International Journal of Scientific Research and Management (IJSRM)
||Volume||12||Issue||02||Pages||1018-1027||2024||
Website: https://ijsrm.net ISSN (e): 2321-3418
DOI: 10.18535/ijsrm/v12i02.ec01

Filtering Swamp Water into Clean Water Using Carbon Charcoal and Silica Sand Filter Media

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Abstract:
Water filtration is an essential need in ensuring the quality of a safe water supply for the community around Meritai Raya Village Rt 027, Sungai Pinang Village, Rambutan District, Banyuasin Regency, South Sumatra Province. The method used was a completely randomized design (CRD) using activated carbon charcoal, silica sand, coir, gravel and filter cotton as media. The aim of the research is to determine the efficiency of the performance of swamp water processing filters in removing water quality parameters in the form of pH (Potential of Hydrogen) and TDS (Total Dissolved Solid). Design a which has 3 tubes uses filter media in the form of sand (12 cm), coir (15 cm), and cotton (3 cm) in tube 1, coir (20 cm), gravel (8 cm), and cotton (3 cm) in tube 2, carbon charcoal (8 cm) and cotton (10 cm) in tube 3. And design b which has 2 tubes in the form of gravel (6 cm), silica sand (12 cm), 8cm coir, and cotton (4 cm.) in tube 1. carbon charcoal (7 cm), coir (10 cm), and cotton (10 cm) in tube 2. The research results show that filtration is effective in reducing water pH and TDS in water, namely up to pH 7.6 and TDS 92 ppm in design A and pH 8.3 and TDS 104 ppm in design B even though it does not meet the clean water quality standards of Minister of Health Regulation No. 32 of 2017. The two filtration designs have performance effectiveness that is not much different in treating swamp water. However, overall filtration with the 3 tube variation has better performance.

Keywords: Activated Carbon, Silica Sand, Swamp Water

1. Introduction

Clean water is a natural resource that is very important for human life and the environment. Clean water is water that is free of contaminants and materials or particles that can harm human health. Even though the earth consists mostly of water, only about 2.5 percent of the total available water is fresh water, and only a small portion of it can actually be used as drinking water (Jariah, 2007). Water has become a vital necessity in human life and its availability is absolute to support human survival in carrying out its activities (Lestari & Susanto, 2021).

Research on water purification is very important in the context of environmental protection and human health. Water is an invaluable source of life, but more and more regions throughout the world are facing problems of poor water quality (Agustiningsih et al., 2012). The ever-increasing human population and industrial growth have led to an increase in demand for clean water. Limited clean water resources make research important in developing efficient water purification methods (- et al., 2017). Many areas experience water pollution due to industrial, agricultural, domestic waste and other human activities. This pollution can contain dangerous chemicals, pathogenic microbes, heavy metals, and other toxic substances that endanger

human health and aquatic ecosystems (Atima, 2015). Polluted water can cause various health problems such as stomach ailments, infections and chronic diseases (Adeko et al., 2019). Therefore, water purification is important to maintain public health. Aquatic ecosystems, including rivers, lakes and seas, also need to be protected. Polluted water can damage water ecosystems and threaten the sustainability of natural resources (Budiman et al., 2017).

Previous research shows that high pH levels, water pollutants and turbidity in water can cause health problems, therefore filtration is carried out (Nelson et al., 2020). Filtration is used to reduce turbidity and Fe levels by utilizing silica sand, activated carbon, and several other supporting media and studying the effect of a combination of filtration media on reducing turbidity and Fe (Jenti & Nurhayati, 2014). Good water quality is very important as a source of clean water. Water purification is a critical step in ensuring water that is safe and suitable for use. Technological developments and innovations in the field of water purification have enabled the development of more efficient, cheaper and environmentally friendly methods (Prayogo, 2015) (Putra & Yulia, 2019). And the effectiveness of the tool used with the water quality parameters resulting from the filtration of the tool. Dug well water is groundwater which contains a lot of iron (Fe) and manganese (Mn). The elements Fe and Mn in water cause the color of the water to change to brownish yellow after a short period of contact with air. And it can cause an unpleasant odor and pose a risk to health, namely causing chronic diarrhea for people (Roslinda et al., 2019).

Thus, water purification research is a very important effort in maintaining water quality, protecting human health, and preserving the natural environment. Many studies aim to identify the best solutions to overcome this increasingly worsening water quality problem, including the use of various technologies such as filtration, water treatment with chemicals, use of aquatic plants, etc. (Sriyanti et al., 2022) (Nenohai et al., 2023).

2. Literature Review

Homeland of the Swamp Area

Swamp groundwater is water trapped in layers of soil or organic sediment in swamps, wetlands or peat areas. This water-containing soil layer can be different in composition and properties compared to soil layers in dry areas. Swamp groundwater usually has a higher organic content than groundwater in non-swamp areas (Pasmawati et al., 2023).

Swamp groundwater often contains large amounts of water-soluble organic matter. This can give a brown color to the water and can affect the taste and smell of the water. Ground water contains sediment and mud because organic deposits that occur in swamps can make the water cloudy and oily. And it is used in a variety of applications, including water filtration, air purification, wastewater treatment, and drug overdose treatment (Sweetman et al., 2017). Apart from that, activated carbon is also used in industry, such as in the process of purifying and separating chemical substances. In addition, it is also often used in gas masks and dust masks to protect breathing. Activated carbon can be used in the form of fine powder, granules, or as a solid block depending on the application (Arsad, 2010). The success of activated carbon in absorbing various substances makes it a very valuable material in the fields of water treatment, waste treatment, and often has low oxygen levels as well as hydrogen sulfur gas content which can give an unpleasant odor. Humic and fulvic acids can affect water pH and change the chemical characteristics of water (Indrayati & Setyaningsih Wahyu, 2016).

Activated Carbon

Activated carbon, also known as activated charcoal or activated charcoal, is a type of charcoal that has a surface structure of very large pores. The manufacturing process involves the activation of charcoal materials, such as coal, coconut shells, or wood, using chemicals or high heat (Hartanto & Ratnawati, 2010). This activation produces a large and numerous pore structure, giving activated carbon extraordinary adsorption properties. Adsorption is the process of absorbing gas, liquid or solid particle molecules onto the

surface of a solid (Harsanti, 2010). Because activated carbon has a very large surface area and pores that can absorb many types of substances, it has many other applications.

Silica sand

Silica sand is a term that refers to sand that consists primarily of grains (silica dioxide) in the form of microscopic crystals or crystals. Silica is a compound consisting of one silicon atom and two silicon atoms (SiO2) (Adi, 2018). Silica sand is generally used in various applications because of its beneficial properties, including heat resistance, corrosion resistance, and the ability to be converted into various products (Haryanti & Wardhana, 2019). One common use of silica sand is that it can be used in water filters to filter out unwanted particles and substances. Silica sand is also often used in water filtration as a filter medium in the filtration process (Setyobudiarso & Yuwono, 2014). The use of silica sand generally involves a slow sand filter or fast sand filter, where water flows through a layer of silica sand to remove particles and dissolved substances from the water (Abuzar & Pramono, 2014).

3. Research Methods

The method used was a Completely Randomized Design (RAL), a method of managing treatments in experimental research where each treatment is given randomly to each experimental unit (Rahmawati & Erina, 2020). This research uses a simple filter tool. The test subjects included dug well water, the parameters assessed were TDS and water pH, with activated carbon and silica sand as media. Silica sand acts as a filter, capturing large particles and dirt. Activated carbon media is used to remove odors, tastes and certain substances from water. The water samples taken will be carried out in 2 filtration treatments with 6 repetitions. The drilled well water that is sampled has been analyzed first before the test takes place. The method of collecting data in this research was by examining the TDS and pH of water in Meritai Raya Village Rt 027, Sungai Pinang Village, Rambutan District, Banyuasin Regency, South Sumatra Province and the Bina Darma University Laboratory.

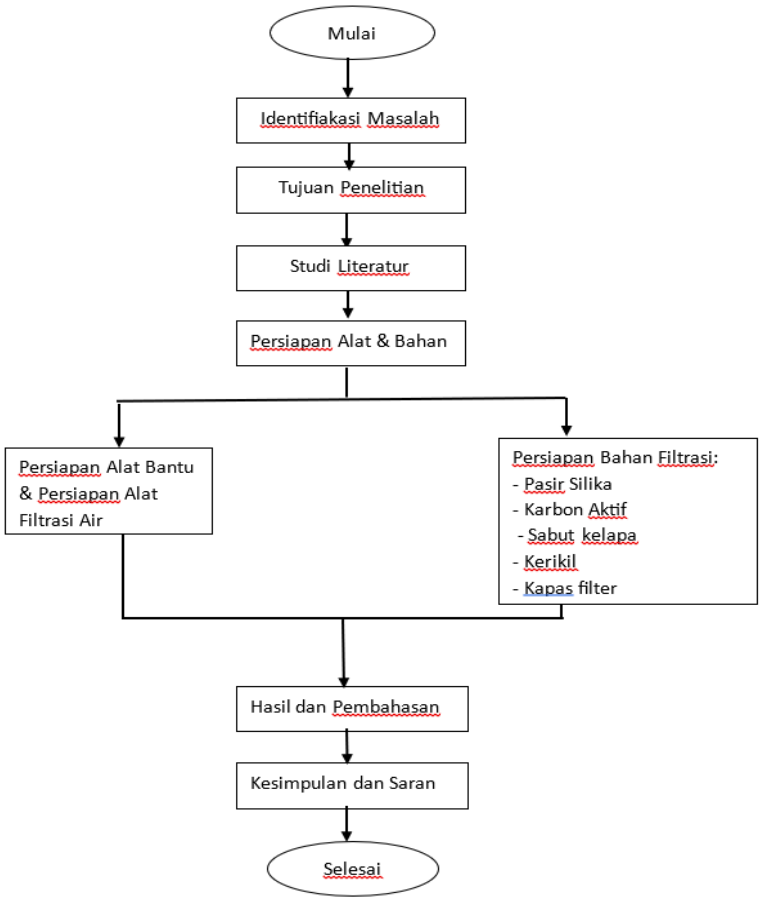

Figure 1: Research flow diagram

Water purifier design

The tool used is a water filtration tool that is easy to use to get access to water that is suitable for use, easy to install and does not require too large a space (Gemala & Oktarizal, 2019). This tool will work automatically as a water purifier, each tube functions as a filter for water which is pumped by the machine and then distributed directly to the tool directly (Rahmayanti et al., 2019) (Prasetya & Ruchban, 2021). And pass through 3 filter tubes for test session 1, pass through 2 tubes in the test session, through existing pipes. Each filter tube will have a different composition that has been planned in advance. The size of the tool used is 40 cm high and 10 cm wide

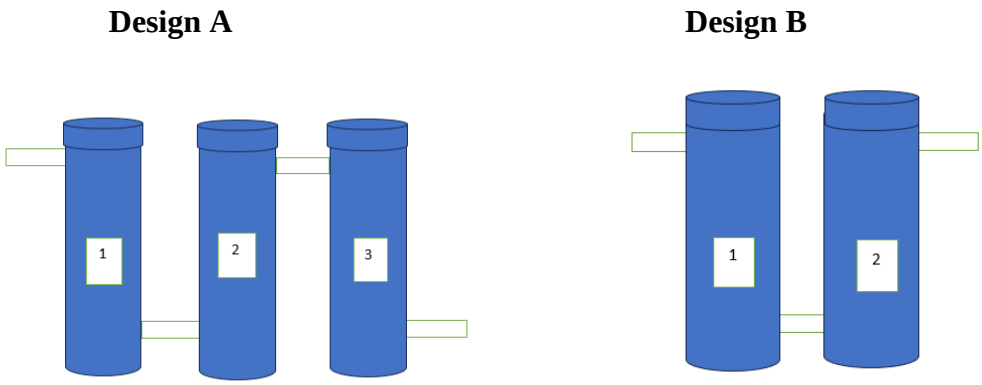

Figure 2: Water filtration device design

This filtration process will be carried out several times according to analysis needs and will be carried out on 6 water samples from a research area. Testing is carried out to determine the effectiveness of the results of the tools used. The performance of this water filtration device is measured based on how clean the water is after going through the existing equipment process and the pH quality of the water is measured using a pH meter and the TDS of the water using a TDS meter, in order to know whether the water is suitable for use.

Tools and materials

Some of the tools and materials used in the research are as follows:

- Pipa pvc 4 inch
- Pipa pvc ½ inch
- Silica sand
- Coconut fiber
- Gravel
- Carbon charcoal
- Filter cotton
- Ph meter
- Tds meter

4. Results

The data obtained for this research is the result of testing and direct tests on the water purification equipment that has been designed. Analysis of research variables shows an increase in clean water quality, so that the order of the data that has been collected can be seen.

Table 1: Filtration Results Water becomes clean water after going through the A filtration process

Testing A	No	initial pH	pH test results	Advance TDS	TDS Yield
-Use of 3 filter cartridges	1	8.6	8,3	360ppm	92ppm
-2 liter air	2		7.8		211ppm
Composition arrangement	3		7.6		144ppm
Tube 1 (Silica sand 12 cm | Coir 15 cm | Cotton 3 cm)	4		9.1		92ppm
	5		8.9		131ppm
Tube 2 (Coir 20 cm|gravel 8cm|cotton 3 cm)	6		8.3		233ppm
Tube 3 (Carbon Charcoal 8cm|cotton 10cm)					

Data from the pH test results with the composition of the contents in the tube are as follows. In Test A which used 3 filter tubes, tube 1 (12 cm sand, 15 cm coir, and 3 cm cotton) Tube 2 (20 cm coir, 8 cm gravel, and 3 cm cotton.) Tube 3 (8 cm carbon charcoal) with each tube 40 cm long and 10 cm wide.

Table 2: Filtration Results Water becomes clean water after going through the filtration process

Testing B	No	initial pH	pH results test	Initial TDS	TDS Yield test
Use of 2 filter cartridges	1	8.6	9.1	360 ppm	104ppm
2 liter air	2		8.6		181ppm
Composition arrangement	3		8.3		258ppm
Tube 1 (gravel 6 cm | Silica sand 12 cm | Coir |	4		8.3		153ppm
Coir 8 cm | palm fiber 4 cm	5		8.6		211ppm
Tube 2 (Carbon charcoal 7 cm | Coir 10 cm | Cotton 10 cm)	6		8.5		252ppm

Data from test results from test B using 2 filter tubes, tube 1 (6 cm gravel, 12 cm silica sand, 8 cm coir, and 4 cm cotton.) Tube 2 (7 cm carbon charcoal, 10 cm coir, and 10 cm cotton.) with each each tube is 40 cm high and 10 cm wide.

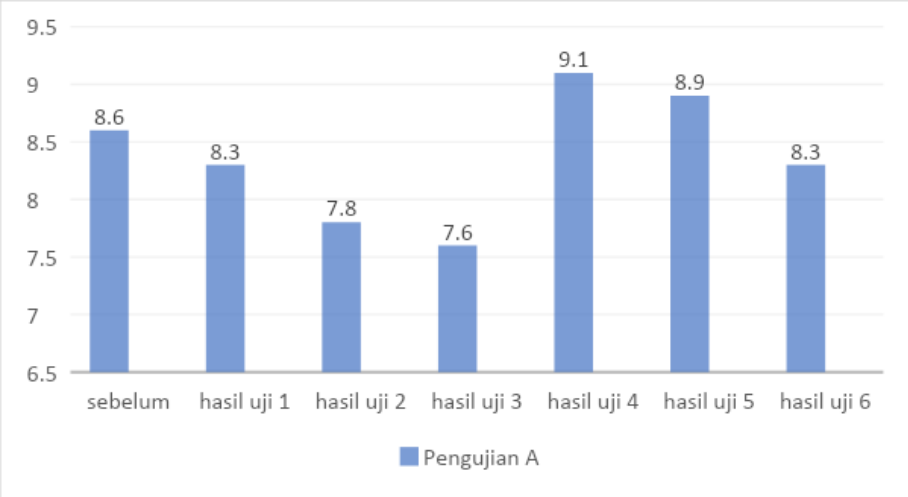

Figure 3: Water filtration results in design A with water pH parameters

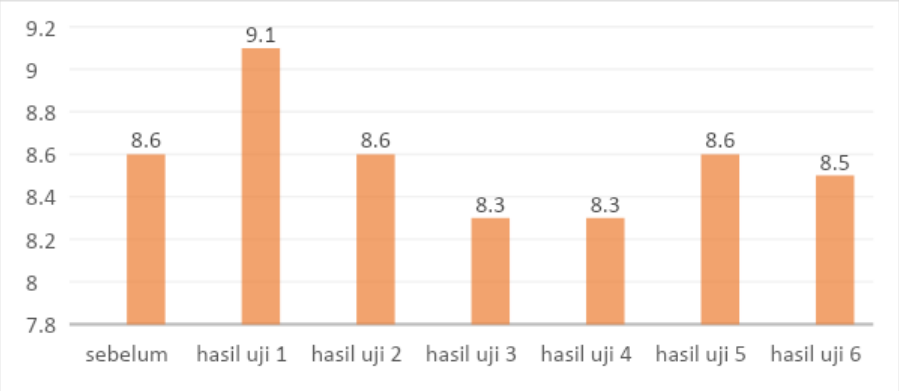

Figure 4: Water filtration results in design B with water pH parameters

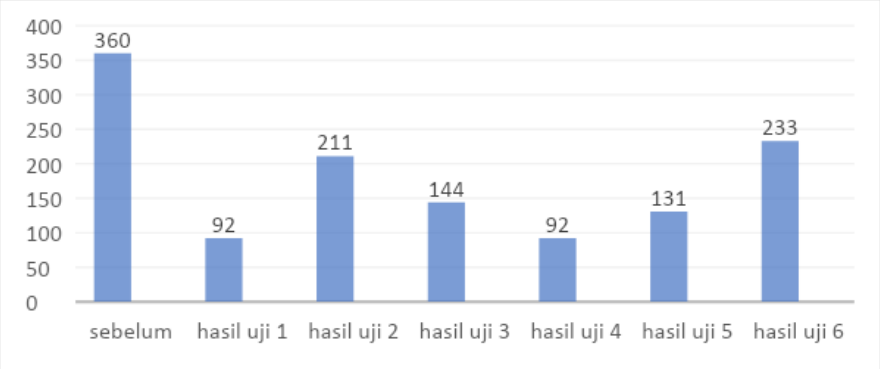

Figure 5: Water filtration results in design A with TDS parameters

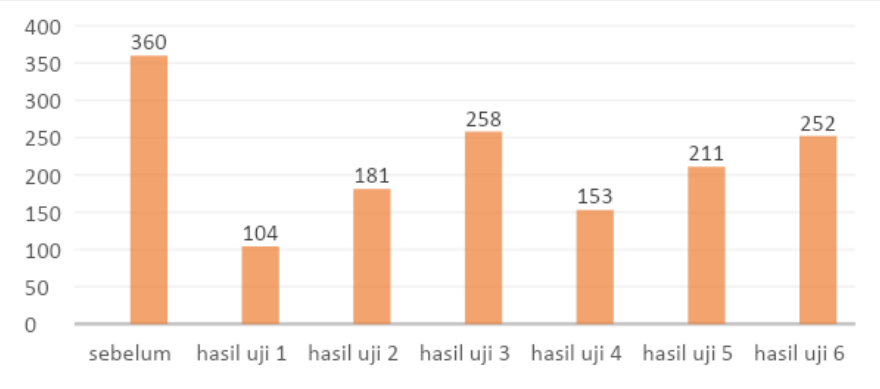

Figure 6. Water filtration results in design B with TDS parameters

5. Discussion

The processing of the results data after the water filtration that has been carried out aims to determine the effect of each filter media on the water samples being tested, especially the parameters that have been determined, because the process used is filtration. The filter media composition of silica sand, activated carbon, coir, gravel, cotton) was made by adjusting the prototype used with the aim of finding the effectiveness of 2 different treatments. The silica sand used in this research is expected to influence water by retaining solid particles such as mud, soil, and dissolved organic substances in water (Coenraad et al., 2019). The activated carbon used is expected to reduce the color of the water because activated carbon has pores that can absorb/absorb color (Apriyani & Novrianti, 2020). Research samples were taken from well water in Meritai Raya Village Rt 027, Sungai Pinang Village, Rambutan District, Banyuasin Regency, South Sumatra Province. Then the samples are checked for quality based on parameters based on the quality standards of Minister of Health Regulation Number. 32 of 2017. The condition of the land in this area is peat soil and is lowland so that during the rainy season there are often floods with the water being brownish in

color and also a little sticky to the skin and a little muddy (Putra & Mairizki, 2019) (Situmorang et al. , 2019).

Measuring the pH of water is a way to determine the level of acidity or alkalinity of a solution. The pH scale ranges from 0 to 14, where a value of 7 is considered neutral, a value below 7 indicates acidity, and a value above 7 indicates alkalinity (Sugeng & Sulardi, 2019) (Medeiros et al., 2020). The results of the pH analysis can be seen in Figure 3 and Figure 4. The results of the initial analysis of the water sample used in the test have a pH of (*Potential of Hydrogen*) high water with a value of 8.6 and has a TDS (*Total Dissolved Solid*) with a value of 360 ppm. Based on Figure 3 in test A and Figure 4 in test B, it can be seen that the pH value of the groundwater sample after filtration results ranges between 7.6-9.1 (Design A) and 8.3-9.1 (Design B). The test results show that the majority of samples are below the minimum standards for clean water quality standards, namely Minister of Health Regulation Number. 32 of 2017, so the water is not worthy of being called clean water. This is due to the geological factors of the location in question, which is peat soil, causing the water to be alkaline or have a high pH. Matter

A high pH value of water can affect the skin, especially if the water is alkaline or basic. Most are only slightly or only mildly acidic or basic. The ideal pH value of water for the skin is usually around 4 to 7, therefore supporting a healthy environment for the skin. The effect of high pH water (more than 7) is that it causes dry skin. Water with a high pH can remove natural oils from the skin, because a high pH value can change the natural balance of oil in the skin, reducing skin moisture because water with a high pH reduces the ability of the skin to dry out. To maintain skin moisture, water with a high pH can damage the skin barrier, allowing dangerous substances or bacteria to enter the skin more easily (Hajratul Aswad et al., 2019). Apart from the impact of water with a high pH which causes skin problems, there are other problems if water with a high pH is consumed. Some potential effects of high pH values on the body. Consumption of highly alkaline substances can cause digestive disorders. The human body has a balanced acidity system to help digest food, and drastic changes in pH affect this balance. Metabolism is disturbed, especially in the blood, which is very important for the normal functioning of the body (Mugagga & Nabaasa, 2016). Because a significant pH imbalance can affect metabolic processes and enzyme function. The test results indicate that the pH value in the area is very far from the permissible safe quality standard threshold so further action needs to be carried out immediately because it will be dangerous for meeting water needs in the area.

TDS or total dissolved solid, refers to the total amount of dissolved substances in water, including minerals, salts and organic compounds, TDS measurements are useful for determining the level of water quality. There are no TDS limits specifically set for general sanitation, as TDS does not fully reflect the specific contaminants that may be present in water. Therefore, in the context of sanitation, it is more important to pay attention to other water quality parameters that can affect sanitation safety (Dosskey, 2001). However, in general, clean water used for sanitation or hygiene is expected to be of good quality and safe for users. Based on Figure 5 in test design A and Figure 6 in test design B, it can be seen that the TDS (Total Dissolved Solid) value of the resulting water sample after filtration ranges between 92-233 ppm in test design A and 104-258ppm in test design B. These test results shows that most of them have met clean water quality standards, namely Minister of Health Regulation no. 32 of 2017 in 1 TDS (Total Dissolved Solid) parameter, the TDS water limit set for sanitation purposes is 1000 mg/l and 300 mg/l for drinking water. This could be caused by the filtration media used in the filtration device. High TDS can affect the taste and smell of water and health if consumed, for example high concentrations of sodium in water can be a problem for humans with high blood pressure. And another problem, with reference to the total amount of dissolved substances in water.

However, water standards cannot only be measured by just one parameter, therefore water is tested to be clean water using pH and TDS parameter measurements. These two parameters must be included in the clean water quality standards, not just one parameter. The method and filter media used had an improving effect on the water tested, although it still did not meet the researchers' expectations. Researchers'

expectations that are not met in the filtration results can be caused by various factors. (1) The filter media used is not effective in affecting the water samples tested. (2) Incorrect arrangement in the filter tube which can worsen the condition of the water sample being tested.

6. Conclusions And Recommendations

Based on the results of research that has been carried out regarding filtering swamp water into clean water using active carbon and silica sand as a medium in Meritai Raya Village Rt 027, Sungai Pinang Village, Rambutan District, Banyuasin Regency, South Sumatra Province. Several parameters, including pH values ranging from 7.6-9.1 and TDS 92-258 ppm, can be concluded that the groundwater at this location is in the unfit for use category because it has far exceeded the specified quality standard limits. This must be handled immediately, in order to restore the condition of the water to clean water that is safe for use by the local community. The effectiveness of the results did not occur in the two test designs because the pH and TDS parameters tested did not meet the quality standards for clean water standards, Minister of Health Regulation Number. 32 of 2017. However, overall design A has better results. Apart from that, further research needs to be carried out because the formula that has been carried out has not found satisfactory results. Suggestions for further research to find a suitable formula to recondition pH values that are too high.

REFERENCE

1. -, P., Yusuf, M., & Maya Putra, M. U. (2017). Analisis Faktor-Faktor yang Mempengaruhi Permintaan Air Minum Isi Ulang di Kota Binjai. *Jurnal Wira Ekonomi Mikroskil*, *6*(2), 103–112. https://doi.org/10.55601/jwem.v6i2.317
2. Abuzar, S. S., & Pramono, R. (2014). Edektivitas Penurunan Kekehuran Dengan Direct Filtration Menggunakan Saringan Pasir Cepat (Spc). *Prosiding SNSTL I*, *September*, 89–95.
3. Adeko, R., Ermayendri Politeknik Kesehatan Kementerian Kesehatan Bengkulu, D., Kesehatan Lingkungan, J., Indragiri Nomor, J., & Harapan Bengkulu, P. (2019). KOMBINASI LIMBAH BATU BARA DAN LIMBAH CANGKANG KOPI SEBAGAI ADSORBEN DALAM MENURUNKAN KADAR BESI (Fe) PADA AIR SUMUR GALI COMBINATION OF COAL WASTE AND SHELL COFFE WASTE AS ADSORBEN IN REDUCING IRON LEVELS (Fe) IN DUG WELLS WATER. In *JNPH* (Vol. 7, Issue 1).
4. Adi, A. S. (2018). Analisa Penggunaan Pasir Silika Sebagai Pengganti Agregat Halus Pada Campuran Beton. *Jurnal Riset Pembangunan*, *1*(1), 36. https://doi.org/10.36087/jrp.v1i1.25
5. Agustiningsih, D., Budi Sasongko, S., & Sudarno, S. (2012). *Analisis kualitas air dan strategi pengendalian pencemaran air Sungai Blukar kabupaten Kendal*.
6. Apriyani, N., & Novrianti, N. (2020). Penggunaan Karbon Aktif Dan Zeolit Tak Teraktivasi Dalam Alat Penyaring Air Limbah Laundry. *Jukung (Jurnal Teknik Lingkungan)*, *6*(1).
7. Arsad, E. (2010). Treatment technology and utilisation of activated carbon for industry. *Jurnal Riset Industri Hasil Hutan*, *2*(2), 43.
8. Atima, W. (2015). Bod Dan Cod Sebagai Parameter Pencemaran Air Dan Baku Mutu Air Limbah. *Biosel: Biology Science and Education*, *4*(1), 83. https://doi.org/10.33477/bs.v4i1.532
9. Budiman, A., Wahyudi, C., Irawati, W., & Hindarso, H. (2017). Kinerja koagulan Poly Aluminium Chloride (PAC) dalam penjernihan air Sungai Kalimas Surabaya menjadi air bersih. *Widya Teknik*, *7*(1), 25–34.
10. Coenraad, R., Wiratno, & Karelius. (2019). Perancangan Filter Penjernih Air Sungai Kahayan Berbasis Pasir Silika Dan Lempung Alam Asal Kalimantan Tengah. *Jurnal Jejaring Matematika Dan Sains*, *1*(2), 70–76. https://doi.org/10.36873/jjms.v1i2.213
11. Dosskey, M. G. (2001). Toward quantifying water pollution abatement in response to installing buffers on crop land. *Environmental Management*, *28*(5), 577–598. https://doi.org/10.1007/s002670010245
12. Gemala, M., & Oktarizal, H. (2019). RANCANG BANGUN ALAT PENYARINGAN AIR LIMBAH LAUNDRY. *CHEMPUBLISH JOURNAL*, *4*(1), 38–43. https://doi.org/10.22437/chp.v4i1.6910
13. Hajratul Aswad, Muhammad Siri Dangnga, & Henni Kumaladewi Hengky. (2019). Faktor Risiko Kejadian Penyakit Kulit Pada Nelaya Di Desa Teteaji Kecamatan Tellu Limpoe Kabupaten

Sidenreng Rappang. *Jurnal Ilmiah Manusia Dan Kesehatan*, *2*(3), 459–472. https://doi.org/10.31850/makes.v2i3.191
14. Harsanti, D. (2010). Sintesis Dan Karakterisasi Boron Karbida Dari Asam Borat, Asam Sitrat Dan Karbon Aktif. *Jurnal Sains & Teknologi Modifikasi Cuaca*, *11*(1), 29. https://doi.org/10.29122/jstmc.v11i1.2178
15. Hartanto, S., & Ratnawati. (2010). Pembuatan Karbon Aktif dari Tempurung Kelapa Sawit dengan Metode Aktivasi Kimia. *Jurnal Sains Materi Indonesia*, *12*(1), 12–16. http://jurnal.batan.go.id/index.php/jsmi/article/view/4588/4002
16. Haryanti, N. H., & Wardhana, H. (2019). Pengaruh Komposisi Campuran Pasir Silika dan Kapur Tohor Pada Bata Ringan Berbahan Limbah Abu Terbang Batubara. *Jurnal Fisika Indonesia*, *21*(3), 11. https://doi.org/10.22146/jfi.42443
17. Indrayati, A., & Setyaningsih Wahyu. (2016). Karakteristik Air Tanah Di Sekitar Rawa Jombor, Klaten dan Potensinya Sebagai Sumber Belajar Geografi Di Lapangan. *Jurnal Geografi* , *13*(2), 1–13.
18. Jariah, A. (2007). Kelebihan Penduduk dan Konsumsi Berlebihan dalam Kasus Krisis Air Dunia. *Millah*, *6*(2), 7–24. https://doi.org/10.20885/millah.vol6.iss2.art2
19. Jenti, U. B., & Nurhayati, I. (2014). Pengaruh Penggunaan Media Filtrasi Terhadap Kualitas Air Sumur Gali Di Kelurahan Tambak Rejo Waru Kabupaten Sidoarjo. *WAKTU: Jurnal Teknik UNIPA*, *12*(2), 34–38. https://doi.org/10.36456/waktu.v12i2.908
20. Lestari, F., & Susanto, T. (2021). *PEMANENAN AIR HUJAN SEBAGAI PENYEDIAAN AIR BERSIH PADA ERA NEW NORMAL DI KELURAHAN SUSUNAN BARU*. *4*.
21. Medeiros, R. C., de, N., Freitas, B. L. S., Sabogal-Paz, L. P., Hoffmann, M. T., Davis, J., Fernandez-Ibañez, P., & Byrne, J. A. (2020). Drinking water treatment by multistage filtration on a household scale: Efficiency and challenges. *Water Research*, *178*. https://doi.org/10.1016/j.watres.2020.115816
22. Mugagga, F., & Nabaasa, B. B. (2016). The centrality of water resources to the realization of Sustainable Development Goals (SDG). A review of potentials and constraints on the African continent. *International Soil and Water Conservation Research*, *4*(3), 215–223. https://doi.org/10.1016/j.iswcr.2016.05.004
23. Nelson, N., Fahyuan, H. D., Deswardani, F., Nurhidayah, N., & Afrianto, M. F. (2020). Pemberdayaan masyarakat dalam pengolahan air Sungai Batanghari menjadi air bersih menggunakan adsorben biochar. *Riau Journal of Empowerment*, *3*(1), 61–68. https://doi.org/10.31258/raje.3.1.61-68
24. Nenohai, J. A., Minata, Z. S., Ronggopuro, B., Sanjaya, E. H., & Utomo, D. Y. (2023). *PENGGUNAAN KARBON AKTIF DARI BIJI KELOR DAN BERBAGAI BIOMASSA LAINNYA DALAM MENGATASI PENCEMARAN AIR : ANALISIS REVIEW*. *21*, 29–35. https://doi.org/10.14710/jil.21.1.29-35
25. Pasmawati, Y., Renilaili, R., Kusmindari, C. D., Zahri, A., & Hardini, S. (2023). Pengolahan Air Rawa Menjadi Air Bersih. *Jurnal Altifani Penelitian Dan Pengabdian Kepada Masyarakat*, *3*(1), 27–33. https://doi.org/10.25008/altifani.v3i1.317
26. Prasetya, E., & Ruchban, A. (2021). *PELATIHAN PEMBUATAN PENYARINGAN AIR SEDERHANA UNTUK MEMENUHI KEBUTUHAN AIR BERSIH MASYARAKAT TRAINING MAKING SIMPLE FILTRATION OF WATER TO MEET COMMUNITY'S CLEAN WATER NEEDS*. http://ejurnal.ung.ac.id/index.php/jpkm/index
27. Prayogo, T. B. (2015). *Analisis kualitas air dan strategi pengendalian pencemaran air sungai metro di kota kepanjen kabupaten malang*. *6*(2), 105–114.
28. Putra, A. Y., & Mairizki, F. (2019). Analisis Warna, Derajat Keasaman dan Kadar Logam Besi Air Tanah Kecamatan Kubu Babussalam, Rokan Hilir, Riau. *Jurnal Katalisator*, *4*(1), 9. https://doi.org/10.22216/jk.v4i1.4024
29. Putra, A. Y., & Yulia, P. A. R. (2019). Kajian Kualitas Air Tanah Ditinjau dari Parameter pH, Nilai COD dan BOD pada Desa Teluk Nilap Kecamatan Kubu Babussalam Rokan Hilir Provinsi Riau. *Jurnal Riset Kimia*, *10*(2), 103–109. https://doi.org/10.25077/jrk.v10i2.337
30. Rahmawati, A. S., & Erina, R. (2020). Rancangan Acak Lengkap (Ral) Dengan Uji Anova Dua Jalur. *OPTIKA: Jurnal Pendidikan Fisika*, *4*(1), 54–62. https://doi.org/10.37478/optika.v4i1.333
31. Rahmayanti, A., Laily, D., & Hamidah, N. (2019). EFISIENSI REMOVAL BAKTERI PADA

FILTER AIR PAYAU DENGAN MEDIA KARBON AKTIF. In *Journal of Research and Technology* (Vol. 5, Issue 1).
32. Roslinda, E., Hardiansyah, G., Kehutanan, F., Tanjungpura, U., Imam, J., & Pontianak, B. (2019). *TEKNOLOGI MULTI MEDIA FILTER UNTUK MEMPRODUKSI AIR BERSIH DI LAHAN GAMBUT MULTI MEDIA FILTER TECHNOLOGY FOR PRODUCING CLEAN WATER ON PEATLANDS AREA*.
33. Setyobudiarso, H., & Yuwono, E. (2014). *RANCANG BANGUN ALAT PENJERNIH AIR LIMBAH CAIR LAUNDRY DENGAN MENGGUNAKAN MEDIA PENYARING KOMBINASI PASIR-ARANG AKTIF*.
34. Situmorang, M. E., Astiani, D., & Ekyastuti, W. (2019). PENGARUH TINGGI MUKA AIR TANAH PADA POPULASI SERANGGA DI LAHAN RAWA GAMBUT DESA KUALA DUA KABUPATEN KUBU RAYA. *Jurnal Hutan Lestari*, *7*(1), 637–644.
35. Sriyanti, I., Marlina, L., Sanjaya, M. R., Almafie, M. R., & Jauhari, J. (2022). PENGGUNAAN TEKNOLOGI NANO UNTUK MENGHASILKAN FILTER AIR BERSIH BAGI MASYARAKAT PERAIRAN KABUPATEN BANYUASIN. *JURNAL PENGABDIAN KEPADA MASYARAKAT*, *28*(2).
36. Sugeng, B., & Sulardi, S. (2019). Uji keasaman air dengan alat sensor pH di STT Migas Balikpapan. *Jurnal Kacapuri: Jurnal Keilmuan Teknik Sipil*, *2*(1), 65–72.
37. Sweetman, M., May, S., Mebberson, N., Pendleton, P., Vasilev, K., Plush, S., & Hayball, J. (2017). Activated Carbon, Carbon Nanotubes and Graphene: Materials and Composites for Advanced Water Purification. *C*, *3*(4), 18. https://doi.org/10.3390/c3020018

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