

Utilization of Water Hyacinth as Organic Fertilizer on Kemaro Island, Palembang City



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ABSTRACT: The water hyacinth is a free-floating aquatic plant. Water hyacinth has massive reproductive capacity, which causes several problems, including ecosystem destruction, irrigation problems, and its use as a breeding ground for mosquitoes, which causes the mosquito population to increase. The high growth rate of water hyacinth is also a major problem faced by the people on Kemaro Island. The large number of water hyacinth plants on Kemaro Island causes environmental issues, such as slum settlements. Pupuk Sriwidjaja Palembang (Pusri) Ltd. is here to overcome this problem through a community empowerment program, namely the Sehat Sejahtera Program (Sesera). The methods used in this research are literature study, observation, and interviews. The research results show that the Sesera Program is able to reduce the number of water hyacinths that accumulate around the residences of Kemaro Island residents. Through the Sesera Program, Pusri empowers the community to utilize and process water hyacinth in order to reduce the number of water hyacinth growing around Kemaro Island. Activities carried out by utilizing water hyacinth to become compost. To maintain these impacts or benefits, the Sesera Program through water hyacinth composting activities needs to involve other stakeholders who are able to encourage and increase the impact of the program, such as the Village Government, City government, and agriculture service.

KEYWORDS: Water Hyacinth, Organic Fertilizer, Kemaro Island

I. INTRODUCTION

Eichornia crassipes, widely known as water hyacinth, is a weed plant that lives in aquatic areas (Rezekiah et al., 2022; Vidya & Girish, 2014). Water hyacinth lives floating in deep water or develops roots in the mud in shallow water (Rezekiah et al., 2022; Sindhu et al., 2017). The physical characteristics of the water hyacinth plant are wide, thick, shiny, and oval leaves with long, springy, and round stems. Water hyacinth has hairy roots and is purple-black in color. Water hyacinth can live at temperatures range from 21.1 °C to 27.2 °C, with an estimated pH tolerance range from 5.0 to 7.5 (Vidya & Girish, 2014).

Water hyacinth has fast development rate, both vegetatively (once every 3 – 5 days) or generative, where 1 (one) water hyacinth stem will develop an area of 1 m² within 52 days (Rezekiah et al., 2022). Judging from its fast reproduction, water hyacinth is nicknamed the 'beautiful blue devil' because it grows quickly like a dense green mat on the surface of water, such as lakes, rivers, ponds, waterways and ditches (Vidya & Girish, 2014). The rapid development of water hyacinth has turned water hyacinth into a weed plant in water areas (Rezekiah et al., 2022). Grodowitz (1998) stated that water hyacinth is one of the most productive plants on earth and at the same time is the worst water weed in the world.

Water hyacinth has become one of the main problems in water resources management due to its high level of development (Kwenda et al., 2023). Research conducted predicts that ten water hyacinth plants on a land area of around half a hectare can regenerate into 650,000 plants within 8 months. According to de Medeiros et al. (2017), excessive nitrogen and phosphorus content is the main cause of the high growth of water hyacinth plants. This content triggers excessive growth and increases phytoplankton, which then causes a decrease in biological oxygen demand (BOD) in the water (de Medeiros et al., 2017). This plant has an impact on deoxygenation of water sources, which affect aquatic life forms (Rommens et al., 2003).

Water hyacinth plants are currently considered a serious threat to biodiversity. Environmental hazards associated with these plants are a decrease in water quality and drastic changes in plant and animal communities, diffusion of light and oxygen that limits the reduction of water movement, and also as a breeding ground for mosquitoes, which causes the mosquito population to increase (Sornvoraweat & Kongkiattikajorn, 2010). Other environmental hazards include blockage of irrigation, hydropower and

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water supply lines, obstructions to water transportation, blockage of canals and rivers leading to flooding (Vidya & Girish, 2014). Efforts to control this weed require high costs and very high labor. Several biological, physical and chemical methods have been tried to control and eradicate water hyacinth, but none of these strategies has proven to be a permanent solution for controlling this weed (Sindhu et al., 2017).

Contrary to its nickname as the worst plant in the world, water hyacinth contains 20% cellulose, 48% hemicellulose and 3.5% lignin (Sindhu et al., 2017). The high content of hemicellulose and cellulose in water hyacinth can be explored and used as a raw material for making biofuels. In addition, Sahu et al. (2002) explained that water hyacinth contains large amounts of nitrogen, phosphorus, magnesium, sulfur, manganese, copper, zinc and other constituents. Water hyacinth has a higher content of iron, calcium and potassium than other terrestrial plants, but it has not been widely used because of the low level of dry matter. Previous research reported that water hyacinth can be converted into ethanol and biogas fuel (Das et al., 2016). Vidya & Girish (2014) also explained that water hyacinth can be used in traditional medicine, biogas production, mushroom bedding, black carbon production, rope making, fiberboard production, as animal feed and fish feed, green manure, compost, and as a plant ornamental.

Kwenda et al. (2013) explained that water hyacinth can be used for wastewater treatment. Huynh et al. (2021) emphasized that water hyacinth plants are very effective in removing stains, suspended solids, BOD, organic matter, and heavy metals, so water hyacinth has great potential to be used as a natural water purification system at a lower cost than the cost of standard waste treatment facilities (Du et al., 2020; Kwenda et al., 2023). Based on research conducted by MAULIDYNA et al. (2021) obtained results that water hyacinth can be processed into organic fertilizer, which can be marketed widely and then ultimately be able to reduce the number of water hyacinth populations. Water hyacinth can be processed into organic fertilizer because it contains 78.47% organic material, 21.23% C-Organic, 0.28% Total N, 0.011% Total P, and 0.016% Total K, and contains cellulose (Rezekiah et al., 2022). Referring to this composition, water hyacinth plants have the potential to be used as organic fertilizer.

II. METHOD

This research is qualitative research with data collection methods through literature study, observation and interviews. Literature studies are carried out by collecting literature related to the topic to be studied. Observations were carried out by observing water hyacinth composting activities carried out by the Kemaro Island community to overcome the problem of accumulation of water hyacinth plants. Interviews were conducted with Pupuk Sriwidjaja Palembang (Pusri) Ltd., residents and Heads and Officials of Satu Ilir Village, Palembang City, South Sumatra.

III. RESULT AND DISCUSSION

Kemaro Island is one of the areas in Satu Ilir Village, Ilir Timur Dua District, Palembang City, South Sumatra. Kemaro Island, is a small delta on the Musi River, located about 6 km from the Ampera Bridge. Kemaro Island is located in an industrial area which is between the Sriwijaya Fertilizer Factory and Pertamina Plaju and Sungai Gerong. The position of Kemaro Island is slightly to the east from the center of Palembang City. Kemaro Island has an area of \pm 79 hectares with a height of 5 meters above sea level.



Figures I. Kemaro Island
Source: fainun.com

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A. The potential for processing organic fertilizer from water hyacinth and its benefits

Organic fertilizers are fertilizers made from organic materials such as plants and/or animals, which are used as planting media so that the supply of soil organic matter is fulfilled (Rezekiah et al., 2022). The use of fertilizers aims to improve the physical, chemical and biological properties of the soil so that plants become more fertile, especially the use of organic fertilizers, which are able to provide better growth and development results for plants. In addition, the use of organic fertilizers does not have a negative impact on soil conditions when compared to inorganic fertilizers, which can cause soil productivity to decrease if used excessively (Rezekiah et al., 2022). Organic fertilizers are also somewhat cheaper and more effective as a good source of nitrogen for sustainable crop production, but their availability is a problem because the demand for fertilizer is very high (Vidya & Girish, 2014).

Furthermore, Vidya & Girish (2014) explained that the use of organic matter such as weeds is a resource that is often overlooked for remediation of soil fertility. Weed exploitation is a more effective and efficient way to overcome the problem of the high growth rate of water hyacinth. The productivity potential of water hyacinth in nutrient enriched waters is the reason why water hyacinth was chosen as a source of biomass for organic fertilizer. This is a prospective effort to tackle water hyacinth weeds in water areas, namely by utilizing water hyacinth plants for organic fertilizer. Organic fertilizer produced from water hyacinth contains 18.93% C-organic, 1.78% total N, 1.10% P, and 1.26% K (Yunindanova et al., 2020).

B. Water Hyacinth and Kemaro Island

Kemaro Island is a small delta located in the middle of the Musi River, Palembang City, South Sumatra. Due to its location in the middle of a river, the growth of water hyacinth plants around Kemaro Island is uncontrolled. The water hyacinth plants that grow continue to grow every day, causing accumulation, which in turn causes a slums around the residences of the Kemaro Island residents.

The people of Kemaro Island have always considered the water hyacinth plant as a nuisance plant that destroys the environment in which they live. Water hyacinth plants grow in large numbers, causing accumulation, which then causes an unpleasant odor. Apart from that, the accumulation of water hyacinth also causes slums in residential areas, which ultimately reduces the quality of the living environment for the people of Kemaro Island. Water hyacinth plants that grow abundantly also often cover harbors or riverbanks where boats owned by local residents rest. So far, local residents have never felt the positive impact of the water hyacinth plants which grow in very large numbers around Kemaro Island.

Through the Sehat Sejahtera Program (Sesera) that initiated by Pupuk Sriwidjaja Palembang (Pusri) Ltd. with the aim of empowering the people of Kemaro Island has succeeded in utilizing and processing water hyacinth into a useful resource. Pusri was keen to see the opportunities from the abundant water hyacinth plants on Kemaro Island. Several activities are carried out to utilize water hyacinth, including water hyacinth composting activities, water hyacinth biomass, and water hyacinth crafts. The water hyacinth composting activity was carried out by inviting Kemaro Island residents to utilize and process water hyacinth into compost which was then used as a planting medium. Pusri provided training to the people of Kemaro Island on how to technically process water hyacinth into organic fertilizer.

Utilizing water hyacinth through water hyacinth composting activities can reduce the number of water hyacinths that accumulate around residential areas. Through water hyacinth composting activities, water hyacinth can be managed as much as 1 ton/month. Based on this data, Pusri's intervention in the use of water hyacinth was able to reduce the number of hyacinths that had accumulated around Kemaro Island, thereby reducing the slums of residential areas. The existence of water hyacinth composting activities can help residents save costs on planting media and fertilizer used for agriculture up to IDR 25,000,000.00.

IV. CONCLUSION

Water hyacinth (*Eichornia crassipes*) is a weed plant in aquatic areas that lives floating in deep water or develops roots in mud in shallow water. Water hyacinth has become one of the main problems in water resources management, because of its high regenerative power and is included in the list of the top ten plants that are harmful to the environment according to the IUCN version. However, behind the problems that can be caused by water hyacinth, water hyacinth can also be processed into organic fertilizer, which can be marketed and at the same time can reduce the water hyacinth population in the water.

The use of water hyacinth as organic fertilizer is carried out through water hyacinth composting activities in the Sehat Sejahtera Program (Sesera) run by Pupuk Sriwidjaja Palembang (Pusri) Ltd. on Kemaro Island. This program aims to empower the community and utilize the resources owned by Kemaro Island. Through the water hyacinth composting activity, the community was given training on the technical processing of water hyacinth into compost and provided materials in the form of decomposers. The compost produced from this activity is then used as fertilizer for hydroponic plants. The use of water hyacinth plants as organic fertilizer can reduce the amount of water hyacinth that accumulates around residential areas.

V. RECOMMENDATIONS

Based on the results and discussions, suggestions that can be given to increase the use of water hyacinth as organic fertilizer are to collaborate with government agencies to disseminate processed organic fertilizer from water hyacinth by mass marketing it on the market.

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