

Skill Building for Simple Electrolysis Equipment for Rainwater Treatment in Gemulak, Sayung, Demak, Indonesia

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Abstract. Water is essential to human life because it is the main foundation for survival. The service aims to collaborate with Gemulak Sayung Village, Demak Regency, and Jawa Tengah coastal communities to obtain a decent drinking water supply from rainwater treatment using electrolysis science and technology. The stages of service implementation were carried out through observation, training in making simple electrolysis equipment, monitoring, and evaluation. On observation, the problem was obtained: water availability is still minimal for consumption. Implement training in making electrolysis equipment that can be applied in their homes. Monitoring and evaluation are carried out to ensure the sustainability of the service implementation. The service results showed that participants learned about the benefits of rainwater and simple processing technology using electrolysis to produce electrolyzed water in alkaline and acidic water. 95% of participants wanted the service process to be continued because it benefited the Gemulak Village, Sayung, and Demak communities.

Keywords: rainwater, drinking water, electrolysis, gemulak

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INTRODUCTION

Gemulak Village, Sayung Subdistrict, Demak Regency has a strategic area located in the westernmost part and directly adjacent to Semarang City, Indonesia. As a result of its proximity to Semarang City, the industrial sector in the sub-district has experienced rapid growth. The rapid growth because of the expansion of industry and trade from the city of Semarang directly influences economic development in Sayung Sub-district (Nurdin et al., 2019). The area of Sayung Sub-district stretches 8 km from west to east and 16 km from north to south. There are also significant connections with other surrounding towns and sub-districts. For example, the distance from Kecamatan Sayung to the capital city of Demak is approximately 29 km. Meanwhile, Kecamatan Karangtengah is about 8 km away, Kecamatan Mranggen is about 10 km away, and Kecamatan Karangawen is about 15 km from Kecamatan Sayung (Utomo, 2022).

The challenges faced by the partners involve the impact of climate change, which changes weather patterns and makes them unpredictable. Within one year, a prolonged rainy season can be followed by

an equally long dry season (Kurniawan et al., 2022). During the rainy season, rainfall is abundant, and often, the soil cannot absorb it properly, resulting in flooding. However, when the dry season arrives, the situation becomes contradictory, with droughts occurring (Rachmat et al., 2022). The impact of climate change is felt in Sayung Subdistrict, Demak Regency, especially in its coastal areas. Problems that arise include water crisis, flooding, and the threat of rob/abrasion. All of the impacts of the residents' difficulties in meeting their daily needs for clean water are essential elements in their daily activities. In Sayung Village, clean water sources come from wells and water purchases. However, in a coastal area, water from wells tends to be contaminated by seawater, resulting in a salty taste. The condition causes limitations in the use of healthy water by residents. Demak Regency shows tropical climate characteristics (Wigati et al., 2022). The amount of rain that falls in the Demak Regency area ranges from 1000-2000 mm and 2000-3000 mm. In the coastal areas of Demak Regency, rainfall is dominant, with a range of 2000- 3000 mm (Brauns & Turek, 2020). Specifically, Sayung Sub-district recorded a rainfall intensity of 1,731 mm and 75 rainy days (Siska et al., 2022). Reports from the

Demak Regency Office of Settlement and Regional Infrastructure (KIMPRASWIL) and Semarang Climatology Station indicate that the Demak region recorded between 59 and 109 rainy days with rainfall amounts ranging from 1,801 mm to 2,167 mm (Kusuma, 2020).

The analysis listed reflects efforts to overcome problems through water conservation measures using electrolysis technology to convert rainwater into clean water (Sankara et al., 2022). Clean water or drinking water is a fundamental need that is very important for human health and survival. The composition of water in the human body includes various parts, such as the brain (74% water), muscles (about 75.6%), blood (83%), and kidneys (82.7%). Bones contain about 22% water (Rachmat et al., 2022). Based on the standard pyramid of minimum water requirements, everyone requires 10 liters daily (Zalillah, 2022).

Based on the description of the partner's problems, we recommend an alternative solution by applying electrolysis technology to process rainwater into water suitable for consumption for drinking and other purposes. The solution also acts as a form of water conservation that can help maintain water security and prevent land surface damage and potential floods (Rahmayanti et al., 2021). The process of rainwater electrolysis technology begins with the harvesting step. The rainwater harvesting system is one of the most appropriate options to overcome the water crisis. The system is suitable, especially in the Sayung Sub-district, because it is simple and can be implemented by every household. Each household can take steps to collect rainwater from roofs or areas that receive rain, and then the water can be utilized during the dry season (Singh et al., 2021). The purpose of the activity is to introduce and improve the skills of the Gemulak Sayung Demak Village community in making simple electrolysis equipment, strengthen local carrying capacity for independent rainwater management, and increase understanding of simple technology to overcome the problem of limited clean water. Through, hoped that it will not only help overcome the water crisis but also positively contribute to environmental sustainability and efforts to reduce the impact of climate change and the risk of water-related disasters.

METHODS

Activity Time and Location

The time of service implementation activities were carried out from April to July 2023. The place

of Implementation was Gemulak Village Hall, Jl. Raya Semarang-Demak Km.12.9 Sayung Demak 59563.

Stages of Service Implementation

The community service activity was carried out through three structured stages. The first stage was observation and coordination, where rain harvesting sites were identified, the availability of tools and materials that the community could utilize was evaluated, and coordination was made with the Head of Gemulak Village. The second stage involved training to improve skills in treating rainwater into clean water using the electrolysis method. The stage included socialization activities and the construction of a household-scale electrolysis device, held on July 11, 2023, at Gemulak Village Hall. The activity was attended by 40 participants and local leaders, namely the Gemulak Village Secretary and village officials. During the socialization, the material was delivered by Dr. Harianingsih, S.T., M.T., an expert in electrochemistry. The materials included information on rainwater, its harvesting and utilization process, and simple electrolysis technology. Evaluation and monitoring were carried out by participants filling out questionnaires. Then, data processing was carried out to obtain recommendations for the sustainability of the service implementation.

RESULTS AND DISCUSSION

The community service activity was carried out through three structured stages. The first stage was observation and coordination, where rain harvesting sites were identified, the availability of tools and materials that the community could utilize was evaluated, and coordination was made with the Head of Gemulak Village. The second stage involved training to improve skills in treating rainwater into clean water using the electrolysis method. The stage included socialization activities and the construction of a household-scale electrolysis device, held on July 11, 2023, at Gemulak Village Hall. The activity was attended by 40 participants and local leaders, namely the Gemulak Village Secretary and village officials. During the socialization, the material was delivered by Dr. Harianingsih, S.T., M.T., an expert in electrochemistry. The material included information. The community service activities began by explaining the benefits of rainwater and electrolyzed water (alkaline and acidic water). Rainwater has a pH of 5-6, usually disposed of, not



Figure 1. Welcome by the Head of Gemulak Village, Sayung, Demak



Figure 2. The resource person presents the making and working of the electrolysis device

collected. Electrolyzed water in the form of alkali is a type of water with alkaline properties or a pH value above 7 (Moentamaria et al., 2022). Alkaline water has many benefits, such as being suitable for consumption as a daily drink. Alkaline water helps maintain body hydration and compensates for excess acid. Water is acidic when it has a pH of less than 7 (Sa'idi, 2020). The acidic water has several potential uses, including as an external medicine, disinfectant, or germ-killing agent (Triyoso & Sari, 2022). Explaining the properties and benefits of the type of water gives people a better understanding of its potential use in daily life and its positive implications for health and body balance.

After the counseling on the making and working of the rainwater electrolysis device, the community became more aware of the benefits of the alkaline and acidic water produced by the device. At first,

some community members were hesitant to try the alkaline water produced, but after undergoing the exposure session, their belief in the benefits of alkaline water strengthened. The community members have high hopes of having the water electrolysis device for use in their homes soon. The positive perception came directly from the information provided during the counseling and demonstration and reflects their awareness of the potential health and quality of life improvements accessible using alkaline and acidic water.

After that, the activity continued by involving residents and students in the assembly process of a household-scale rainwater electrolysis device. The principle of water electrolysis equipment is to produce acidic water and alkaline water (Zulfikar et al., 2022). Water electrolysis involves the decomposition of water molecules (H_2O) into

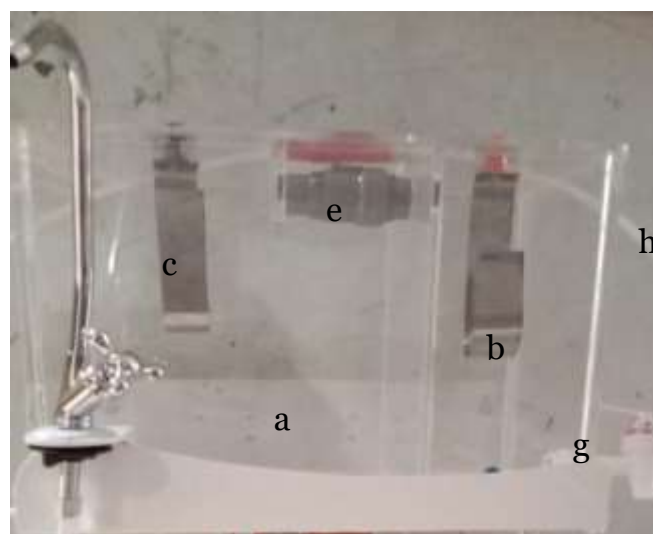


Figure 3. Design of a Household-Scale Rainwater Electrolysis Device

Table 1. Results of the activity evaluation and monitoring questionnaire

No.	Indicator	Before Service Activities		After Service Activities	
		Response	%	Response	%
1	Rainwater-related knowledge, rainwater harvesting, rainwater benefits, water electrolysis	Do not understand	80	Not knowing	0
		Understood enough	15	Know enough	0
		Understand	5	Knowing	95
		Very clear	0	Very knowledgeable	5
		Not knowing	100	Not knowing	0
2	How to make a device and the working principle of water electrolysis	Know enough	0	Know enough	5
		Knowing	0	Knowing	85
		Very knowledgeable	0	Very knowledgeable	10
		Not interested	0		
3	Interest from participants in Participating in community service activities	Interested enough	0	-	
		Interested	20		
		Very Interested	80		
4	Expectations from participants for the sustainability of service activities	-		No further	0
				Want sustainability	5
				Strongly want sustainability	95

hydrogen (H₂) and oxygen (O₂) by using electrical energy (Sankara et al., 2022). The electrolysis process occurs when two electrodes are placed in water, and an electric current flows through them. The anode is connected to the positive pole, while the cathode is connected to the negative pole (Rusidah et al., 2021). The process is essential for making acidic and alkaline water through electrolysis (Irhasyuarna, 2021). Through the involvement of residents and students in the assembly of tools, there is an increase in understanding of technology and active participation in producing solutions that benefit the community.

The electrolysis vessel, which can hold 20 liters of rainwater, is made of acrylic and divided into two parts: the vessel for alkaline water (a) and the acidic water vessel (b), the stainless steel anode electrode (c), the cathode electrode (d), and the membrane (e) for ion exchange, the faucet for alkaline water output (f) and the faucet for acidic water output (g), and power (h).

The assembly of the electrolysis device is carried out in a way that is easy to understand, using materials that are easily obtained by the community. The people of Gemulak Village are enthusiastic because they can make it at a low cost and easily. Monitoring and evaluation were conducted through the questionnaire shown in Table 1.

Based on the data in Table 1, it can be observed that the community's understanding of the benefits of rainwater and water electrolysis after

socialization increased by 15% from those who did not understand. Regarding the creation of tools and the working principles of water electrolysis, the understanding grew by 85% among those previously unaware. The socialization process was highly interactive as many individuals showed enthusiasm for electrolysis science, which transforms rainwater into alkaline water with a pH above 7, ready for consumption (Oktarina et al., 2023). The community's keen interest in participating in these sessions is reflected by a percentage exceeding 80%. Based on the survey findings, 95% of all participants anticipate the continuation of the provided services. Consequently, the community can further enrich their knowledge and be ready for future application, especially during the rainy season. Moreover, adopting water conservation practices can help safeguard the environment, mitigating flooding and soil erosion (Setyowati et al., 2021).

CONCLUSION

Making rainwater electrolysis equipment is a practical activity in Gemulak Village as an alternative to a clean water supply. The activity is a solution for partners to improve their skills in the availability of clean water. The village leaders and participants, in the case, the community members of Gemulak Village, Sayung District, Demak Regency, very positively responded to the activity. Participants also hoped for the sustainability of the activity to increase knowledge and skills in processing rainwater into water suitable for

consumption.

Resource persons can provide further training related to safe and efficient rain harvesting installations. Because rainwater is not used immediately but several days after collection, participants are worried about germs in rainwater. Therefore, knowledge about the proper rainwater harvesting process is needed.

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