

APPROPRIATE TECHNOLOGY IN THE TREATMENT OF CLEAN WATER ON ISLAMIC BOARDING SCHOOLS IN SUNGAI ITIK VILLAGE

Dian Rahayu Jati^{1*}, Azwa Nirmala², Syaifurrahman³, Muhammad Saleh³, Ade Elbani³

¹)Department of Environmental Engineering, Tanjungpura University, Indonesia

²)Department of Civil Engineering, Tanjungpura University, Indonesia

³)Department of Electrical Engineering, Tanjungpura University, Indonesia

Abstract

Sungai Itik Village is located in Sungai Kakap District, Kubu Raya Regency, directly visiting Pontianak City. However, the people in Itik Village have not yet enjoyed clean water from the local water company. So that the surrounding community uses clean water sourced from rainwater or drilled wells. However, the condition of the well water is not yet suitable for use. At the As-Siddiqiyah Islamic Boarding School, it has drilled wells with a flow rate of 30 liters/minute and does not need to be sucked up with a water pump in flat, level conditions. However, the condition of the water still contains a lot of Fe^{2+} ions, has a metallic smell and color. This drilled well water is very possible as raw water to be processed and used as drinking water that can be consumed by the community around the Islamic boarding school. The Student Creativity Program Team of the Faculty of Engineering provides air purification solutions with the Aeration, Sedimentation and Filtration methods contributing to the local community, especially for students at Islamic Boarding Schools. The results of laboratory tests on drilled well water at the As-Siddiqiyah Islamic Boarding School show that raw water that has been treated through water treatment equipment is suitable for daily activities and does not cause health problems. The provision and management of clean water is left entirely to the students in Islamic boarding schools to maintain the continuity and maintenance of the availability of clean water.

Keywords: *aeration, appropriate technology, filtration, sedimentation, Sungai Itik Village*

Introduction

Kubu Raya Regency is one of the regencies directly adjacent to Pontianak City. Kubu Raya Regency has an area of 6,985.24 km² with a population of 609,392 people (Statistics Center Berau, 2020), which has 9 sub-districts, including the Sungai Kakap sub-district which is directly adjacent to Pontianak City. Sungai Kakap sub-district has 13 villages. Among these villages, including Sungai Itik Village, with an

area of 15 km², a population of 5,277 people, mostly Muslims, and there are 3 Islamic boarding schools inhabited by hundreds of students.

Sungai Itik Village is administratively located far from the capital city of Kubu Raya Regency, but adjacent to or directly adjacent to Pontianak City. However, people in the Sungai Itik Village area have difficulty getting clean water for their daily needs. The use of raw water in Sungai Itik Village comes from river water and bore well water. However, the use of raw water in this village is constrained because river water is often exposed to seawater intrusion. This is because the condition of river water is influenced by tidal activity in the estuary in Sungai Kakap District.

^{*})Corresponding Author:
E-mail: dianjati@teknik.untan.ac.id

Most people in Sungai Itik use clean water to drink from rainwater, while for bathing and washing they rely on river water or bore well water. When the dry season arrives, problems will arise, the surrounding community will find it difficult to get clean water for their daily water needs. The condition of drilled well water and river water used is very high in iron ion content (Fe^{2+}), so that when this water is used for bathing or washing purposes, it smells and turns yellowish. The iron content in water tends to cause nausea if consumed and in large doses iron can damage the walls of the small intestine. Iron content that exceeds 1 mg/l will cause irritation to the eyes and skin (Wiyata, 2003).

Currently in Sungai Itik Village there are 2 (two) Islamic Boarding Schools, namely the As-Shiddiqiyah Islamic Boarding School, and the Al Bahja IV Da'wah Educational Institute, (Buya Yahya, Cirebon). As-Shiddiqiyah Islamic Boarding School has a water source from bore wells which is quite heavy with a water flow rate of ± 40 liters/minute, and does not have to be sucked in with a water pump. The resulting discharge has the potential to be used as a source of fresh water as raw material for processing. The fresh water source from the drilling will be utilized and processed with appropriate technology. After being processed and processed, the borehole water will become clear, odorless, tasteless fresh water so that it can be drunk for the needs of students and the surrounding community.

Appropriate technology of sanitation facilities for the Islamic boarding school is important to be able to provide a larger clean water production capacity (Rusmaya et al., 2019), (Hasbiah et al., 2019). Thus it can help meet the needs of the community around the Islamic boarding school. In addition, making Sungai Itik Village a village that is independent of clean water.

Methodology

Planning, Coordination and Initial Information to Local Assisted People

The Student Creativity Program Team from the Faculty of Engineering, Untan, conducted an initial survey, informing local residents through the Islamic boarding school that in Sungai Itik Village they would receive assistance for the development of a clean water treatment and management pilot. Furthermore, coordinating with elements of the District Muspika, village officials and elements of the community, that in the Sungai Itik area, the Student Creativity Program Team activities will be carried out with a focus on implementing activities on the process of procurement and independent clean water management which will be handed over to Islamic boarding schools as managers.

Determination of the Location of the Activity Center

The Student Creativity Program Team of the Faculty of Engineering as the Facilitator, determines the location center for the Village Development Program activities in Sungai Itik. It is clear that the determination of the location of the activity is related to the location of the wellbore springs. Sungai Itik Village generally uses bore well springs as a source of water. One of these springs is located in the As-Siddiqiyah Islamic Boarding School.

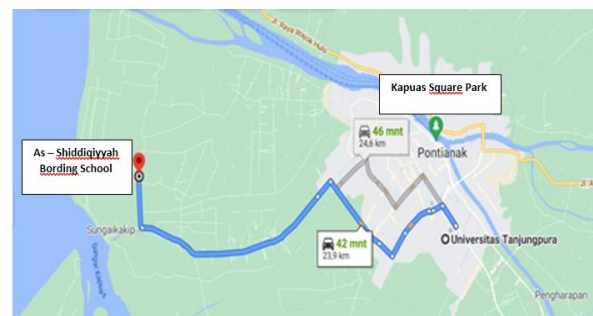


Figure 1. Location of the Student Creativity Program Team Bina Desa Activities, Faculty of Engineering, University of Tanjungpura

Planning and Selection of Raw Material Water Purification Method

Sampling of raw material water at Pondok Pesantren in Sungai Itik is 1 liter and then checked at the Laboratory of the Faculty of Engineering. The results show that the raw material water from the drilled well contains high and yellowish Fe^{2+} , Manganese (Mn) ions, and a small amount of Al (Aluminum), besides that the level of TDS (dissolved solids) is still quite high. Dissolved solids in water usually consist of organic compounds and inorganic compounds that are soluble in water, minerals, and their salts (Munfiah et al., 2014). Water with high TDS levels can leave stains and scale on household appliances and produce water with an unpleasant taste (Sasongko, et.al, 2014).

Furthermore, to solve the problem of providing and managing clean water independently based on Islamic boarding schools in Sungai Itik Village using the Aeration, Sedimentation and Filtration methods. Aeration is one of the efforts made to increase the concentration of oxygen contained in the water so that the oxidation process to change the form of cations goes well (<http://aimyaya.com>, accessed June 2021).



Figure 2. Conditions for the installation of boreholes used by students in Islamic boarding schools

Aeration is also used to remove dissolved gases. Oxidation of iron content in water reduces ammonia content in water through the nitrification process and to increase dissolved oxygen content so that the water feels fresher (Maxell, 2013).

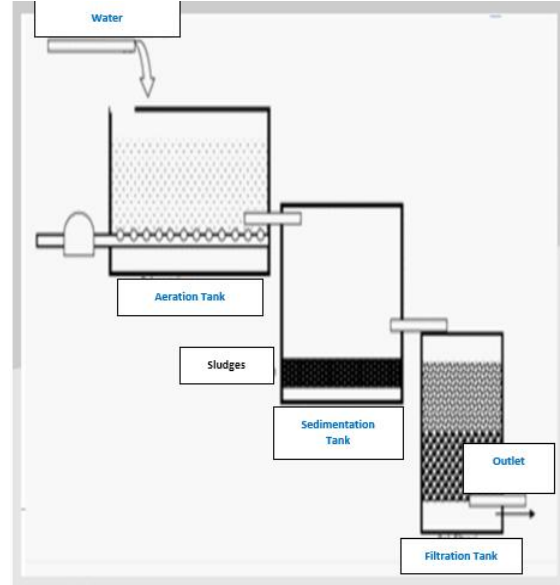


Figure 3. The basic method of the Aeration-Sedimentation-Filtration process

At the time of implementation later, the implementation of Aeration is carried out by spreading water with air or scattering water into the air so that Fe^{2+} bonds with O_2 in the form of air bubbles, oxidation occurs, becoming $\text{Fe}(\text{OH})_3$ which is insoluble in water. Furthermore, the sedimentation process and filtration process are carried out. Filtration process in principle reduces organic and inorganic materials in the water (Reynolds & Richard, 1996). The media used as filtration in this the Student Creativity Program Team activity were shells and sand. This material is considered to have good filtering properties and a more durable filter.

Well water treatment with a combination of aeration, filtration or sedimentation has the potential for significant reduction (Readyningsih, 2000). According to (Sanropie, 1984) the optimal detention time for the sedimentation of aerated water is usually taken 3 hours (2-6 hours) which allows the deposition of Fe (iron) content resulting from aeration is sufficiently dissolved for 1-2 hours. In order to get the right results, further research was conducted on the detention time for the optimal

sedimentation of iron content in drilled well water according to the water source.

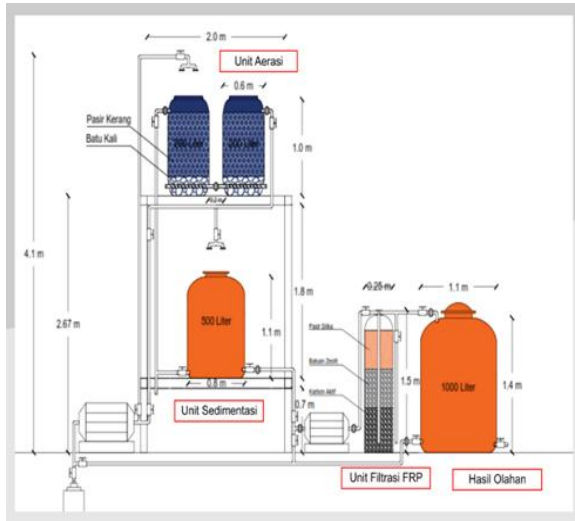


Figure 4. Physical appearance of water supply and management with raw material water from borehole water using the Aeration – Sedimentation – Filtration method

Planning and Preparation of Necessary Equipment and Materials

If the method has been determined, it can be planned and assembling the tools and materials needed for the implementation of the work activities. This is stated in the Budget Plan for the Village Development Program through the activities of Procurement and Management of Independent Clean Water based on Islamic Boarding Schools.

Activity Implementation

The core of the THE STUDENT CREATIVITY PROGRAM TEAM activities of the Faculty of Engineering is through the activities of Procurement and Management of Clean Water based on Islamic Boarding Schools, with the following stages:

- a. Educate students at Islamic Boarding Schools through training programs on water purification with the methods of Aeration, sedimentation and filtration with raw material water sources from bore well water at the boarding school location. As well as

introducing the filtration model as well as the tools and materials used to make the filtration.

- b. Practicing and inviting students to assemble filtration equipment (assistance)
- c. Build an independent clean water supply and management system with the students.
- d. System engineering trial
- e. Evaluation and improvement, system refinement
- f. Test the quality/quality of water produced in the laboratory
- g. System improvement on the filtration and sedimentation side (if still needed)
- h. Teaching the repair system to the students
- i. Submission of an independent clean water supply and management system to students and the community.

Result and Discussion

The results obtained from this activity are the achievement of the stages of implementing the activities properly, starting from the planning stage, socialization, making water treatment installations and operating and maintaining equipment. This is due to good and smooth coordination with the As - Shiddiqiyah Islamic boarding school, Sungai Itik Village, Sungai Kakap District, making it easier to carry out activities. The construction of water treatment installations using the Aeration – Sedimentation – Filtration method is carried out in stages starting from the activities of transporting tools and materials, making foundations, assembling tools and piping, and operating tools.

Transportation of tools and materials to Pondok Pesantren uses pick ups, because access to Pondok Pesantren As – Shiddiqiyah takes \pm 30 minutes. The next stage is making a sedimentation aeration-filtration unit foundation made of ironwood, filling shellfish sand into the aeration filtration tank, installing electricity and pumps, installing FRP filter tubes, assembling tools and piping, and making the identity of a

clean water treatment plant. Clean water treatment equipment can be seen in Figure 5.



Figure 5. Clean Water Treatment Equipment Pondok Pesantren As – Shiddiqiyah

Figure 5 is equipped with a backwash system that aims to wash the unit periodically. The backwash process is the process of washing the filter media without having to remove the filter media from the filter tube (Pratama et al., 2017). To ensure that the water treatment equipment that has been built can function properly, a sample of raw water source water is taken and compared with the processed water that has passed through the treatment equipment.



Figure 6. Water Quality Before and After Treatment at Pondok Pesantren As – Shiddiqiyah

Figure 6 shows the results of the comparison between water quality before and after treatment at Pondok Pesantren As – Shiddiqiyah. Physically, the quality of the water after going through the processing becomes clean, this shows that the water treatment equipment that has been built can function properly and is

suitable for use at the As - Shiddiqiyah Islamic Boarding School. The results of water treatment and raw water are put into a sample bottle with a size of 1,500 mL with a tight seal to avoid air contact for testing the quality of dug well water. Testing of dug well water after processing is brought to the laboratory for parameter testing.

Based on the results of laboratory tests, there is a comparison before and after processing, there is a decrease in parameters, namely the iron (Fe) parameter has decreased by 97.33%, Total Dissolved Solid (TDS) has decreased by 78.89%, Organic Substance has decreased by 99%, pH of 7.08, and there is no *E. coli* content that can harm the body, such as causing diarrhea, stomach cramps, and vomiting. There are several parameters that are still above the standard and need further processing which can reduce the parameters that still exceed the quality standard.

The water treatment plant that has been built is then handed over to the As-Shiddiqiyah Islamic Boarding School. Documentation can be seen in Figure 7.



Figure 7. Delivery of Water Treatment Equipment at Pondok Pesantren As – Shiddiqiyah

In addition to socialization and delivery, this activity was also continued with the submission of SOP (Operational and Maintenance Standards) for clean water treatment equipment. The Head of the As-Shiddiqiyah Islamic Boarding School has received the SOP for clean water treatment equipment. This SOP serves as a

guide in the operation and maintenance of equipment, as well as assists in overcoming problems that occur in water treatment equipment. For administrative completeness and proof of delivery of clean water treatment equipment, an official report and handover of equipment was signed by the Head of the As-Shiddiqiyah Islamic Boarding School.

Conclusion

Based on the results of clean water treatment activities at the As - Shiddiqiyah Islamic Boarding School, it can be concluded that the available water is sufficient for daily activities and does not cause health problems. The application of appropriate technology for water treatment is suitable for As-Shiddiqiyah Islamic boarding schools. As-Shiddiqiyah boarding school has acquired knowledge and skills about clean water treatment and has operational and maintenance guidelines for water treatment plants.

Acknowledgment

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