

Sanitation, Hygiene, and Occupational Safety and Health in Community-Based Organic Waste Management: A Case Study of Legok Beterled, Bandung City

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Article history:

Received : 2025-10-09

Revised : 2025-11-15

Accepted : 2025-12-04

Keywords:

Community waste management, Hygiene, Occupational safety and health, Organic waste, Sanitation

ABSTRACT

Waste management remains a critical environmental and public health concern, particularly in urban settings such as Bandung, which previously faced a waste emergency due to landfill overcapacity. Legok Beterled has emerged as a community-based organic waste management model utilizing Black Soldier Fly (BSF) larvae. This study aims to describe the implementation of sanitation, hygiene practices, and occupational safety and health (OSH) at Legok Beterled, while identifying existing challenges and formulating recommendations for improvement. A qualitative descriptive method was employed through observations, in-depth interviews, and documentation involving one key informant selected using purposive sampling. Data were analyzed through data reduction, data display, and conclusion drawing. The findings show that sanitation conditions were relatively adequate, supported by the separation of processing units, utilization of natural ventilation, and application of Local Microorganisms (MOL) to minimize odors. Hygiene practices were reflected through regular handwashing and the separation of eating areas from workspaces; however, the use of personal protective equipment (PPE) remained inconsistent. OSH implementation was indicated by the availability of a first aid kit, evacuation routes, and proper sorting of sharp waste, although key facilities such as fire extinguishers and ergonomic workstations were still lacking. Major challenges included low community participation in source waste sorting, limited PPE supplies, insufficient financial support, and a shortage of human resources. This study highlights that systematic sanitation, hygiene, and OSH practices play a significant role in ensuring the sustainability of community-based organic waste management initiatives.

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INTRODUCTION

The issue of waste is a global problem that continues to grow alongside population growth, changing consumption patterns, and urbanisation. The What a Waste 2.0 report shows that the world produces more than 2 billion tonnes of solid waste per year, but only 19% is successfully recycled and

around 11% is processed through incineration, while the rest accumulates in landfills or pollutes the environment (World Bank, 2022). This situation increases the risk of soil, water and air pollution, which impacts public health and ecosystem sustainability (Lingga et al., 2024).

In Indonesia, the complexity of the waste problem is increasingly apparent, with 175,000 tonnes of waste generated every day (Kementerian Lingkungan Hidup, 2024). Major cities such as Bandung face severe pressure due to the limited capacity of their final disposal sites (TPA). The 2023–2024 Bandung waste crisis, triggered by the overcapacity of the Sarimukti TPA, which can only accommodate 1,300 tonnes/day while the city generates 1,700 tonnes/day, highlights the urgency of strengthening a more adaptive and collaborative waste management system (Syaputri et al., 2022). In such circumstances, a community-based approach is a key strategy because it can accelerate waste sorting, waste reduction at source, and community empowerment.

One innovation that is rapidly developing in Indonesia is the management of organic waste through the cultivation of Black Soldier Flies (BSF). This method is considered more efficient than conventional composting, because BSF larvae can break down organic waste up to five times their body weight and produce economically valuable products such as animal feed and organic fertiliser (Christensen and Bisinella, 2021). At the national level, the BSF approach has been widely adopted in the development of the circular economy because it enables organic waste to be converted into new resources in a sustainable manner (Sutikno et al., 2023).

Despite its great potential, community-based organic waste management faces significant challenges in terms of sanitation, hygiene, and occupational health and safety (OHS). Various studies in Indonesia confirm that workers and volunteers in the waste sector are vulnerable to skin infections, respiratory disorders, injuries from sharp objects, and exposure to bioaerosols and hazardous gases (Fitriandini, Adriyani and Akliyah, 2024). In addition, the low availability of personal protective equipment (PPE), minimal occupational health and safety training, and unequal knowledge of hygiene are factors that increase the risk (Sajodin et al., 2024).

Legok Beterled, established in 2023 in Bandung City, is a community-based organic waste management model that integrates maggot farming, composting, and the utilisation of derivative products such as kasgot. This community contributes to the Kang PisMan (Reduce, Separate, Utilise) programme and is able to reduce waste by up to 1 tonne per month. However, initial findings indicate a number of challenges, such as limited availability of personal protective equipment (PPE), low community participation in waste sorting, and incomplete health and safety facilities (Suparmi, Fauziah and Siahaan, 2025).

Previous studies on community waste management in Indonesia have mostly focused on

environmental sanitation (Mulasari et al., 2024) or changes in public health behaviour (Syam and Bungawati, 2025), while research related to the informal sector and communities often focuses on OHS risks (Syaputri et al., 2022). However, there has been no comprehensive study that integrates sanitation, hygiene, and occupational health and safety simultaneously into a single community-based organic waste management model, particularly in the city of Bandung. This research gap is what prompted the need for an in-depth analysis of operational practices in Legok Beterled.

Thus, this study aims to provide a comprehensive overview of sanitation implementation, hygiene practices among managers, and OSH implementation at Legok Beterled as a model for community-based organic waste management. In addition to describing the current conditions, this study also aims to identify implementation challenges and formulate recommendations for improvement that can serve as a reference for the development of similar models in other areas.

RESEARCH METHOD

Research Types and Approaches

This study uses a descriptive qualitative approach that aims to gain an in-depth understanding of sanitation, hygiene, safety and occupational health practices in community-based organic waste management. A qualitative approach was chosen because it allows researchers to explore the meanings that emerge from the direct experiences of informants and observe phenomena in their natural context (Susanto, Risnita and Jailani, 2023). Thus, this study focuses on the meaning of the process, field conditions, and operational dynamics that take place daily in Legok Beterled.

Location, Time, and Research Informants

The research was conducted on 20–21 September 2025 in Legok Beterled, located in RW 3, Ledeng Village, Cidadap Subdistrict, Bandung City. The main informant for the study was the manager of Legok Beterled (Mr H), who was selected using purposive sampling. This informant was chosen based on his direct involvement in all waste management activities and his comprehensive understanding of sanitation, hygiene, and occupational health and safety aspects at the research site (Firmansyah and Dede, 2022).

Data Collection Techniques and Instruments

Data was collected through field observations, in-depth interviews, and documentation. Observations were conducted to assess the sanitation conditions of the work area, the hygiene practices of managers, and the adequacy of

available occupational health and safety facilities. The observation process was participatory, using assessment sheets compiled based on indicators of environmental cleanliness, ventilation, odour control, hand washing habits, use of personal protective equipment (PPE), and safety facilities such as first aid kits and evacuation routes. The compilation of these indicators referred to the principles of qualitative observation, which emphasise contextual observation (Pugu, Riyanto and Haryadi, 2024).

Next, in-depth interviews were conducted to explore the informants' understanding of the operational flow of waste management, their experiences related to occupational health and safety risks, the obstacles they faced in maintaining sanitation and hygiene, and their needs for supporting facilities. The interviews were conducted in a semi-structured format so that the informants could provide flexible, broad answers based on their actual experiences in the field (Utami et al., 2023).

In addition, documentation was used to supplement the findings through photographs of the working conditions, sanitation facilities, use of PPE, and waste management processes. This documentation served to reinforce the findings of the observations and provide visual evidence of the conditions described by the informants.

Data Validation

Data validity is strengthened through triangulation of methods, which involves comparing the consistency of findings obtained from observation, interviews, documentation, and supporting literature. This technique is used to reduce researcher bias and ensure that the information presented has an adequate level of validity (Susanto, Risnita and Jailani, 2023). Thus, the data obtained is not only subjective, but also verified through various sources.

Data Analysis Techniques

Data analysis was conducted by referring to the Miles, Huberman, and Saldana model, which consists of three main stages, namely data reduction, data presentation, and conclusion drawing (Ash-Shiddiqi, Sinaga and Audina, 2025). In the data reduction stage, all findings were selected and categorised according to the themes of sanitation, hygiene, and occupational health and safety. Next, the reduced data was presented in the form of an integrated narrative and thematic tables so that important patterns could be seen. The final stage involved drawing conclusions by identifying relationships between findings and verifying interpretations through triangulation.

Research Ethics

This research was conducted in accordance with the principles of qualitative research ethics. The researcher first obtained permission from the Legok Beterled management to conduct research at the location and sought informed consent from informants before conducting interviews. The identities of informants were kept confidential, and the entire data collection process was carried out without disrupting waste management operations.

RESULTS AND DISCUSSION

An overview of the conditions in Legok Beterled is presented in Table 1. This table summarises observations covering three main aspects, namely sanitation, manager hygiene, and occupational health and safety (OHS). The purpose of this table is to provide an initial understanding of the existing conditions before they are explained in more detail in the sub-section on analysis of results and discussion.

Table 1
Sanitation, Hygiene, and Occupational Health and Safety Conditions in Legok Beterled

aspect	General Conditions	Important Notes
Sanitation	Good	Effective odour control; clean area; waste sorting available.
Hygiene	Fair	Hand washing is consistent, but PPE use is not yet optimal.
K3	Fair	First aid kit and evacuation route available; fire extinguisher not yet available.
Challenges	Needs improvement	Low community participation, limited PPE, few human resources.

Table 1 shows that most sanitation, hygiene, and occupational health and safety indicators in Legok Beterled have met adequate basic practices, particularly in odour control, area cleaning, and the availability of basic facilities such as first aid kits and evacuation routes. However, several limitations were still found, particularly in the consistent use of PPE, the absence of fire extinguishers, and low community participation in waste sorting. These conditions form an important basis for further analysis in the next section, which discusses each aspect in detail.

Sanitation

Sanitation in Legok Beterled shows relatively good management, although it is still limited to simple facilities. Based on observations, the work area does not experience waterlogging because the processing location is semi-outdoor. The manager explained that rainwater at the location seeps directly into the ground so that it does not cause puddles. This condition is considered effective in preventing the risk of disease vectors. As stated by one of the managers, "the water seeps directly into the ground and all parts of the site are frequently monitored, so there is no standing water" (Field Observation, 2025).

These observations are reinforced by field documentation showing that areas with paving blocks and gardens with exposed soil function as natural infiltration media, as shown in Figures 1 and 2.



Figure 1. Condition of the work area floor made of paving blocks



Figure 2. Garden area with open soil as a drainage medium

Efforts to control odours are carried out through several strategies. First, the processing units (maggot house, composting site, catfish pond, chicken coop, and vegetable garden) are separated so that the smells from each unit do not interfere with each other. Second, the composting site is always tightly closed. Third, the semi-open room design supports natural ventilation, which ensures smooth air circulation. In addition, the manager also applies the use of Local Microorganisms (MOL) as a bioactivator. MOL accelerates organic decomposition while reducing unpleasant odours, thereby improving the quality of sanitation in the processing environment. The application of MOL can be seen in Figure 3, which shows the process of applying MOL liquid to bricks in the composting process.



Figure 3. Application of MOL in the composting process

These findings are consistent with research Tasrun, Ardiansyah and Achmad (2023) which shows that the use of simple material-based MOLs can help reduce odours and improve environmental sanitation quality, but differs in that this study was conducted on a household scale using the Takakura method, whereas the research in Legok Beterled was community-based and more extensive.

Waste management in Legok Beterled applies the principle of sustainability. Organic waste is partly used as maggot feed, while waste that cannot be digested by maggots is used to make compost. Meanwhile, KasGot (maggot waste), which is the remaining faeces and cultivation media from maggots or black soldier fly (*Black Soldier Fly*/BSF) larvae, is used as organic fertiliser. Thus, almost all of the waste produced is reused, thereby reducing the potential for pollution.

Facility cleaning is carried out daily using simple equipment such as brooms. This is reinforced by the manager's statement, "*The place is cleaned regularly every day*" (Field Observation, 2025). With this routine, the work area remains clean even though the available facilities are limited. There are also a sufficient number of separate bins, which supports the process of separating organic and inorganic waste from the outset. The availability of these facilities demonstrates the manager's awareness and commitment to maintaining the cleanliness of the work area and making it easier for the community and managers to sort waste.

These findings indicate that Legok Beterled has successfully implemented community-based sanitation based on the principles of the circular economy. Research by Pasymi, Sundari and Munzir (2022) demonstrates that organic waste treatment using the BSF maggot cultivation method can overcome environmental pollution by decomposing organic waste quickly and efficiently, thereby significantly reducing the volume and impact of organic waste on the environment. This is consistent with the opinion Sutikno et al., (2023) which emphasises that integrated waste management can support environmental sustainability and public health. Noordianty et al. (2024) also emphasises that good sanitation not only prevents contamination, but also improves the

quality of the processed product. In addition, the use of MOL as a *bioactivator* is in line with environmentally friendly management practices that have been proven effective in controlling odours and accelerating fermentation. Suparmi, Fauziah and Siahaan (2025).

Hygiene

The hygiene practices of managers at Legok Beterled show a fairly good level of awareness, especially in terms of maintaining personal hygiene and separating eating areas from waste processing areas. The managers consistently wash their hands before and after work, a habit that was mentioned directly by an informant: *"After tidying up or before work, we usually wash our hands first, so we are used to doing that to be cleaner"* (Field Observation, 2025). This habit is a basic form of control against potential contamination that can arise from the organic waste processing process. The implementation of this hygienic behaviour is confirmed by field documentation, which can be seen in Figure 4. The managers carry out hand washing procedures after completing their work activities.



Figure 4. Hand washing procedure by managers after work activities

The dining area has also been separated from the work area to minimise the risk of cross-contamination, demonstrating an understanding of the importance of hygiene even though it is not yet supported by specific written SOPs. However, the use of personal protective equipment (PPE) is still inconsistent. Although masks and gloves are occasionally available, boots are very limited and aprons are not used at all. This inconsistency is not only influenced by availability, but also by user comfort. One manager said, *"Wearing gloves can be awkward, so it's easier to just wash your hands often to stay clean"* (Field Observation, 2025). This shows that compliance with PPE has not been fully established because some managers rely more on the habit of washing their hands than on physical protection.

These field findings are consistent with research Fitriandini, Adriyani and Akliyah (2024), which revealed that discomfort with PPE is a major factor in low compliance among waste workers in the use of personal protective equipment, which in turn increases the risk of dermatitis and skin infections. Research Azzahra and Fauziah (2025)

also emphasises that good hygiene practices are directly linked to increased worker comfort and productivity. In addition, Sari, Marji and Kurniawan (2021) found that consistency in the use of PPE is greatly influenced by the availability of adequate equipment and comfort during use, which is relevant to the conditions in Legok Beterled. Hygienic behaviour in the processing of organic waste using the BSF maggot cultivation method is very important to prevent contamination and disease. This hygiene aims to maintain the quality of the maggots as feed and to keep the cultivation environment healthy and productive without posing a health risk to humans. (Yuliana et al., 2023).

Critically, although a handwashing culture has been strongly established, this practice cannot completely replace the role of PPE in protecting managers from potential biological and physical contamination. The irregular availability of PPE, especially boots and aprons, increases the risk of exposure to organic materials, sharp objects, and potential contaminants from waste. The absence of written SOPs on hygiene also has the potential to make cleanliness standards dependent on personal awareness rather than on formal guidelines that can be applied consistently.

Taking into account the findings and literature, hygiene management at Legok Beterled can be categorised as fairly good in terms of behaviour, but it still needs to be strengthened through the provision of adequate PPE, improved PPE comfort, and the development of written SOPs so that hygiene practices are not just an individual routine but part of a standardised work system.

Occupational Safety and Health (OSH)

The implementation of occupational safety and health (OSH) at Legok Beterled is still in the development stage. Based on observations, a number of potential hazards can be identified, including the risk of being pierced by sharp objects when sorting waste, as well as exposure to odours and dust from the processing. Although the scale of management is still community-based, these potential hazards still require serious attention as they can affect the long-term safety of managers.

Efforts to prevent hazards at Legok Beterled are carried out in several simple but effective ways. Managers strive to use personal protective equipment (PPE) while working and to establish safer work procedures. Some managers comply with PPE use, while others do not due to comfort factors. Compliance with PPE use can be seen in Figure 4, which shows managers using PPE while cultivating BSF maggots.



Figure 5. Use of PPE during maggot cultivation

Efforts are made to avoid the risk of accidents caused by sharp waste such as skewers, which are often mixed in with food waste. Managers always sort through the waste deposited by residents before it enters the processing stage. This was conveyed by one of the managers, *"If there is food waste, it is often mixed with skewers, so before processing, we always sort it first to be safer"* (Field Observation, 2025). Although these preventive measures have been implemented, there are still some managers who are not consistent in wearing complete PPE. This condition shows that awareness of the potential dangers actually exists, but compliance with K3 procedures is still not fully uniform.

In terms of facilities, Legok Beterled already has first aid kits available in the work area, although they are rarely used because accidents are relatively rare. Emergency evacuation routes are also available and quite numerous, with access from various directions that can be used when needed. This is an advantage because it allows for rapid evacuation in case of an emergency. However, simple firefighting facilities are still not available, so this is an aspect that needs to be added to complete the OHS readiness at the location. In addition, in terms of supporting facilities, Legok Beterled does not yet have a special work table for the process of making Local Microorganisms (MOL). As a result, the manager mixes MOL ingredients directly in the yard without the facilities of a table and chairs. This condition not only makes the work uncomfortable, but also has the potential to cause physical complaints such as muscle aches due to non-ergonomic working positions. The provision of simple work tables can help improve comfort and efficiency in the MOL production process.

These results are consistent with research Syaputri et al. (2022) which emphasises that waste workers face a high risk of occupational accidents, making it important to improve protection even on a small scale. In addition, Sajodin et al., (2024) emphasising that continuous OSH education and socialisation can increase public and worker awareness in applying safety principles. The implementation of OSH training, as recommended Antesty et al. (2025), can also be an important strategy for waste management communities to

minimise potential accidents and foster a safer work culture.

Thus, the implementation of K3 in Legok Beterled can be categorised as quite good but not yet optimal. The availability of first aid kits, the habit of using PPE, and the existence of simple work standards are positive first steps. However, limitations in facilities such as evacuation routes, fire extinguishers, and formal training remain challenges that need to be addressed immediately. Improving OSH aspects will not only protect workers but also strengthen public confidence in the sustainability of Legok Beterled as a community-based waste management centre. (Paramita et al., 2025).

Challenges and Obstacles

Waste management in Legok Beterled faces various challenges that affect the effectiveness of sanitation, hygiene, and occupational health and safety practices. The main challenge lies in the low level of public awareness regarding waste sorting at home. Although the programme is already underway and the community participates in waste collection, most residents still mix organic and inorganic waste, which complicates the processing. This was revealed by the manager, *"Many people still mix their waste, so we have to re-sort it so that it can be processed"* (Field Observation, 2025). This condition is in line with research Suparmi, Fauziah and Siahaan (2025) which emphasises that low community participation in waste sorting is a major obstacle to the success of community-based management.

The next obstacle is the limited sanitation and occupational health and safety facilities. Legok Beterled actually already has PPE equipment provided for managers, but its availability is not always stable. Sometimes PPE stocks run out, resulting in a delay before new supplies can be procured. As one manager explained, *"PPE is available, it is usually prepared, but sometimes stocks run out so we have to wait for more"* (Field Observation, 2025). This limitation is also evident in the types of PPE available. The number of boots is very limited and sometimes not available at all, so managers have to use regular shoes, which are less safe. In addition, aprons, which should be worn to protect work clothes from dirt and contamination, are not used at all. These shortcomings mean that protection and hygiene standards in waste management have not been fully achieved. In addition, supporting facilities such as simple fire extinguishers are not yet available, so occupational health and safety protection is not yet optimal. In addition, limitations in work facilities are still being felt. For example, the MOL manufacturing process is still carried out in the yard because there are no special tables and chairs available. This makes the work

less ergonomic, causing muscle aches and potentially reducing work effectiveness. These conditions can be seen in Figure 5, which shows the MOL manufacturing process still being carried out in the yard without special work facilities.



Figure 6. The process of making MOL in the yard area

Another challenge is the limited human resources. The number of managers involved is relatively small, resulting in a heavy workload. This situation has an impact on the suboptimal implementation of work standards, including discipline in the use of PPE and environmental hygiene. Similar obstacles were also found in the study. Hasrianti et al. (2024), which indicates that human resource constraints often hinder the sustainability of community-based sanitation programmes.

Overall, the main challenges facing Legok Beterled can be summarised in three aspects, namely low public awareness of waste sorting, limited sanitation and occupational health and safety facilities, and a lack of human resources and financial support. These obstacles not only slow down operations, but also have the potential to reduce the sustainability of the programme if they are not immediately addressed with support from the government and external parties.

Learning

The waste management experience in Legok Beterled provides a number of important lessons that are relevant to the development of community-based waste treatment centres. From a sanitation perspective, the measures implemented have proven effective in maintaining environmental cleanliness. The separation of work units, compost enclosure, natural ventilation, and the use of Local Microorganisms (MOL) have been able to control odours while accelerating the decomposition process. This simple strategy based on local wisdom is in line with the findings of Suparmi, Fauziah and Siahaan (2025)

which emphasises that a community-based approach can improve sanitation quality without the need for complex technology.

Managerial hygiene is also an important lesson. Awareness of personal hygiene is quite high, as evidenced by the habit of washing hands before and after work and the separation of eating

areas from waste processing locations. Although there are no specific written SOPs regarding hygiene, hygiene rules have been integrated into the SOPs for maggot cultivation and composting. This shows that internal standards can function well when there is commitment from managers. Research Fitriandini, Adriyani and Akliyah (2024) emphasises that consistent hygienic practices are highly influential in preventing diseases among waste workers.

In terms of occupational health and safety (OHS), Legok Beterled has shown progress with the provision of first aid kits and adequate emergency evacuation routes from various sides of the location. However, limitations are still evident in the availability of other supporting facilities such as simple fire extinguishers and PPE, which are not yet fully consistent. Antesty et al. (2025) emphasises that structured health and safety training can strengthen a culture of safety in community waste management, making this an important aspect to consider further.

In addition to technical factors, management at Legok Beterled also shows that the success of the programme is highly dependent on community participation. Low awareness among residents in sorting waste means that managers must re-sort the waste before processing. This situation is consistent with the findings. Hasrianti et al. (2024) which emphasises that active community involvement is a key requirement for the success of community-based environmental sanitation.

Thus, the lessons learned from Legok Beterled include the effectiveness of applying the principles of the circular economy in reducing pollution, the importance of hygienic habits even with simple standards, the need to strengthen health, safety and environmental aspects through facilities and training, and the crucial role of community participation in waste sorting. This management model can serve as inspiration for other regions that wish to develop community-based waste management systems tailored to local capacities.

CONCLUSION

This study shows that community-based organic waste management in Legok Beterled can be effective through the implementation of simple sanitation practices, good hygiene behaviour, and basic occupational health and safety measures, even though the available facilities and infrastructure are still limited. The combination of work unit separation, the use of MOL, hand washing habits, and initial waste sorting has been proven to support smooth operations and maintain the quality of the working environment. However, a number of aspects still need to be strengthened, particularly regarding the consistent use of PPE, the completeness of safety facilities, and the development of more structured SOPs so that

sanitation, hygiene, and OHS practices can be implemented consistently and sustainably.

This study provides empirical contributions to the integration of sanitation, hygiene, and occupational safety (K3) aspects in community-based waste management, particularly in the BSF-based processing model. These findings confirm that the success of community waste management systems depends not only on technology or processing methods, but also on the behaviour of managers, work culture, and community support in sorting waste before disposal. Thus, the results of this study can be used as a reference for the development of community-based waste management programmes in various regions with limited facilities, while also offering a model that has the potential to be replicated more widely if supported by a strong system, thereby promoting a healthier, safer and more sustainable environment.

SUGGESTIONS

It is recommended that Legok Beterled managers improve the provision and consistent use of personal protective equipment (PPE), including masks, gloves, boots, and aprons, to ensure that hygiene and occupational safety practices are carried out in accordance with standards. The management is also advised to develop written Standard Operating Procedures (SOPs) covering sanitation, hygiene, and occupational health and safety aspects so that the implementation of activities has clear guidelines that can be applied consistently by all members. In addition, it is recommended that supporting facilities such as fire extinguishers, ergonomic work tables, and waste sorting systems be improved to reduce the risk of accidents and increase operational efficiency.

Local governments and relevant stakeholders are also advised to strengthen their support through regular training on occupational health and safety, workplace hygiene, and BSF-based waste management, so that the capacity of managers can continue to develop. Community participation needs to be increased through education on waste sorting at source, given that the success of community-based waste management systems is highly dependent on community contributions. These collaborative efforts are expected to strengthen the sustainability of Legok Beterled as a model for safe, effective organic waste management that is oriented towards improving environmental quality.

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