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Peatland Water Processing at State Islamic Senior High School (MAN) 1 Kubu Raya: An Exploration

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Abstrak

Madrasah Aliyah Negeri (MAN) 1 Kubu Raya merupakan salah satu fasilitas pendidikan yang berada di Kecamatan Rasau Jaya, Kabupaten Kubu Raya. Jenis tanah di Kecamatan Rasau Jaya merupakan tanah gambut sehingga kualitas air yang ada di lokasi sekitar juga dipengaruhi oleh jenis tanah tersebut. Kualitas air gambut secara fisik berwarna coklat dan memiliki endapan. Jika menggunakan air gambut untuk keperluan mandi, cuci, dan kakus (MCK) memberikan dampak berupa adanya warna kecoklatan pada peralatan dapur dan peralatan makan serta pada bak kamar mandi. Kecamatan Rasau Jaya juga belum mendapatkan aliran air dari Perusahaan Umum Daerah Air Minum sehingga masyarakat menggunakan air gambut untuk keperluan MCK, dan air hujan untuk keperluan minum. Berdasarkan hasil penelitian menunjukkan bahwa kualitas air gambut melewati baku mutu yang dipersyaratkan, sehingga harus diolah terlebih dahulu sebelum digunakan. Kegiatan Pengabdian kepada Masyarakat dilakukan di MAN 1 Kubu Raya dengan tujuan untuk mengedukasi siswa dalam mengolah air gambut. Kegiatan yang dilakukan adalah sosialisasi dan simulasi pengolahan air gambut dengan beberapa metode pengolahan sederhana seperti koagulasi dan filtrasi. Dengan adanya pengolahan sederhana ini diharapkan siswa dapat menerapkan pengolahan air gambut di lingkungan sekolah dan di rumah masing – masing.

***Kata kunci**: Air Gambut; Filtrasi; Koagulasi*

Abstract

Madrasah Aliyah Negeri (MAN) 1 Kubu Raya is an education facility in Rasau Jaya District, Kubu Raya Regency. The soil type is peat soil, so the kind of soil also influences the quality of water in the surrounding area. The physical quality of peat water is brown and has sediment. Using peat water for bathing, washing, and toileting purposes will result in a brownish color of the kitchen eating utensils and the bathroom tub. Rasau Jaya District has no water supply from the Regional Public Drinking Water Company, so people use peat water for toilets and rainwater for drinking. The research shows that peat water quality exceeds the required standards, so it must be processed before use. Community Service Activities were conducted at MAN 1 Kubu Raya to educate students in processing peat water. The activities carried out were socialization and simulation of peat water processing with simple processing methods such as coagulation and filtration. Students are expected to apply peat water treatment in school and at home with this simple treatment.

***Keywords:** Coagulation; Filtration; Peat Water*

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INTRODUCTION

Madrasah Aliyah Negeri (MAN) 1 Kubu Raya is the only Madrasah Aliyah Negeri in Kubu Raya Regency. MAN 1 Kubu Raya is under the authority of the Ministry of Religious Affairs with accreditation (Direktorat Kurikulum, 2023). The background of this school was previously a Private Madrasah Aliyah Yayaysan Pendidikan Al-Muhajirin Rasau Jaya, which was founded on 17 March 1987. MAN 1 Kubu Raya is located on Jalan Sultan Agung, Rasau Jaya, Kubu Raya Regency. The school location is very strategic because it is right on the edge of the highway and the main road of Rasau Jaya.

This school has two floors, with 398 students consisting of 164 male and 234 female students. The number of teachers and administrators is around 40 people. Rasau Jaya is one of the sub-districts without proper access to clean water. To meet the need for clean water, especially for bathing and washing and serving as a lavatory (toilet) activity, MAN 1 Kubu Raya uses river water right behind the school. Because the type of soil in Rasau Jaya District is peat soil, the water is also influenced by peat soil, and the community usually calls it peat water. The water is sucked up using a pump and collected in a catch basin, then flowed into the tub in the bathroom.

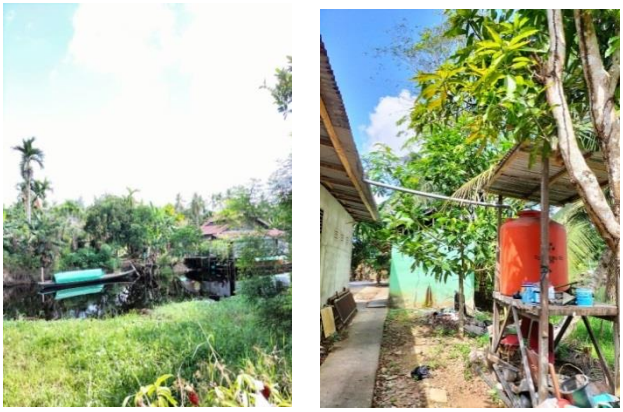

Figure 1. Source of raw water

Another source of raw water used at MAN 1 Kubu Raya is rainwater. Based on Figure 1, rainwater is collected from the roof and flows through a pipe to a reservoir made of polyethylene plastic. The quality of rainwater is quite good, but the quantity depends on how large and the number of water reservoirs to collect the rainwater.

Clean water is a basic need for every human being. Based on the Sustainable Development Goal of clean water and sanitation, the target by 2030 is for 100% of people to have safe and proper clean water (United Nations Development Programme (UNDP), 2015). Some people believe that peat water is not contaminated water. This statement is not entirely true because peat water is natural water that flows through peat soil types, so the substances contained in peat water become colored and have a lot of organic substances. Still, compared to the required quality standards, peat water is unsuitable for direct use because it will impact health and environmental sanitation (Said et al., 2019).

Peat water has brownish-yellow characteristics, has a low pH so that it is acidic, contains high organic substances (Fitria et al., 2020), has a brownish color, is acidic, has a high content of Total Suspended Solid (TSS), Total Dissolve Solid (TDS), Electrical Conductivity (EC), Biological Oxygen Demand (BOD) and Chemical Oxygen Demand (COD) (Nusantara et al., 2019). Compared to the quality standards in the Regulation of the Minister of Health of the Republic of Indonesia, Number 66 of 2023 on the Regulation for the Implementation of Government Regulations, and Number 66 of 2014 concerning Environmental Health, the water

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does not meet the required quality standards. Hence, it must be treated first (Peraturan Pelaksanaan Peraturan Pemerintah Tentang Kesehatan Lingkungan, 2014).

Untreated peat water will impact aesthetics, as the catch basin walls become yellow-brown and cutlery washed using peat water (Y. M. Said et al., 2019). Peat water may also contain heavy metals, which can cause poisoning, allergies, vomiting, dizziness, cancer, and even death. The low pH of the water also causes tooth decay and abdominal pain (Roslinda & Hardiansyah, 2019).

Based on research by Syamsiah Nur et al. (2022), it is stated that untreated peat water can be permissible, makruh or *haraam* to be used for ablution. The law is acceptable if peat water with a pH and organic substances can still be considered normal, but *makruh* is used in the long term as a form of caution. If the water has been processed into clean water, it is permissible to use it for ablution because it has changed in taste, color, and smell, considering the increasing need for clean water. However, this legal decision has not evaluated the adaptability that the surrounding community may own.

MAN 1 Kubu Raya has clean water sanitation facilities in raw water reservoirs from the river and rainwater reservoirs. The raw water reservoir from the river is a pond with wooden walls, while the rainwater reservoir is made of polyethylene plastic, commonly available in the market. MAN 1 Kubu Raya has three male toilets, four female toilets, and one toilet specifically for teachers. Each toilet has a water reservoir; some are still in a basin, but some are permanent and have ceramic porcelain. The existing condition of clean water facilities and infrastructure at MAN 1 Kubu Raya is shown in Figure 2.

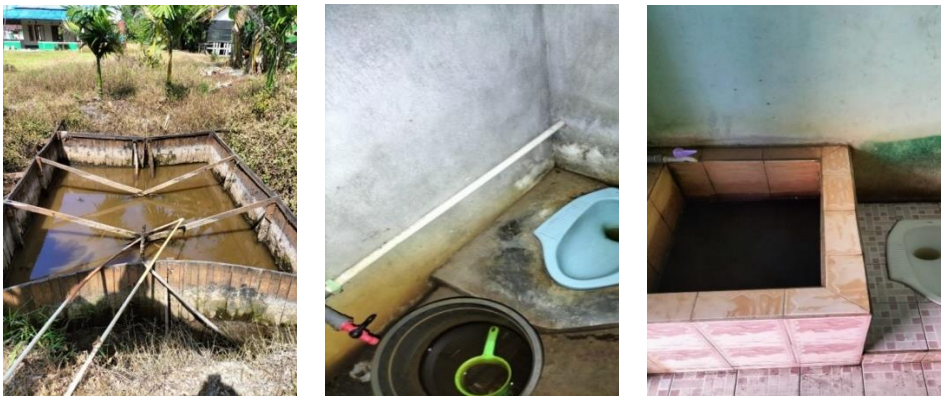

Figure 2. Existing condition of clean water facilities

In Figure 2, it can be physically seen that the water used has a brownish yellow to educate color. This condition shows that at the MAN 1 Kubu Raya school location, there is no treatment for the raw water source used, which is peat water. This community service activity was carried out at MAN 1 Rasau Jaya to educate the younger generation so that they can add insight into knowledge that can be applied in the school environment and at home because it uses simple, cheap, and readily available tools and materials.

The implementation of this community service will use three different materials or processing media, namely alum, shell sand, and activated carbon. The media commonly used in peat water treatment are activated carbon, zeolite, manganese, resin, and quartz sand. Clamshells and moringa seeds can also be used but must be processed first. Other media that can be used to treat water are alum (Said, 2010), carbon (Nurdin et al., 2022), PAC (Pinem et al., 2020), and shell sand (Suhendra & Perdana, 2019).

The processes that occur in these media are also different. The process that occurs when water is treated using alum is called coagulation, where alum is a coagulant material that can agglomerate organic particles to form flocs, which will later settle (Gebbie, 2005). Another water treatment process often used is filtration; one filter media used is shell sand. Sand shells are quickly and widely found on the beach; the water treatment process with sand shells uses the principle of filtering, where larger particles will be retained, while those whose particle size is smaller than the size of the gap between the media will pass the filter (Musa et al., 2016). The last treatment process that will be carried out is using activated carbon. Activated carbon is one of the adsorbent media, where the processing process is called adsorption (Harimisa et al., 2021). The adsorption process absorbs a substance on the surface of the adsorbent media. Activated carbon adsorbents are also often used in water treatment because they are cheaper and more effective than other adsorbent media (Steinhaus et al., 2022). The purpose of using these materials is to see the removal ability of each process or material and find out what media is most effective in reducing excess parameters contained in peat water. This simulation taught students that peat water can be treated in various ways or processes.

METHODS

The materials used in peat water treatment are alum, Poly Aluminum Chloride (PAC), lime, clamp shell, and activated carbon. Community services activities carried out at MAN 1 Kubu Raya consist of 4 (four) stages, including the preparation stage, field orientation stage, activity implementation stage, and community service activity evaluation stage.

1) Preparation stage.
   The preparation stage is the initial stage carried out before carrying out community service activities. At this stage, internal coordination is carried out regarding the theme of the activity and the location of the activity. At this preparation stage, coordination was also carried out with the partner. Coordination is carried out by licensing the community service team to MAN 1 Kubu Raya.
2) Field orientation stage.
   The next stage is field orientation, carried out by conducting a survey directly to MAN 1 Kubu Raya. The survey is intended to identify problems that exist at the partner location, check the clean water facilities and infrastructure, and look for alternative solutions that will be offered. At this stage, the community service team also determines the technical implementation of community service activities to run efficiently.
3) Implementation stage.
   The implementation stages begin with an opening, remarks from the school and the community service team, socialization, and water treatment simulations. At the time of the water treatment simulation, there were different media: alum, shell sand, and activated carbon. Each of these processing media will be contacted with peat water for 15 minutes, after which the difference before and after processing will be seen and compared between one processing and another. During the simulation, students will be divided into groups to create an active discussion atmosphere.
4) Evaluation stage.
   The evaluation stage is the final stage of community service activities. Evaluation of activities is carried out thoroughly on community service activities that have been carried out. At this stage, it also discusses the program's sustainability, which may be carried out at the MAN 1 Kubu Raya location to establish cooperation between universities and schools as a process of transferring knowledge.

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RESULTS AND DISCUSSIONS

Preparation Stage

The implementation of community service begins with coordination with the school as a follow-up coordination where previous field orientation has been carried out and identification of problems experienced related to limited clean water. At this stage, the community service team discussed the technical implementation of community service, such as socialization, training, and making water treatment equipment.

The construction of water treatment equipment is carried out simultaneously with socialization and training activities. Before the socialization activities are carried out, the community service team has designed the processing equipment and provided the tools and materials needed to make the processing equipment so that it can be directly installed at the activity location. If there is a shortage of tools and materials, they can be purchased at the building shop around MAN 1 Kubu Raya.

Community service activities were conducted in a MAN 1 Kubu Raya classroom. The activity began with the opening and remarks from the community service team and the principal, who in this case was represented by the Head of Administration of MAN 1 Kubu Raya, Mr. Agus Lutfi, S.Hi. The school felt greatly helped by this community service activity because the school still uses untreated peat water to meet the needs of the MCK at school. This activity also benefits students personally because it can increase their understanding of clean water and treat peat water for their homes' clean water needs. Before the socialization began, the community service team prepared tools and materials for water treatment simulation.

Figure 3. Students were conducting direct experiments to improve the peat water.

Socialization and Experiment Stage

Socialization activities include water treatment simulation, presentation of lessons, discussion, and field-scale water treatment. Before the presentation of the content, simulation activities were carried out because water treatment simulations require time for the sedimentation or settling process, so to optimize time efficiency, simulations were carried out at the beginning of the socialization activities.

The simulation used several treatment alternatives to treat peat water: neutralization, coagulation-flocculation, sedimentation, filtration, and disinfection. Several treatments were used to compare each treatment and determine the most optimal treatment for peat water. The treatment simulation uses the following media shown in Table 1.

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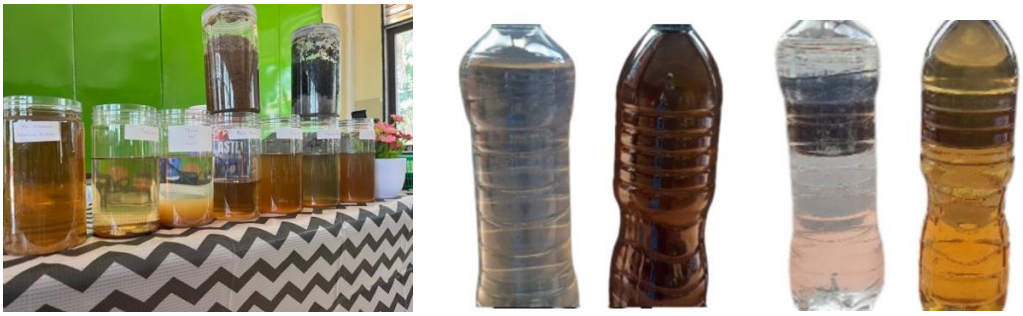
Table 1. Peat water treatment simulation

Material	Perform as
Alum	Coagulant
PAC	Coagulant
Lime	Coagulant
Clamshell	Filter media
Activated carbon	Filter media
Alum + PAC + lime	Combination of coagulant + filter media + pH neutralizer

During the simulation, students were divided into six groups, and each group was given untreated peat water and different processing media. After that, each group received different instructions for processing. While waiting for the treatment, the activity continued with material and discussion. The materials presented were types of raw water sources and their characteristics, water treatment alternatives, water treatment media, and water treatment processes. After the presentation of the material, the discussion continued. The participants' enthusiasm was seen during the discussion and question and answer process; students and teachers who participated in this activity actively asked questions.
The activity continued by looking at each group's peat water treatment results. Each group brought the treated water, compared it with the peat water before treatment, and checked the water quality based on temperature, pH, Total Dissolved Solid (TDS), Dissolved Oxygen (DO), and salinity. Based on physical observations, it is known that peat water treatment using a mixture of alum, PAC, and lime is the most effective treatment.



(a) (b) (c)

Figure 4. (a) The peat water was treated in various ways (b) The peat water before treatment (c) The peat water after treatment

Field-scale Peat Water Treatment

The activity continued with field-scale peat water treatment. The peat water treatment tub was made behind the school because it is close to the raw water source, making it easier to pump and distribute to the bathrooms. The stages in field-scale peat water treatment are as follows:

1) Pumping raw water (peat water) into a 500-liter tank.
2) Make alum solution by mixing 55 grams of alum into a bucket of peat water and stirring it.
3) Make a PAC solution by mixing 75 grams of PAC into one bucket of peat water and stirring.
4) Make a lime solution of 45 grams in a bucket.
5) Putting alum solution into the bucket.
6) Each solution is gradually added to the raw water.
7) The water that has been mixed is allowed to stand for 30 minutes, after which it is ready to be used as a place for bathing and washing and serving as a lavatory (toilet) activity.

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In this treatment process, no manual stirring is required because an automatic stirrer is made from a pipe in the treatment basin. The water produced from the treatment process physically changes color from brownish yellow to clear white. Overall, this community service activity went smoothly without any significant obstacles. Still, it took quite a long time to test the treated water during the simulation because there were many alternative variations of water treatment, and testing was carried out one by one for each parameter. In addition, the field-scale water treatment process also takes quite a long time because the water must have waited to be full and treated.

Monitoring and evaluation activities are carried out after the community service activities. For the sustainability of this tool, the school has prepared a manager/officer who will operate this peat water treatment tool. The school appreciates this activity and expects similar activities in the mosque around their neighborhood. Documentation of this community service activity can be seen at the link https://www.youtube.com/watch?v=uC8LKncEa48.

(a) (b)

Figure 5. (a) Peat water treatment simulation results (b) Group photo at the field-scale peat water treatment equipment.

The next step was the tools handover, a group photo with the community service team and the socialization participants, and a group photo with the students and school stakeholders.

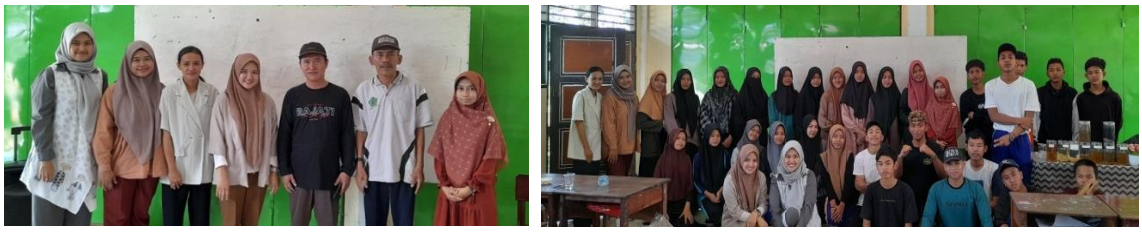

Figure 6. Group photo of COMMUNITY SERVICE Team with school staff and students of MAN 1 Kubu Raya

CONCLUSION

Community Service activities in peat water treatment have been conducted at Madrasah Aliyah Negeri (MAN) 1 Kubu Raya. The activities carried out were socialization and simulation of peat water treatment with simple processing methods such as coagulation and filtration. Apart from transferring knowledge to students, this community service activity also produces clean water that can be used for daily needs.

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