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IMPLEMENTATION OF FISH POND PEAT WATER TREATMENT WITH SOLAR POWER BASED FILTRATION AND ABSORPTION METHOD IN IRRIGATION CANAL OF SUNGAI BATANG VILLAGE, SOUTH KALIMANTAN

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ABSTRACT
In the realm of fisheries, particularly in the cultivation of fish in peat ponds, well water or irrigation is the primary water source. However, due to its peat composition, the water used exhibits turbidity and a high density of particles. Consequently, the quality of this water for fish cultivation remains a subject of debate. Within peatlands, the quality of pond water significantly impacts fish growth. Filtration and absorption technology has been selected, as it presents various advantages and disadvantages when compared to current conventional methods. The filtration and absorption media used consist of 15% silica, 15% active sand, 20% active carbon, 25% zeolite, and 25% corosex pH adjuster. Other issues, electricity-related challenges frequently arise in fish farming. The adoption of renewable energy in the form of solar power has been proposed to generate electrical energy. This application utilizes solar power-based filtration and absorption water processing technology, with a series of test variables to ascertain the impact on pond water quality. This is accomplished by comparing the filtration and absorption settings to untreated pond water and pond water treated with water hyacinth. The results of this application include the production of 100% alternative electric power, reduction of TDS levels by up to 29%, the elevation of PH levels by up to 2.81%, and decrease of NH3 levels by up to 16.33% when compared to untreated peat water fish ponds and peat water fish ponds utilizing the traditional mechanism of water hyacinth.

KEY WORDS
Filtration, absorption, solar power, peat water.

Geographically, Sungai Batang village West Martapura irrigation flow is in a peat area. Many fish pond farmers use non-productive peat land, one of which is fish farmers with integrated fish farming with irrigation flow. In the process of cultivating fish in this area, the general mechanism is still used, namely by making peat water ponds which are peat land, and feeding the fish. The process requires consideration of several things, including the quality and condition of the water, turbidity, ammonia (NH_3), pH (degree acidity), and oxygen levels in the fish pond water. Increasing the growth of quality fish also requires special attention during the fish farming process.

One of the pressing challenges confronting peat areas pertains to the decline in water quality, which carries implications not only for the vitality of these delicate ecosystems but also for the well-being of neighboring communities that depend on them as a source of potable water (Youcai, 2018). Alterations in precipitation patterns and extensive deforestation possess the potential to engender a reduction in natural water resources, encompassing rivers and wells, which serve as the primary repositories of untainted water for communities (Fezzi et al., 2017). The phenomenon of climate change is currently instigating augmented temperatures and capricious rainfall patterns in South Kalimantan (Sukmara et al., 2022).

Figure 1 – Sungai Batang village location

This occurrence can culminate in ramifications for the hydrological cycle, resulting in an extended and severe dry season (Tolosa & Tolossa, 2021). The sources of these predicaments encompass organic waste stemming from household activities, such as food and beverage waste, detergent (soap), fertilizer applications in agricultural endeavors, livestock waste, fish food waste, human waste, mammal animal waste, other livestock waste, the remains of living organisms such as deceased avian creatures, as well as bacteria originating from household waste. Besides this, the status of the irrigation water occasionally assumes a murky and brownish complexion due to the overflow of rainwater. These turbid conditions can also present difficulties for fish farmers in the management of their fish ponds.

Figure 2 – Fish pond with irrigation peat water in Sungai Batang village

The growth of fish in peatlands is significantly influenced by the pH of the pond water. When the pH is low, there is a decrease in the content of dissolved oxygen, which in turn leads to a decrease in oxygen consumption. Consequently, there is an increase in fish respiratory activity and a decrease in their appetite (Rochyani, 2018). Studies have shown that the optimal pH for catfish growth ranges from 6.5 to 9.0 (Andriyanto et al., 2012).

Furthermore, research indicates that freshwater fish have a critical pH point of 4.0 for acidity and a critical pH point of 11.0 for alkalinity (Syahrizal et al., 2016). For catfish, the dissolved oxygen level that promotes growth is between 7.0 and 8.4 ppm, although a content of 5 ppm is still sufficient for fish survival. This condition is concerning as it may negatively impact fish growth, quality, and production quantity. Growth is a crucial parameter in fish farming, particularly for economically valuable fish, as it determines the production value. Growth can be defined as an increase in length or weight over a specific period of time (Hidayati et al., 2021).

After analyzing the challenges faced by our partners, several solutions can be proposed to address water quality issues. Water plays a vital role in the fish farming process; however, the presence of peat water in the West Batang Martapura River irrigation area can affect the well-being of fish in ponds. Additionally, the availability of electricity is a significant factor that impacts the operational costs of fish management. Alternative sources of electricity are required to facilitate this process. Implementation of solar-powered filtration systems for peat water in fish ponds, this method has the potential to affect the turbidity, ammonia levels, and pH of the water. This is due to the inclusion of physical and chemical factors such as turbidity, ammonia (NH3), pH (acidity level), and the concentration of ions and organic and inorganic solids. Maintaining water quality in aquaculture is of utmost importance to ensure proper water exchange and replacement mechanisms.

MATERIALS AND METHODS OF RESEARCH

The procedure commenced with preliminary observations in the flow of irrigation in sluice gate 3 of the Batang River. Through an understanding of the state of fisheries based on the presence of irrigation water that settles in ponds, it has been identified that issues exist concerning the condition of peat water. The evaluation of water quality roles as an appraisal of the state of water regarding its physical, chemical, and biological properties. Peat water, which is recognized by its brown hue, acidity, and high nutrient content, exhibits a pH value of 5.2 primarily due to the significant presence of humic acid (Notodarmojo et al., 2017). The proportion of organic matter in peat soil ranges from 70% to 97% (Raghunandan & Sriraam, 2017). The concentration of natural organic matter encountered in peat water relies on the prevailing soil and climate conditions. The reddish-brown color of peat water is an inherent characteristic consisting of colloidal particles with positive charges that cannot be settled by means of gravity; therefore, special treatment is necessitated (Yallop & Clutterbuck, 2009).

The evaluation of water quality often functions as a standard indicator of the state of well-being of aquatic ecosystems. The surrounding environment impacts the feed input in the pond. Insufficient levels of oxygen in the pond can effecting the fish, leading to stress, illness, and ultimately death. The degradation of water quality is primarily caused by the excessive quantity of ammonia and inadequate levels of dissolved oxygen in the pond. Thus, a mechanism is required to ensure the maintenance of satisfactory water quality, namely, peat water filtration.

Several methods are used to purify water, including precipitation, complexation, electrochemical, membrane filtration, ion exchange and reduction.cThe choice of method is contingent upon the source water and the water standards employed. Filtration based on membranes is advantageous in terms of separation and has the capability to meet diverse water quality standards (Zheng et al., 2015). Pre-treatment plays a crucial role in the regulation of membrane fouling caused by waste organic materials. The elimination of suspended particles, colloids, and microbiological contaminants can be efficiently achieved through UF/MF filtration (Vedavyasan, 2007). Adsorption is an insignificant technique that cannot be utilized for the removal of dissolved nonpolar organic compounds found in waste organic materials, emerging pollutants like endocrine-disrupting compounds, as well as natural organic materials. Adsorption is a highly effective technique for extracting various types of contaminants that are soluble in water. It is an established process for the removal of dissolved organic matter from water due to its strong attraction for eliminating hydrophobic organic compounds even at low concentrations. Numerous researchers have demonstrated that activated carbon is an effective adsorbent for the treatment of water with high concentrations of organic compounds (Syafalni et al., 2012).

Figure 3 – One of the media materials for processing peat water

This implementation utilizes suitable technology through the integration of various water treatment methods involving modified filtration and absorption techniques. The filtration and absorption media are arranged within FRP tubes (Fiber Reinforced Polymer) 1045, which have a diameter of 10 inches and a height of 150 cm. These tubes are equipped with a backwash system. The filtration process employs silica sand and a filter membrane based on polyethylene, whereas absorption is achieved through active sand, activated carbon, zeolite, and a pH adjuster. The composition of the filtration tube, expressed as a percentage of the tube size, consists of 15% silica, 15% active sand, 20% activated carbon, 25% zeolite, and 25% corosex pH adjuster. Each layer of media is sealed using a polyethylene filtration membrane to prevent mixing and to ensure effective filtering during each filtration process.

The peat water processing procedure necessitates the use of electrical power. To regulate the power source, a power controller is employed, which is powered by solar panels. This ensures a more stable amperage for charging the battery (Nugrahadi & Triyasmono, 2019). Consequently, the installation of solar panels can reduce the need for fish management operations (Nugrahadi et al., 2021). Solar panels seize sunlight and change it into electrical power, which is then stored in batteries. Therefore, this water treatment system is equipped with a 12 V deep cycle 100 AH battery.

Figure 4 – Results of equipment installation

Figure 5 – Fish Pond with water hyacinth and Fish Pond without filtration and absorption

A process for determining pond water quality with a filtration and absorption setup. Water treatment results are compared with pond water without filtration and absorption and with pond water treated with water hyacinth, a traditional mechanism in swampy environments. South Kalimantan.

RESULTS AND DISCUSSION

The results of peat water purification of fish ponds with solar energy based filtration and absorption methods in the fish ponds of the Irrigation System in Sungai Batang Village, West Martapura, South Kalimantan led to changes in pond water treatment. The quality of peat water has changed in the fish ponds of fish farmers in irrigation canal Sungai Batang Village, West Martapura in South Kalimantan. This water treatment is automatic with a timer and uses solar energy for electricity consumption, so it can reduce the electricity costs of fish farmers. Using the solar filtration and absorption method, the fish pond peat water treatment plant consists of several devices, which are FRP pipes with backwash mechanism, solar panels, power regulators, pumps and batteries. To find out the changes in the water, the results of peat water purification were tested in the laboratory. The parameters taken in the test are TDS (Total Dissolved Solid), pH (acidity) and NH3 (ammonium).

Table 1 – Comparison of results of water quality parameters

Source	TDS (ppm)	Ph	NH_3 (mg/L)
Fish pond with water hyacinth	91,3	6,92	0,4704
Fish pond without filtration and absorption	95,9	7,05	0,5488
Fish pond without filtration and absorption	68,2	7,12	0,4592

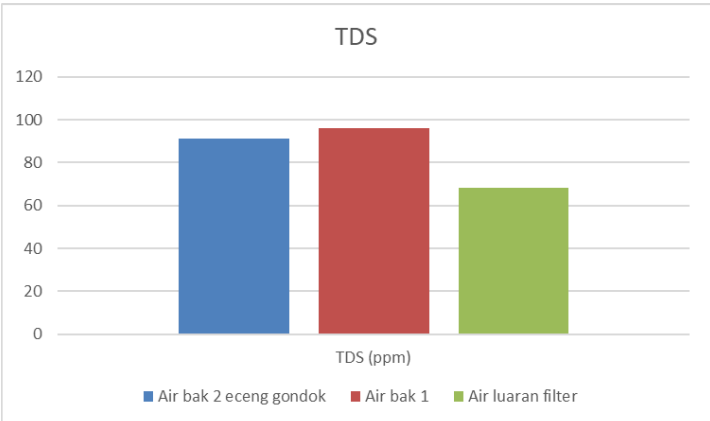

Figure 6 – Comparison of TDS parameters

Based on this table, the results of water purification were compared from untreated water, water after treatment and water naturally treated with water hyacinth.

In Figure 6, the TDS parameter test results show that the filter output results are lower than other pool water conditions. This is shown by a reduction of TDS of 25% in water hyacinth ponds and 29% in ponds without a filter.

In Figure 7, the pH parameter test results show that the filter output results are higher when using pH regulators than in other pool water conditions. This showed a pH increase of 2.81% in water hyacinth ponds and 0.98% in non-filtered ponds.

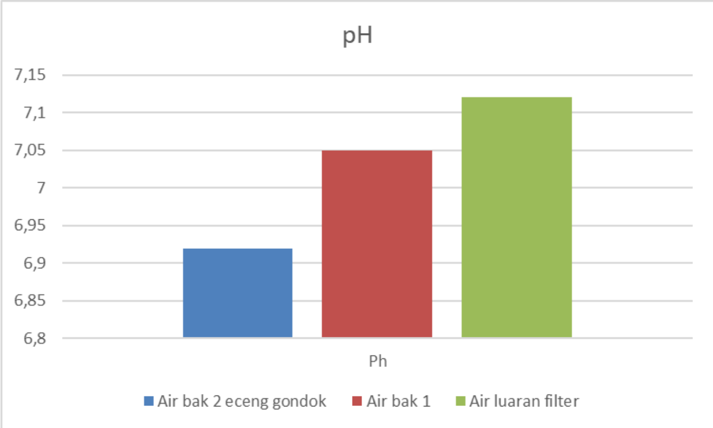

Figure 7 – Comparison of pH parameters

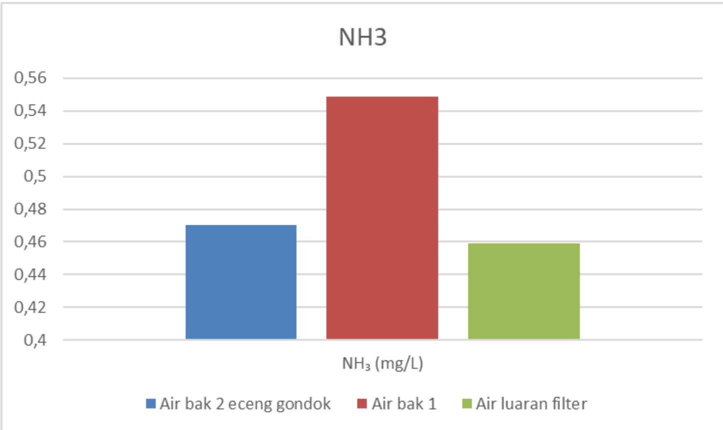

Figure 8 – Comparison of NH3 parameters

In Figure 8, the NH3 parameter test results show that the filter output results are lower than other pool water conditions. This results in an NH3 reduction of 2.38% in water hyacinth ponds and 16.33% in ponds without a filter. The results of the analysis were obtained from the changes in the water quality of the ponds due to the application of filtration and absorbent peat water treatment. Therefore, a medium with a combination of filtration and absorption can be used and gives better results than others, especially for TDS, pH and NH3 parameters.

CONCLUSION

Treatment of peat water from fishponds with solar-based filtration and absorption methods in the West Batang Martapura River Irrigation System in South Kalimantan fishponds led to changes in pond water treatment. This implementation provides a 100% alternative to electricity, except that it was able to reduce TDS levels up to 29%, increase pH levels up to 2.81% and reduce NH3 levels up to 16.33% compared to untreated peat. water from fish ponds and peat water from fish ponds using water hyacinth, which is a traditional mechanism.

The proposition involves the perpetuation of this endeavor by enacting a mechanized procedure founded on contemporary technology to augment the caliber of aquatic facilities by means of the Internet of Things innovation. This subsequently heightens the degree of mechanization in pisciculture for pisciculturists.

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