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Community Empowerment in Kasunyatan Village Through the Utilization of Water Hyacinth (*Eichhornia crassipes*) into Biomass Briquettes as an Effort for Flood Mitigation and Local Economic Improvement

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Abstract

The water hyacinth problem in the Cibanten River has not been optimally addressed. Community efforts, along with the Youth Organization (Karang Taruna) and the Maulana Yusuf Tourism Awareness Group (POKDARWIS), have generally been limited to river cleanups and community service activities. These activities are temporary, as the water hyacinth will regrow within a short time. However, if managed properly, water hyacinth has significant potential as a biomass resource that can be utilized to create valuable and economically viable products, one of which is biomass briquettes. Community empowerment activities in Kasunyatan Village, utilizing water hyacinth to produce biomass briquettes, have achieved their objectives. The community has successfully increased their knowledge, skills, and awareness of sustainable environmental management. The participatory, case-based implementation method is aligned with the challenges and needs of the community facing flooding and excessive water hyacinth growth. This program has had a positive impact on the environment by reducing river blockages and providing economic benefits through business opportunities for briquette production. Furthermore, it has fostered collective community awareness to maintain environmental cleanliness and utilize local resources independently. In the future, it is recommended that this activity be developed by improving the quality of briquette products and strengthening cooperation with related parties to provide broader and more sustainable benefits.

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1. INTRODUCTION

Kasunyatan Village, located in Kasemen District, Serang City, is situated in the downstream area of the Cibanten River and is recognized as one of the regions highly vulnerable to flooding, particularly during periods of heavy rainfall. This condition is exacerbated by the presence of water hyacinth (*Eichhornia crassipes*), which grows abundantly along the river flow. The excessive proliferation of water hyacinth has covered the water surface, slowed the river current, and accelerated the sedimentation process. Dead and decaying plants accumulate at the bottom of the river, increasing sediment volume and reducing the river's water-holding capacity. Consequently, during heavy rainfall, the river overflows and causes flooding in nearby residential areas.

The issue of water hyacinth in the Cibanten River has not yet been addressed optimally. Community efforts, together with local youth organizations (Karang Taruna) and the Tourism Awareness Group (POKDARWIS) Maulana Yusuf, have generally been limited to river-cleaning activities and environmental community service programs. However, these efforts are temporary in nature, as water hyacinth rapidly regrows within a short period. In fact, when managed properly, water hyacinth has significant potential as a biomass resource that can be processed into valuable and economically beneficial products, one of which is biomass briquettes.

Water hyacinth (Eichhornia crassipes) is an aquatic plant that floats on water and occasionally roots in the soil. Due to its rapid growth, water hyacinth can become an aquatic weed that covers the water surface and causes environmental problems. Nevertheless, despite its negative impacts, water hyacinth also provides benefits because it is capable of absorbing organic substances, inorganic substances, and heavy metals that act as pollutants (Ratnani, 2018).

One potential utilization of water hyacinth is as a raw material for briquette fuel. Briquettes are compact blocks of combustible material used as fuel to initiate and maintain fire combustion (Pratama, 2019).

The conversion of water hyacinth into briquettes represents an environmentally friendly innovation that provides dual benefits: reducing river blockages as a flood mitigation effort and improving community welfare through the development of alternative energy sources. Water hyacinth contains relatively high lignocellulosic compounds, making it suitable as a solid fuel with adequate calorific value when processed through proper carbonization and binder-mixing techniques. Briquettes produced from water hyacinth can be utilized as household fuel, for agricultural product drying, or sold as an additional source of community income.

To date, the people of Kasunyatan have not yet possessed the necessary skills to process water hyacinth into economically valuable products. Therefore, community empowerment activities are needed through training and assistance programs focused on the production of briquettes using simple technology. This initiative is not only aimed at reducing aquatic plant waste but also at strengthening community capacity in managing local resources productively and sustainably.

The program for utilizing water hyacinth as biomass briquettes supports the 11th and 13th Sustainable Development Goals (SDGs), namely sustainable cities and communities, and climate action. In addition, this activity aligns with the fourth mission of Asta Cita, which emphasizes the strengthening of human resources, science, technology, as well as youth and community empowerment. Academically, this program also contributes to the Higher Education Key Performance Indicators (Indikator Kinerja Utama/IKU), specifically IKU 2 (student experiences outside the campus) and IKU 5 (the utilization of lecturers' work by the community).

Therefore, the community empowerment program through the innovation of water hyacinth briquettes in Kasunyatan Village is expected to become an ecological solution for addressing environmental problems caused by the excessive growth of aquatic plants, while also serving as an alternative renewable energy source with economic value for the community.

Problems

The problems faced by the community of Kasunyatan Village originate from the geographical condition of the area, which is located in the downstream section of the Cibanten River and is highly vulnerable to flooding. The uncontrolled growth of water hyacinth has caused the river surface to become covered, slowed the water flow, and reduced the river's capacity due to the accumulation of dead plants and sediment. Efforts undertaken by the community together with the local youth organization (*Karang Taruna*) and the Tourism Awareness Group (*POKDARWIS*) Maulana Yusuf have so far been temporary in nature, consisting mainly of community-based river-cleaning activities without any sustainable management measures.

In addition, the community has not yet acquired the skills necessary to process water hyacinth into economically valuable products, despite the plant's significant potential as a biomass resource. The limited utilization of water hyacinth as an alternative fuel indicates that the available

local potential has not been optimized. Furthermore, there is still no community empowerment model that provides training in simple biomass-processing technology, resulting in limited community capacity to manage local resources in ways that support environmental and economic sustainability principles.

Solutions

The proposed solution to address these problems is the implementation of a community empowerment program through training and assistance in the production of briquettes made from water hyacinth. This program is designed to provide technical skills to the community regarding the processes of carbonization, binder mixing, molding, and briquette drying, enabling them to process water hyacinth into useful alternative energy sources.

The application of simple technology allows the community to produce briquettes independently and sustainably. In addition to helping reduce river blockages as part of flood mitigation efforts, briquette production also creates new business opportunities for the community as an additional source of income. Collaboration among the community, *Karang Taruna*, *POKDARWIS*, and higher education institutions further strengthens the sustainability of the program while supporting the achievement of the Sustainable Development Goals (SDGs) related to sustainable settlements and climate action. The program is also aligned with the fourth mission of *Asta Cita*, which emphasizes strengthening human resource capacity and technology development.

Through this solution, the potential of water hyacinth can be utilized productively, thereby generating both economic and ecological benefits for the community of Kasunyatan Village.

2. IMPLEMENTATION METHOD

Data collection was conducted through field observation to identify the presence and distribution of water hyacinth around the river, as well as to assess its potential as a raw material for briquette production. In addition, interviews and group discussions were carried out with local village officials, members of the *Karang Taruna*, and neighborhood leaders (RT) to determine their initial understanding of water hyacinth processing. All training and practical activities were systematically recorded using observation sheets and daily production journals. A simple evaluation of briquette quality was conducted by observing the burning performance and physical strength of the briquettes produced by the community after the training. The collected data were then analyzed descriptively to illustrate improvements in skills and product quality.

The implementation of the activity began with socialization sessions for the local community to explain the objectives, stages of the program, and the division of roles among the service team, students, and *Karang Taruna*. The socialization was followed by initial technical discussions to identify resource readiness, raw material availability, and community expectations regarding the program. After this stage, the activity proceeded with briquette production training. At this stage, participants were introduced to the characteristics of water hyacinth, its environmental impacts, and its potential as an alternative fuel source. The training continued with hands-on practice in briquette production, starting from collecting water hyacinth, washing, drying, grinding, mixing with binding agents, and proceeding to molding and final drying. The entire process was conducted in a participatory manner, where participants practiced each production step under the guidance of the service team and students.

The technology implementation stage involved the production of water hyacinth briquettes using simple equipment provided by the service team. The dried water hyacinth was chopped using a shredding machine, carbonized using a carbonization unit, and then ground using a grinding machine. After that, the material was mixed with a natural binder using a digital scale to ensure the binder composition was approximately 10% of the total material mass. The mixture was then molded using a briquette pressing machine to produce uniform shapes and subsequently dried using a drying machine to reduce moisture content and improve briquette quality. Quality

evaluation was conducted through a simple combustion test to observe flame stability, durability, and overall briquette performance.

In the final stage, efforts were made to strengthen the sustainability of the program. The community was encouraged to form a production group responsible for organizing the continuous utilization of water hyacinth into briquettes. In addition, participants were encouraged to develop plans for briquette utilization, both as a household alternative fuel and as a potential small-scale business opportunity. Thus, this activity is expected not only to serve as an ecological solution for reducing river blockage caused by water hyacinth, but also to open additional economic opportunities for the community.

3. RESULTS AND DISCUSSION

The community empowerment activities in Kasunyatan Village through the innovation of water hyacinth utilization into biomass briquettes showed significant outcomes in environmental, social, and economic aspects. This program successfully transformed the community's perception of water hyacinth, which was previously considered an invasive weed, into a valuable resource. The participatory approach applied in this program involved the community directly from the planning stage to production, resulting in a strong impact on increasing residents' knowledge and skills.

The activities were implemented through five main stages: socialization, training, technology implementation, mentoring and evaluation, and program sustainability. The entire series of activities was designed to provide a hands-on learning experience (learning by doing) for the community. A summary of the implementation and outcomes is presented in Table 1 below.

Table 1. Summary of Implementation and Outcomes of Water Hyacinth Briquette Production Activities

Activity Stage	Main Objective	Form of Activity	Technology/Tools Used	Results and Outcomes
Socialization	Increase community awareness and understanding of water hyacinth potential	Outreach and discussions at Kasunyatan Village Office	-	Improved community understanding of the value of water hyacinth
Training	Provide technical skills in briquette production	Hands-on practice including shredding, carbonization, mixing, molding, and drying	Shredding machine, carbonization drum, molding machine, drying machine	Participants understood the complete briquette production process
Technology Implementation	Introduce and operate simple production tools	Use of shredding machine, grinding machine, digital scale, molding machine, and dryer	Shredding machine, grinding machine, digital scale, molding machine, drying machine	Production became more efficient, producing solid and uniform briquettes
Mentoring and Evaluation	Monitor production results and assess learning effectiveness	Community assistance during production and combustion testing	Same equipment as production process	The briquettes burned steadily, and the community was able to produce them independently

Program Sustainability	Foster long-term environmental awareness and commitment	Continued education and motivation to utilize water hyacinth	-	The community became more aware of and motivated to manage water hyacinth independently.

From the results of the implemented activities, several important findings were identified, showing positive changes in the community as well as the effectiveness of the program. These findings illustrate how the empowerment process contributed to improving knowledge, skills, and environmental awareness based on local resource potential.

1. Increased Knowledge and Ecological Awareness

   Socialization and training activities successfully improved community awareness regarding the importance of environmental management. Water hyacinth, previously considered a nuisance weed, is now perceived as a valuable resource. This awareness has become the foundation for behavioral change in maintaining river cleanliness and managing aquatic plant waste.

2. Improved Skills and Utilization of Appropriate Technology

   Through training and technology implementation, the community acquired basic skills in briquette production using simple tools. The use of shredding and drying machines improved production efficiency, while digital scales ensured consistency in material composition. These skills enabled the community to independently produce briquettes.

3. Environmental and Social Impacts

   The utilization of water hyacinth for briquettes has had a positive impact on river conditions. The volume of water hyacinth in the Cibanten River has decreased as part of it has been utilized. In addition, the community has begun to recognize the economic value of environmental activities, although it has not yet developed into a commercial business. The social impact includes increased responsibility and environmental awareness among residents.

4. Sustainability Through Collective Awareness

   The sustainability stage focuses on building collective awareness so that the community continues to utilize water hyacinth independently without reliance on formal programs. This approach emphasizes changes in mindset and behavior toward independent and sustainable environmental resource management.

   Overall, this activity demonstrates that improvements in knowledge, skills, and environmental awareness can be achieved through a local resource-based approach. The community not only learned how to process water hyacinth into briquettes but also began to understand the importance of maintaining river ecosystem balance and using natural resources wisely.

Image 1. Water Hyacinth Shredding Process

Image 2. Water Hyacinth Charcoal Production Process

Image 3. Water Hyacinth Briquette Molding Process

This approach is in line with the concept of community-based environmental management, which emphasizes the importance of active participation and behavioral change as key factors for sustainable environmental management (Kurniawan et al., 2022). Through the application of simple appropriate technology, this activity demonstrates that ecological awareness can be developed without formal structures, but rather through voluntary participation and collective community responsibility.

4. CONCLUSIONS

The community empowerment program in Kasunyatan Village through the utilization of water hyacinth into biomass briquettes has successfully achieved its objectives. The community demonstrated improvements in knowledge, skills, and awareness regarding sustainable environmental management. The implementation method, which is participatory and problem-based, was well aligned with the community's needs and conditions, particularly in addressing flooding issues and the excessive growth of water hyacinth.

This program has provided positive environmental impacts by reducing river blockage caused by water hyacinth accumulation, as well as economic benefits through opportunities for briquette production as a small-scale business. In addition, it has fostered collective awareness among the community to maintain environmental cleanliness and independently utilize local potential resources.

For future development, it is recommended that this program be expanded through improving briquette product quality and strengthening collaboration with relevant stakeholders to ensure broader and more sustainable benefits.

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