, and packaging wood waste into powder. The tools and materials used are wood pallet shredder, hammer, crowbar, and personal protective equipment. This research follows a systematic flow from problem identification to evaluation and analysis of results. Results of the study showed that the application of wood pallet shredder machine significantly reduced the volume of wood pallet waste. From January to May 2024, the unutilized waste accumulated to 4.67 tons. After introducing the shredding process in June and July 2024, waste utilization increased, achieving an 80% reduction in solid waste. The processed wood powder was effectively used to absorb hydrocarbon spills, optimize resource use, and reduce disposal costs. This research has implications for the feasibility of converting industrial wood waste into useful products, contributing to environmental conservation and cost efficiency. It emphasizes the importance of sustainable waste management practices in reducing the environmental footprint of industrial activities while fostering employee awareness on environmental protection.

Keywords: Waste Wood Pallets, Recycling, Wood Cutting Machine, Hydrocarbon Spill Absorbent, Industrial Waste Management.

INTRODUCTION

Waste wooden pallets, although made from natural materials, can have a negative impact on the environment if not managed properly, such as pest nests, soil and water pollution and accumulation of waste in large volumes (Zhang et al., 2024). Reducing the impact of waste can generally be managed with the 3R approach, namely Reuse, Recycle and Reduce (Wahyudin et

al., 2020). Of the 3R principles, the method that is considered quite effective in reducing the impact of wood waste is the recycle method (Monalisa et al., 2024). Reuse has the meaning of creating and innovating to realize appropriate goods according to needs.

Companies understand the importance of managing the environmental impacts of their business activities so that they can dedicate efforts to preserve the environment to maximize added value for stakeholders and the environment (Oktariyani, 2024). Environmental issues, especially the waste factor, are often forgotten by some companies in the implementation of social and environmental responsibility. Even though the company's environmental problems can have a positive effect on several other aspects for the welfare of the local community (Riyanti & Raharjo, 2021).

Waste is waste generated from a production process, both industrial and domestic (Faizah et al., 2022). Waste management should be in accordance with the type or characteristics of the waste so that the results are optimal, for example, waste that is easily decomposed needs special handling so as not to pollute the environment (Wijaya & Mustaqim, 2021). According to (Kahfi & Hartanto, 2021) waste derived from wooden pallets can be reused and recycled which is environmentally friendly and has a minimal carbon footprint. The wood pallet waste owned by PT AMM comes from the remaining packaging of goods to make the position stable when the goods are moved. At this time, efforts are made to handle the waste by dismantling and sorting the feasibility level of wood.

Containerized wood pallets are made from wood materials that have a lot of potential to be upcycled. This is one of the sustainable efforts in conserving natural resources and balancing the ecosystem (Savitri et al., 2021). According to (Loppies et al., 2022) the benefits of wood waste can be in the form of planting media and other benefits such as fertilizer, sawdust briquettes, mixed materials for making particleboard, spill kits (absorbing hazardous waste spills) and renewable fuels (biomass). Based on the potential of used pallet wood that can still be utilized, the SHE team of PT AMM Site Mifa Bersaudara tries to utilize wooden pallets as an implementation of reducing the amount of non-B3 solid waste generation.

This study offers a novel approach to waste management by not only recycling wooden pallet waste but also integrating it into the company's operational hazard mitigation processes. The innovation lies in the utilization of a wood chipper machine to convert wooden pallet waste into absorbent powder, which is then used for hydrocarbon spill management in the maintenance workshop area. Unlike conventional recycling efforts, this approach directly addresses two critical issues simultaneously: waste reduction and the need for sustainable spill mitigation materials. This dual-purpose solution sets a new precedent for environmental management practices in industrial settings, particularly in coal mining companies where waste accumulation and hydrocarbon spill risks are prevalent. Additionally, the study emphasizes an internalized waste management system that minimizes dependence on external waste

processors, thereby reducing logistical and financial burdens while promoting environmental stewardship.

Based on the above background, the main objective of this research is to reduce the accumulation of wood pallet waste through an effective recycling process while creating value-added products that contribute to operational safety. So that the benefits in the implementation of this research by utilizing wood pallet waste to produce absorbent materials, the company can significantly reduce the volume of waste sent to landfills, thus saving storage space and lowering disposal costs. In addition, this initiative also supports the company's commitment to environmental conservation by promoting a circular economy and reducing dependence on new raw materials.

RESEARCH METHOD

The concept of utilizing wood pallet waste is as follows, used pallets that are no longer used, are sent to PT Mifa's landfill / Kebling, then processed and utilized using a wood chopping machine, with the final result in the form of powder and used as an absorbent or handling B3 spills. The materials and tools that need to be prepared are as follows:

1. Pallet wood crushing machine
2. Ring wrench, as a Daily Check and Inspection (P2H) tool on wood pallet crushing machine
3. Saw, as a cutting tool for used pallet wood
4. Hammer and crowbar, as nail removal tools
5. Sack for sawdust container
6. PPE for waste treatment operators (helmet, goggles, gloves, ear plugs)

The steps of this research are first to identify problems, analyze the impact of problems, set goals, analyze the cause and effect of the root of the problem, determine solutions, make improvement plans, prepare the resources needed, implement plans and measure data, evaluate and analyze the achievement of goals.



Figure 1. Flowchart of wood pallet waste processing.

This activity starts from the stage of collecting wood pallet waste from the partners to PT AMM site Mifa Bersaudara; determining the tools to be used for recycling; selecting the appropriate wood pallet raw materials and the final process is the packaging of processed used wood pallets that have become powder, which are then used as follows.

Table 1. PT AMM Jobsite Mifa Bersaudara wood pallet solid waste processing activities

No.	Activities	Used	Implementation	Documentation
1	Sorting of Wooden Pallets	Used	Sorting is done by determining the type of wood that is suitable, still in good condition, not much contaminant	
2	Cleaning from contaminants	from	Wooden pallets that still have nails or other contamination are cleaned.	
3	Wood Crushing Process		Wood that has been separated from contaminants, the size has also been adjusted to the inlet, one by one is inserted into the machine for chopping.	
4	Finishing		The wood chips that come out of the hole/outlet of the machine are collected using sacks and are ready to be distributed to the relevant departments.	

RESULT AND DISCUSSION

This research shows significant results in the utilization of pallet wood waste at PT AMM Jobsite Mifa Bersaudara, which can be seen in the following figure:

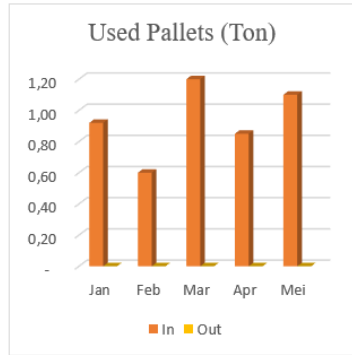


Figure 2. Waste wood pallet generation

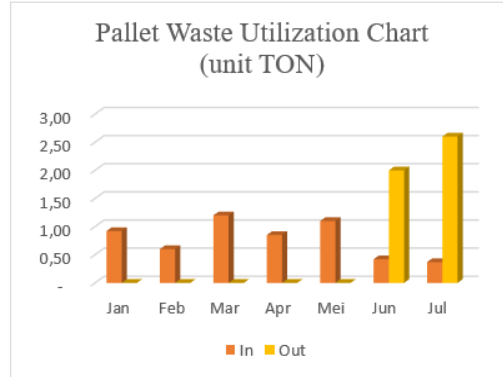


Figure 3. Utilization of wood pallet waste

Figure 2 shows the accumulated data of incoming (In) and outgoing (Out) pallet wood waste from January to May 2024, where it can be seen that there is no waste utilization (Out) during the period. Figure 3 displays the pallet wood waste utilization graph from January to July 2024. In June and July, following the procurement of the pallet wood shredder, there was a significant increase in waste utilization (Out), with the amount reaching 2.0 tons in June and 2.6 tons in July, demonstrating the effectiveness of the machine in reducing the volume of pallet wood waste.

Table 2. Accumulation of wood pallet solid waste in January - July 2024

No.	Month	Amount of Solid Waste Used Wooden Pallets	
		In	Out
1	January	0.92	0.0
2	February	0.60	0.0
3	March	1.20	0.0
4	April	0.85	0.0
5	May	1.10	0.0
6	June	0.42	2.0
7	July	0.37	2.6

In January to May 2024, the unutilized waste wood pallet generation was 4.67 tons. In June and July 2024, improvements were made by procuring a pallet wood shredding machine as an advanced processor of pallet wood waste with a wood shredding machine capacity of 200-250 kg, showing that used pallets can be processed into wood powder. It can be seen from the graph that there is an increase in the number of utilization of wood pallet waste in June and July 2024, the amount of utilization is influenced by the utilization of wood pallet waste into powder using a pallet shredder. The graph above can be interpreted that with an average monthly amount of wood pallet waste generation of 0.78 tons / month, with a machine capacity of 0.2-0.25 tons /

hour, the generation of solid waste can be resolved. The reduction in solid waste (pallets) can be calculated at 80%.

The utilization of pallet wood waste as a hydrocarbon spill absorbent powder at PT AMM Jobsite Mifa Bersaudara shows significant results in industrial waste management. This process is supported by previous studies which state that pallet wood waste has great potential to be processed into environmentally friendly products, such as planting media, briquettes, and absorbent materials (Syafiisab, 2014); (Fatriasari & Hermiati, 2016). This research confirms the importance of the waste recycling approach to reduce environmental impacts and support the conservation of natural resources through the utilization of existing materials.

Technically, this study used a pallet wood shredder to process the waste into reusable powder. The use of this technology is also in line with the findings of (Setyati et al., 2016), which emphasize that simple technologies such as shredders can produce value-added products from wood waste. In the context of this research, the innovative use of sawdust as a hydrocarbon sorbent provides a practical solution to the needs of the industry while reducing operational costs, as observed by the 80% reduction in waste volume after the implementation of the machine.

From a sustainability perspective, this utilization of wood waste also supports the concept of a circular economy, where waste is not only reduced but also converted into new resources (Yuniar et al., 2024). The study (Al Ariyah et al., 2023) noted that recycling-based approaches make a major contribution to environmental conservation while creating economic value. This is relevant to the results of this study which show that in addition to reducing waste disposal costs, the company is also able to produce useful materials for its operations (Rashidi et al., 2024).

In addition, this research also has a positive impact on environmental awareness among employees (Lupoae et al., 2025). According to (Musthofa, 2019), environmental management initiatives that involve employee participation can increase collective awareness of the importance of social and environmental responsibility. In this study, employee involvement in the internal waste management process not only creates operational efficiency but also strengthens the company's environmentally conscious culture.

CONCLUSION

Utilization of wood pallet waste using a wood shredder into powder can reduce the generation of wood pallet waste. In addition to reducing disposal costs, internal processing of wood pallet waste can reduce the need for storage space and the frequency of transporting waste, thereby lowering company expenses for waste disposal to landfills. Optimizing resource use, treated wood pallet waste can be reused as raw material for other products, minimizing the use of new resources. Through the internal waste treatment program, the company can foster employee awareness of the importance of protecting the environment.

In the future, this research provides a foundation for developing advanced waste management systems in industrial settings. The method of processing wooden pallet waste into absorbent powder can be expanded to include other types of waste, such as plastic or mixed solid waste, which may also have potential for reuse in various industrial applications. Furthermore, the findings can be used as a reference for other industries to adopt similar approaches, fostering a broader movement toward sustainable and circular waste management practices.

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First publication right:

Asian Journal of Engineering, Social and Health (AJESH)

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