

# Water Hyacinth Management Due to Eutrophication in Water Bodies Around Pasir Panjang Village, Batam City

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## Abstract

Water is a human need to carry out activities ranging from daily essentials to agricultural needs and others. Domestic wastewater must meet physical, chemical, and biological requirements so that humans cannot be polluted by the water, especially the water around the Pasir Panjang Village area in Batam, Riau Islands. This study aims to determine the potential use of water hyacinth for environmental health. This research was conducted by direct observation and measurement of water quality by grab sampling. Observation results show that not all residents use septic tanks as wastewater treatment results from daily activities. Some residents drain their wastewater directly into water bodies or surrounding land, resulting in decreased environmental aesthetics. Water quality testing for nutrient parameters shows that the quality standards have been met. However, further measurements are needed for total nitrogen and phosphate. Besides that, it also causes a population explosion of water hyacinth. In addition to the ability to treat water hyacinth waste, its economic potential is also analyzed. The growth of water hyacinth is sufficient and fulfills its capacity, and water hyacinth can be used for various crafts that can improve the community's welfare.

**Keywords:** water bodies, eutrophication, water hyacinth

## 1. Introduction

Pasir Panjang Village is famous for its views and abundant marine products, but it is not utilized optimally due to the lack of adequate infrastructure in this village. Pasir Panjang village also has high tourism potential (1,2). The condition of the people of Pantai Pasir Panjang, the infrastructure is still said to be lacking to support the development of the potential that exists in the village.

Considering that the people of Pantai Pasir Panjang Village still use shallow and shallow wells, the contamination of water sources will have the potential to be even greater. Given the limited ability of environmental self-purification, the processing is needed. With wastewater treatment, it is possible to prevent the transmission of various diseases that endanger human health and decrease water quality (3,4) so that environmental stability can be carried out. One treatment that can be done is to use the integration of a septic tank and a constructed wetland (5–7). The basic principle of this constructed wetland ecosystem is the respiration process of water plants, which can suck oxygen from the air through leaves, stems, and roots and which are then released back into the area around the plant roots.

Environmental sanitation activities in the village are very necessary, the goal is that the village can become a healthy place for all living things in it (8–11). So, if the environment is healthy, it can affect the quality of life and the health status of the people who live there. Unhealthy home environmental conditions are a risk factor for various diseases, especially environmental-based diseases. Diarrhea is an environment-based disease that has 3 dominant factors. The main factor is clean water and the other factor is the disposal of feces and waste (12). The purpose of this study is to determine the sanitation management that directly impacts environmental health in Pasir Panjang Village and the efforts that can be made to minimize the environmental health impact.

## **2. Materials and Methods**

This study uses the method of observation. The observation method is a data collection technique carried out through observation, accompanied by notes on the state or behavior of the target object. Observation is a systematic observation and recording of the observed phenomena. The observation technique is the systematic observation and recording of the investigated phenomena. This research is limited to direct observations.

In addition to interviews, observation is also one of the most common data collection techniques in qualitative research methods. Observation is essentially an activity using the five senses, including sight, smell, and hearing, to obtain the information needed to answer research problems. The results of observations in the form of activities, events, events, objects, certain conditions or atmospheres, and one's emotional feelings. Observations are carried out to obtain an accurate picture of an event or events to answer research questions.

The sampling technique used is a purposive sampling technique, namely, the researcher can determine which samples will be used as respondents. The type of sample used in qualitative

research methods is a small sample, not representative, purposive, and can develop during the research process. This study uses grab sampling to test water quality (13) in water bodies that experience blooming.

### 3. Results

Water hyacinth (*Eichhornia crassipes*) in Pasir Panjang Village is commonly found in Pasir Panjang Reservoir (Figure 1). The growth of water hyacinth in the vicinity occurs very rapidly. The growth of water hyacinth is thought to occur due to the high value of phosphate in the reservoir. If left untreated, water hyacinth will increase, and bloom will occur. The blooms can affect people's livelihoods who use reservoirs for fishing activities.



**Figure 1.** Reservoir condition in near Pantai Pasir Panjang Village

Besides being used as a waste treatment when the growth of water hyacinth is sufficient, water hyacinth stems can be used for various crafts. Making handicrafts from water hyacinth takes a long process. The water hyacinth is first dried for about two weeks; after it dries, it is in the form of long braids. After forming a long braid, the water hyacinth is woven into the desired item. To further increase the attractiveness of buyers, the woven products are added with textile paint so that they appear shinier and more attractive. In addition, there is a pilot unit for domestic wastewater treatment using a constructed wetland. This is done to provide an example for other public service delivery units, considering that the target of Pasir Panjang Village is as a Tourism Village; as a result, pollution prevention efforts must be carried out early on. At the same time encourage economic growth and impact people's welfare.

Not all residents use septic tanks as wastewater treatment results from daily activities. Some residents drain their wastewater directly into water bodies or surrounding land, resulting in decreased environmental aesthetics. If this continues, it will result in pollution around the coast and decrease the residents' income, most of whom make a living as fishermen. If this happens continuously, estimates that there will be an increase in BOD, COD, N, P, and K levels around the coast, an increase in the number of coliform bacteria in wells and other residents' water sources, and the end, it can stimulate the growth of aquatic weeds.



**Figure 2.** Sanitation conditions and waste water disposal in Pasir Panjang Village

The purpose of aquatic ecosystem management based on Government Regulation No. 18 of 2001 is to protect the ability of aquatic ecosystems against the pressure of change or negative impacts caused by the activity to remain able to support functional integrity according to the carrying capacity of the ecosystem (14). Fund ecosystems naturally have the capacity (biocapacity) to absorb (bioassimilate) nutrients in certain concentrations to support the metabolic processes of their organisms. The nutrient quality standards according to PP No 82 of 2001 can already be used to assess the status of water quality which reflects the level of pollution of a water body. Still, the required nutrients are only dissolved nutrients, nutrients bound in particles (total nitrogen), and total phosphorus) has not been determined. The complete results of water quality measurements can be seen in Table 1.

Table 1. Results of Measurement of Water Samples at the Study Site

Parameters	Value	Standard Class II
DO (mg/L)	3.5	≥ 6
BOD (mg/L)	0.7	2
COD (mg/L)	6.7	7
NH <sub>3</sub> -N (mg/L)	0.35	0.5
NO <sub>3</sub> -N (mg/L)	0.64	10
NO <sub>2</sub> -N (mg/L)	0	0.06
PO <sub>4</sub> P (mg/L)	0.08	0.2

#### **4. Discussion**

Eutrophication is the process of enriching nutrients through a decomposition process that can trigger changes such as increased production of algae or other plants resulting in reduced dissolved oxygen in water bodies (15–19). Dissolved oxygen is oxygen used by living things in water, both animals and plants, to maintain their lives (20). Oxygen levels from these two processes resulted in an increase in dissolved oxygen content that was not too high. This is because when more nutrients enter the lake, the growth of algae and plants also increases.

Total P and Total N can determine eutrophication factors if the Total N concentration is more than eight times the Total P level (21). In comparison, Total N will limit the eutrophication process if the level is less than eight times the Total P level. The criteria for determining eutrophication nutrients (N and P) are the minimum and maximum ranges of nutrients that can determine the growth of algae following the range of tolerance required for the growth of algae and aquatic plants (21). For this reason, further research is needed to examine the total N and P at the study site.

Water hyacinth plants are weeds because they grow fast and can damage the surrounding plants (22). Water hyacinth plants also negatively impact water areas, causing water pollution. In addition, the dead water hyacinth plant waste will experience decomposition (23) it will also result in silting in the water area.

The use of water hyacinth in the study area must also be considered to maximize the circular economy (24). The concept of utilizing waste with zero waste needs to be looked at by maximizing the natural resources around it. Some of the studies conducted are as shown in Table 2. Craftsmen must descend and soak waist-deep on the muddy lakeshore in the hot sun, then gently pull out clumps of water hyacinth with bamboo sticks. The abundant availability of water hyacinth that can be taken at any time is a great potential in supporting the development of Gorontalo water hyacinth craft. The problem is even in supporting materials that are difficult to obtain, such as difficulty in getting leather, bag handles, and dyes. The availability of supporting materials is essential to be combined with basic ingredients to produce various products so that it is easier to get market appreciation. Therefore, to develop the art of water hyacinth crafts, it is necessary to diversify materials by combining basic ingredients and various supporting materials.

Table 2. Literature Study of Water Hyacinth Waste Utilization

Product	Process	Source
Woven Chair	Making water hyacinth chairs through several activities where each activity adds value, affecting the final product. It can be price, quality, motif, or design. The following is a picture of the core process of the Batik Painting Product Value Chain. The core process of the water hyacinth product value chain consists of several activities described in the image above. The activity was started by purchasing the main raw materials, namely dried water hyacinth stems, and supporting raw materials such as rattan, pandan fronds, dyes, and others. Purchasing of raw materials is done when the raw materials needed are almost exhausted.	(25)
Bag	Making bags made of water hyacinth using a compression machine is much more efficient than the conventional method. One of the measuring tools is seen from time efficiency. If the conventional way, making bags can take up to two weeks. So, by using this new machine, bag-making can be done more quickly, which takes no more than five days at most.	(26)
Craft Products	The equipment used by the craftsmen in their production consists of several types: 1) sickles to take raw materials; 2) a press (press) to flatten the stems of water hyacinth; 3) knife and scissors for cutting; and 3) a sewing machine for shaping and attaching supporting materials in the form of cloth or leather.	(27)
Handicraft	The implementation of the production process is carried out with the placement or division of tasks in each field. According to the ability and willingness of the workforce and adjusted to the activities that are needed in the production process.	(28)

To complete the main activity, namely to grow new entrepreneurs in water hyacinth crafts, in achieving the goals, planning and management in a controlled manner are still needed concerning the availability of time. Therefore, the sustainability of the main activity is to make a plan based on the discovery of problems during the current implementation that can be used to achieve the next activity. For example, the issue of managing water hyacinth leaves into a commercially diversified product.

## 5. Conclusions

Water quality in this study for nutrient parameters shows that the quality standards have been met. Further measurements are needed for total nitrogen and phosphate. Nutrients can cause a population explosion of water hyacinth. In addition to the ability to treat water hyacinth waste, its economic potential is also analyzed. The growth of water hyacinth is sufficient and fulfills its capacity. Water hyacinth can be used for various crafts to improve the community's welfare.

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