J. Publ. Kes. Masy. Ind., 2026; 13(1): pp. 88-95.
P-ISSN: 2407-1625 | E-ISSN: 2581-0901
DOI: https://dx.doi.org/10.20527/jpkmi.v13i1.25787

Original Research Article

Achieving Clean Water: A Simple Filtration Approach for Managing River Water

Mika Vernicia Humairo[1*], Sila Kriscahyanti[1], Azizah Yuniarfika[1], Muhammad Tristan[1], Shiesil Rizqia Amadia[1], Neila Rizqi Famiyah[1], Siti Aisah Binti Mokhtar[2]

[1] Department of Public Health, Faculty of Sport Science, Universitas Negeri Malang, Cakrawala No.5, Sumbersari Street, Malang, 65145, East Java, Indonesia
[2] Department of Community Health, Faculty of Medicine and Health Sciences, University Putra Malaysia, Universiti 1 Street, Serdang, 43400. Selangor, Malaysia
*Corresponding Author, Email: vernicia.humairo.fik@um.ac.id

ABSTRACT

Bango River is one of river in Malang city with its role as a primary source for irrigation and community sanitation. According to data from Indonesian Ministry of Environment and Forestry, it was found that the river suffered from heavy pollution for five consecutive years because of open defecation practices and high sediment loads. This condition creates a critical gap between existing water quality and the hygiene standards required for public health. This study aims to make a filtration for Bango water, so people can use it as their function. This filtration system improved the physical and chemical parameters of Bango River water so can suit with national water sanitation standards. This research used the method of pre and post-test experiments to treat Bango River water using simple filtration. The results showed a marked improvement in water quality, with three parameters, turbidity decreased by 63.7**%** (from 12.65 NTU to 4.59 NTU), meeting the sanitation water standards of the Minister of Health Regulation No. 2 of 2023. TDS levels were slightly reduced from 219.6 mg/L to 212.6 mg/L, while Dissolved Oxygen (DO) increased from 4.18 mg/L to 5.16 mg/L. The study concludes that the Multi Stage Filtration method is a viable, low-cost solution for improving river water quality at the household level. Therefore, it can be reducing three out of five water quality parameters that were tested.

Keywords: Chemical quality; Filtration; Physical quality; River; Water

INTRODUCTION

Water is a basic human need, necessary for both consumption and daily activities. The standard requirement for clean water per person for all daily needs is 144 liters (Pangesti & Ariesmayana, 2022). Clean water can be obtained from various sources, including groundwater such as wells, surface water like rivers, rainwater, and springs (Sari, et al, 2023). To make water usable, it must be processed and managed. River water is a surface water resource that can be used as a source of water for community activities. According to the United Nations World Water report, the global water supply is expected to decrease significantly by 2025, which is a concern due to the increasing demand for clean water as the population grows (Boretti & Rosa, 2019) and (UNESCO,2018). However, Indonesia, as a maritime country with a larger area of water than land, should not face water scarcity issues. However, data from 2020 shows that 59.05% of rivers experienced severe pollution, 26.62% experienced moderate pollution, and 8.87% experienced light pollution. This affects the community's ability to meet their clean water needs. In Jawa Timur, the pollution in rivers like Bengawan Solo and Brantas has been severe for five consecutive years from 2016 to 2020.

If the condition of the main river is polluted, it is possible that the watershed area (DAS) is also polluted (Valiant, 2014). From the statistical data on the water quality of the Brantas

J. Publ. Kes. Masy. Ind., 2026; 13(1): pp. 88-95.
P-ISSN: 2407-1625 | E-ISSN: 2581-0901
DOI: https://dx.doi.org/10.20527/jpkmi.v13i1.25787

River in 2016 to 2020, the Brantas River experienced severe pollution. One of the branches of the Brantas River basin in Blimbing Subdistrict, Malang City, namely the Bango river, is located on Tuntang Street, Blimbing Subdistrict, with a distance of about 1.6 km from the branching of the Brantas River at the Bunul Bridge. This river passes through Bunulrejo village and is used as a source of water for irrigation of rice fields and for hygiene and sanitation purposes such as washing. However, there are often people who defecate in the river. The polluted condition of river water can come from changes in environmental conditions and activities carried out by humans (Nursaini & Harahap, 2022). River water can be said to be polluted if its quality is no longer in accordance with the quality standards set in the laws and regulations (Prasetyo, Syech, & Malik, 2020). Water quality is a state of water quality measured based on certain parameters and certain methods based on applicable regulations. Therefore, it is necessary to monitor water quality in accordance with the quality standards set in the Indonesian Ministry of Health Regulation No.2 of 2023. Water suitable for public use must meet certain requirements, including physical, chemical, biological, and radioactive properties. This is because water used by the public, whether clean or drinking water, must not cause harmful health effects (Rismawati, Husaini, & Khairiyati, 2016).

In addition, water management and treatment efforts are needed so that polluted water can be reused by name based on its quality standards. One of the efforts that can be done is by filtering water using simple filtration. Filtration is a method of purifying or clarifying water by filtering water through certain layers that have their respective functions (Purwoto, Purwanto, & Hakim, 2015). In a similar study conducted by (Erawati, Hartini & Aryani, 2023) it was found that the filtration method was effective enough to improve the quality of peat water in physical and chemical parameters. Similarly, (Maksuk & Priyadi, 2022) showed that the river water filtration method helped reduce iron, turbidity, and odor levels in river water.

The complex pollutant profile of the Bango River, which includes high turbidity and organic matter from open defecation (BABS), requires a treatment system that is both effective and sustainable for the local community. Multi-layer filtration is chosen as the primary method because it offers a synergistic approach to water purification. According to Asmadi et al. (2011), this tiered system is essential for surface water treatment to prevent rapid clogging of the filter media. The combination of silica sand, zeolite, and activated charcoal provides an optimal balance for reducing physical turbidity and chemical ions like TDS.

Based on Sebayang, et al (2025) research, the silica sand in multi-layer filtration effectively removes suspended solids as vital for lowering TSS levels. Activated carbon further purifies the water by adsorbing organic substances and odors, while zeolite facilitates the exchange of ions to sequester heavy metals and mitigate hardness. At the end that multi-layer filtration can decrease the turbidity from 5,6 NTU to 0.7 NTU. This multi-layer filtration technology is particularly suitable for the Bango River area. In this research also add some material, not only using zeolite, activated carbon, and silica sand, but also using cotton and palm fiber. Due to its low operational cost and ease of maintenance, this simple filtration method can be used as an appropriate technology for the Bunulrejo community to improve the physical and chemical quality of river water so that the community can utilize it as clean water.

This study evaluates the effectiveness of a simple multi-stage filtration system in improving the physical and chemical quality of water from the Bango River. Changes in key water quality indicators, including turbidity, total dissolved solids (TDS), pH, temperature, and dissolved oxygen (DO), are measured before and after filtration. The research further investigates the potential of affordable, locally available materials such as silica sand, zeolite,

J. Publ. Kes. Masy. Ind., 2026; 13(1): pp. 88-95.
P-ISSN: 2407-1625 | E-ISSN: 2581-0901
DOI: https://dx.doi.org/10.20527/jpkmi.v13i1.25787

activated carbon, palm fiber, and cotton for household water treatment. The findings aim to provide practical evidence supporting sustainable, community-based approaches to mitigating river water pollution and enhancing the safety of river water for sanitation and daily use in affected areas.

METHODS

Research Design

This research was carried out research design with chemical parameters were tested on river water used by the community based on clean water quality standards. Where the results will be used as the basis for determining water treatment instruments with filtration technology to produce physical and chemical quality of water that is in accordance with clean water quality standards, so that it can be used as a means of irrigation water and a source of clean water that the community has been using from river water. This research is an experimental study conducted by pure researchers in which researchers use pre-test and post-test experiment to river water samples before and after filtration in reducing turbidity values and TDS levels and increasing DO, pH and temperature levels in river water. To find out the value or level in river water parameters before filtering, the researcher first tests at the Environmental Health-Epidemiology Lab, FIK UM. Measurements are made using appropriate tools to measure the required parameters. These tools include a TDS meter, DO meter, pH meter and water thermometer. In these measurements, the researcher prepares two containers for measurement in which one container contains clean water as a control while the other container contains river water samples which will be tested for parameter content. Testing of each parameter is carried out three times then the results of the measurements are averaged to get an accurate value.

Instruments and Procedures

Study by Sitorus (2022) demonstrated that varying the compositions of activated carbon, zeolite, and silica sand (with specific thickness ratios is about 15cm:10cm:10cm) effectively improves water quality in accordance with the health standards set by the Minister of Health. Another research from Izarna (2022) indicated that the utilization of silica sand, zeolite, and activated carbon is capable of reducing turbidity levels by up to 87.27% and iron (Fe) content by 89.16%. According to Asmadi et al. (2011) in the book *Water Treatment Technology*, each material serves a specific technical purpose: silica sand acts as a physical filter to remove suspended solids and silt; zeolite functions as an ion exchanger to bind metals and hardness; and activated carbon acts as an adsorbent to remove odors, colors, and organic compounds.

In the measurement after filtration, two containers were also prepared to measure water sample parameters, one container containing clean water as control water and the other container containing filtered river water samples. Steps in measuring parameters in river water samples are measured three times and then the measurement results are averaged to produce accurate values so that the results of differences in parameter values before and after filtration can be known (Iskandar, et al, 2022). In making this filtration device, researchers used 5 filter media, namely palm fiber, silica sand, zeolite sand, activated charcoal/carbon, and cotton arranged in plastic bottles. The steps of making a river water filtration device are as in Figure 1. The Filtration Device. The filtration was designed using a vertical stacked media configuration housed within a cylindrical container. The total active filtration depth consists of

J. Publ. Kes. Masy. Ind., 2026; 13(1): pp. 88-95.
P-ISSN: 2407-1625 | E-ISSN: 2581-0901
DOI: https://dx.doi.org/10.20527/jpkmi.v13i1.25787

several layers with a total height of 13 cm, arranged to optimize physical filtration, adsorption, and ion exchange processes. The procedure was followed the step. First of all, prepare a 1500 ml used bottle, then cut it into 2 parts using a cutter. Place the top of the bottle upside down, and then prepare palm fiber filter material/media, silica sand, zeolite sand, activated charcoal/carbon and wash it with clean water. Follow to arrange the washed filter media into bottles in the order from the bottom: cotton, zeolite sand, cotton, activated charcoal, cotton, palm fiber, cotton, and silica sand. Then, test the physical (turbidity, TDS) and chemical (pH,) parameters of unfiltered water samples and flow the water sample into the filtration device and collect the filtrated water. The last method is retesting the physical and chemical parameters of water samples that have gone through the filtration process.

Figure 1. The Filtration Device

Data Analysis

In this study, data analysis was descriptive method that carried out using the measurement results of river water samples before and after filtration. Furthermore, the measurement results are displayed in tabular form to compare the differences in the measurement results. The research data is then compared with clean water quality standards that refer to Indonesian Ministry of Health Regulation No 2 of 2023 concerning the Implementation of Environmental Protection and Management.

RESULTS AND DISCUSSION

Water quality measurements were conducted on Friday, March 8, 2024, at the Faculty of Sport Science Universitas Negeri Malang Environmental Health-Epidemiology Laboratory. During filtration, the sample water passes through eight layers. Throughout this process, the water undergoes physical and chemical changes. The results of this process are presented in the Figure 2. Water Quality Measurement. The comparative analysis of water quality parameters before and after filtration is illustrated in Table 1. The most prominent improvement was observed in turbidity, which dropped sharply from 12.65 NTU to 4.59 NTU, representing a high efficiency in removing suspended particles. TDS levels showed a slight reduction from 219.6 mg/L to 212.6 mg/L, indicating that while physical filtration is effective, dissolved solids require longer contact time or more specialized media for total removal. Furthermore, the DO level increased from 4.18 mg/L to 5.16 mg/L, suggesting an improvement in the water's oxygenation post-treatment. Meanwhile, temperature and pH remained stable, staying within the optimal range for sanitation water standards.

J. Publ. Kes. Masy. Ind., 2026; 13(1): pp. 88-95.
P-ISSN: 2407-1625 | E-ISSN: 2581-0901
DOI: https://dx.doi.org/10.20527/jpkmi.v13i1.25787

Table 1. Comparison of Water Quality Parameters Before and After Treatment

Parameter	Pre-Test	Post-Test	Effectivity (%)
Temperature (°C)	25.7	25.93	0.90%
TDS (mg/L)	219.6	212.6	3.19%
Turbidity (NTU)	12.65	4.59	63.72%
pH	7.47	7.78	4.15%
DO (mg/L)	4.18	5.61	34.21%

Temperature

Based on Figure 1. Water Quality Measurement, that were carried out three times, it was found that the simple filtration process did not provide significant change to the temperature of the water. The average temperature measurement result before filtration was 25.7°C and after filtration the was 25.93°C. The results of this research are in line with research conducted by (Trianah & Sani, 2023) which states that simple filters do not affect water's temperature and there are no significant changes to temperature. If the water being tested has a temperature above or below air temperature then the water contains certain substances (for example, quite a lot of phenol dissolved in the water) or a certain process is taking place (the process of decomposition of organic matter by microorganisms which produces energy) that emits or absorbs energy in water. Based on Health Regulation No. 32 of 2017, the temperature of water that has gone through a simple filtration process is in accordance with quality standards, namely within a range of approximately 3°C from environmental temperature. In the research conducted (Tumimomor, et al, 2020) it was also explained that there was no significant change in the water temperature before and after filtration or it could be said that the temperature value was relatively constant or unchanged.

Total Dissolved Solid (TDS)

In a simple filtration process, there are quite significant changes in the TDS (Total Dissolved Solid) parameter. The TDS measurement before filtration was 219.6 mg/L and after filtration the result was 212.6 mg/L. Although the reduction was relatively modest, that was only 3.1%, it indicates that the multi-layer filter, particularly the zeolite and activated carbon layers, contributed to the removal of some dissolved ions. This slight decrease suggests that for more effective TDS removal, an increased media volume or a slower flow rate may be required to enhance the ion exchange and adsorption processes (Crittenden et al., 2012). In this way, a simple filtration tool has quite an effect on TDS. According to research (Adi & Puspita, 2014) the fiber layer on the filter functions as an agent that can reduce turbidity levels which in turn, has a reducing effect on TDS and TSS levels. The function of the fibers themselves is as a filter for fine dirt. Apart from that, activated charcoal has a role in reducing TDS levels in water because activated charcoal has a high absorption/adsorption capacity on branches in the form of solution or vapor.

On the other hand, the cotton layer in the filter is useful in reducing TDS levels which is caused by the cotton's ability to filter particles and small organisms in the water. The thickness of the filtration layer greatly influences the quality of the filtration water, the thicker the layer, the better the water produced. Zeolite sand, silica sand and activated charcoal also have a significant role in reducing excessive solids in water. This is in line with research conducted by (Nainggolan et al, 2019). Based on Health Regulation No. 32 of 2017, the TDS value is safe.

J. Publ. Kes. Masy. Ind., 2026; 13(1): pp. 88-95.
P-ISSN: 2407-1625 | E-ISSN: 2581-0901
DOI: https://dx.doi.org/10.20527/jpkmi.v13i1.25787

Turbidity

The simple filtration process provides a very significant change in water turbidity. Turbidity measurements before filtration were 12.65 NTU and after filtration the results were 4.59 NTU. That way a simple filtration tool is very influential on turbidity compared to other parameters. This is due to the filtration material in the form of silica sand which traps impurities in the sample water and then continued with fibers which function as particle filters and flatten the flow of water (Agustina et al, 2022)

According to research (Agustina et al, 2022) silica sand with a thickness of 15 cm can reduce the turbidity rate by 90.4%, while in this study silica sand and palm fiber with a thickness of 2 cm each can reduce the turbidity rate by 56%. When viewed from on Indonesian Ministry of Health Regulation No 2 of 2023. which states the quality standard of the turbidity parameter is 25 NTU. So, it can be concluded that the concentration of turbidity of filtered water meets environmental health quality standards.

Potential of Hydrogen (pH)

The simple filtration process does not provide significant changes to pH. The pH measurement before filtration is 7.47 while after filtration the result is 7.78. Although there is a difference in numbers between before and after pH measurement, there is no significant increase. Silica sand in the filtration component is quite effective in raising the pH level of raw water. This is because the water flowing in the filtration process experiences collisions or collisions between water molecules so that there are air bubbles and ion reactions occur in water that release O ions then result in excess water H + ions resulting in an increase in pH.

Apart from silica sand, activated charcoal can also increase the pH value of water. Evidenced in research (Fadhilah & Wahyuni, 2016) which compared 2 types of water filters, namely without activated charcoal and with activated charcoal. The results of the filter without activated charcoal show a decrease in pH value and the filter with activated charcoal shows a significant increase in pH value. The study also wrote that activated charcoal with a thickness of 10 cm can raise the pH by 17%, in contrast to this study which raised ph by 2.8% with a thickness of 2 cm. In water with a pH below the value of 4 will cause a sour taste, while the value above 8.5 will cause a basic taste. Another research from Utari et al (2022) zeolite, silica sand, and activated carbon media can lower pH over a long period of operation. Furthermore, a small flow rate increases the contact time of the contaminant with the media, resulting in optimal pH absorption by the three media.

Dissolved Oxygen (DO)

The simple filtration process provides a very significant change to DO. Mean of DO measurement before filtration was 4.18mg/l and after filtration the result was 5.61 mg/l. So, a simple filtration tool is able to increase the value of DO which is directly supported by filter media in the form of zeolite sand. The function of zeolite sand is to remove chemical pollutants and bind E coli bacteria. In this study, zeolite sand with a thickness of 2 cm can increase the DO value by 4%.

CONCLUSION

Knowing the problem of pollution in the Bango River, a study was conducted to improve the physical and chemical quality of water in the Bango River with the aim that people can use Bango river water as a source of clean water. This research was carried out with pre and post

experimental methods through river water treatment using simple filtration. The filtration device made has five types of media namely palm fiber, silica sand, zeolite sand, activated charcoal/carbon, and cotton arranged in plastic bottles. The results obtained from this filtration process are three physical and chemical parameters of river water that have improved the physical and chemical quality of Bango River water. The system successfully remediated three out of five tested parameters. First, turbidity was reduced by 63.7% (from 12.65 NTU to 4.59 NTU), TDS decreased from 219.6 mg/L to 212.6 mg/L, and Dissolved Oxygen (DO) levels increased from 4.18 mg/L to 5.61 mg/L. These results indicate that the filtered water meets the physical requirements for sanitation water according to the Minister of Health Regulation No. 2 of 2023. From the results of this experiment, it can be concluded that this simple filtration device is able to reduce three of the five parameters tested.

REFERENCES

Adi W, Puspita Sari S, (2018). Efektifitas filter bahan alami dalam perbaikan kualitas air masyarakat nelayan wilayah pesisir Kabupaten Bangka. Akuatik, Jurnal Sumberdaya Perairan, 8 (2). 34 – 39.

Agustina N, Chandra C, Hadi, Z, Fauzan A, Rahman, E. (2022) Pelatihan pembuatan filter air sederhana skala rumah tangga di Kelurahan Gambut. Jurnal Abdimas Kesehatan, 4 (01), 96–100.

Asmadi, Khayan, & Kasjono, H. S. (2011). Teknologi Pengolahan Air Minum. Yogyakarta: Gosyen Publishing.

Boretti A, Rosa L. (2019). Reassessing the projections of the World Water Development Report. NPJ Clean Water, 2(1). https://doi.org/10.1038/s41545-019-0039-9

Crittenden, J. C., Trussell, R. R., Hand, D. W., Howe, K. J., & Tchobanoglous, G. (2012). MWH's Water Treatment: Principles and Design. John Wiley & Sons.

Erawati E, Hartini E, Aryani L. (2023). Pengolahan air sungai gambut dengan metode filtrasi. Jurnal Kesehatan, 22(2):355–361.

Fadhillah M, Wahyuni D. Efektivitas penambahan karbon aktif cangkang kelapa sawit (Elaeis guineensis) dalam proses filtrasi air sumur. Jurnal Kesehatan Komunitas. 2016;3(2):93–98. https://doi.org/10.25311/jkk.vol3.iss2.110

Iskandar Y, Wahyuni RS, Rohmat R, Darwis R, Oktaviani I. (2022) Filtrasi air dengan menggunakan alat sederhana untuk menghasilkan air bersih bagi warga Desa Cikurutug Kecamatan Cireunghas. PengabdianMu: Jurnal Ilmiah Pengabdian Kepada Masyarakat, 7(1):74–79. https://doi.org/10.33084/pengabdianmu.v7i1.2301.

Izarna, A. D., & Jubaedah, S. (2022). Efektivitas Kombinasi Media Pasir Silika, Zeolit, dan Arang Aktif dalam Menurunkan Kadar Kekeruhan dan Besi (Fe) pada Air Sumur Gali. Jurnal Riset Teknologi Lingkungan, 3(1), 12-20.

Maksuk, Priyadi KA. (2022). Pengolahan air sungai sebagai sumber air bersih masyarakat di kawasan pertanian dengan penyaringan air sederhana. Jurnal Pengabdian Pada Masyarakat, 6(2):352–356.

Minister of Health of the Republic of Indonesia. (2023). *Regulation of the Minister of Health Number 2 of 2023 concerning Environmental Health Quality Standards and Water Health Requirements*. Jakarta: Ministry of Health RI.Nainggolan AA, Arbaningrum R, Nadesya A, Harliyanti DJ, Syaddad MA. Alat pengolahan air baku sederhana dengan sistem filtrasi. Widyakala Journal. 2019;6:12. https://doi.org/10.36262/widyakala.v6i0.187

Nursaini D, Harahap A. (2022). Kualitas air sungai. BIOEDUSAINS: Jurnal Pendidikan Biologi dan Sains, 5(1):312–321. https://doi.org/10.31539/bioedusains.v5i1.3519

Pangesti FSP, Ariesmayana A. (2022). Tinjauan analisis perhitungan kebutuhan air bersih dan air limbah untuk perencanaan sistem penyaluran air limbah di Perumahan Bumi Ciruas Permai 1 Kabupaten Serang. Journal of Sustainable Civil Engineering (JOSCE), 4(01):1–9. https://doi.org/10.47080/josce.v4i01.1831

Pemerintah Republik Indonesia. Peraturan Pemerintah Nomor 22 Tahun 2021 tentang Pedoman Perlindungan dan Pengelolaan Lingkungan Hidup. Sekretariat Negara Republik Indonesia. 2021;1(078487A):483. Available from: http://www.jdih.setjen.kemendagri.go.id/

Prasetyo MY, Syech R, Malik U. (2020). Pemetaan tingkat pencemaran air Sungai Siak sebelum dan sesudah melalui sistem filtrasi dengan dua kali penyaringan berdasarkan parameter fisis. Al-Fiziya: Journal of Materials Science, Geophysics, Instrumentation and Theoretical Physics, 3(1):15–20. https://doi.org/10.15408/fiziya.v3i1.14729

Purwoto S, Purwanto T, Hakim L. (2015). Penjernihan air sungai dengan perlakuan koagulasi, filtrasi, absorbsi, dan pertukaran ion. Jurnal Teknik WAKTU UNIPA. 13(2):45–53. https://doi.org/10.36456/waktu.v13i2.60

Rismawati, L, Husaini, Khairiyati, L. (2016). Efektifitas Pengolahan Air Minum DItinjau dari Kualitas Air Minum Berdasarkan Parameter Fisik, Kimia, dan Biologi di IPA II Pinus PDAM Intan Banjar. Jurnal Publikasi Kesehatan Masyarakat Indonesia 3(2): 74 – 81. 10.20527/jpkmi.v3i2.2753.

Sari N, Paujiah P, Putri NA, (2023). Rusliyani R. Filtrasi air sederhana sebagai solusi peningkatan kualitas air untuk wilayah sekitar perkebunan kelapa sawit. Jurnal Filtrasi Air Sederhana, 3(2):73–83.

Sebayang, ISD., Sinulingga, JF., Kurniadhi, W., Kinasih, RK. (2025). Penerapan Teknologi Penyaringan Air untuk Konsumsi Langsung di Desa Drawati, Bandung Barat. Jurnal Abdimasku, 8(2): 808-815.

Sitorus, B., & Pane, E. (2022). Analisis Variasi Ketebalan Media Filter Pasir Silika, Zeolit, dan Karbon Aktif terhadap Peningkatan Kualitas Air. Einstein: Jurnal Hasil Penelitian Bidang Fisika, 10(2), 45-52. https://doi.org/10.24114/einstein.v10i2.34567

Syech R, Restina R, Malik U. (2018). Pemanfaatan karbon sebagai filter untuk pengendalian pencemaran air sungai oleh logam Zn (seng) dari limbah pabrik kelapa sawit di Kabupaten Kuansing. Komunikasi Fisika Indonesia, 15(1):28. https://doi.org/10.31258/jkfi.15.1.28-35

Trianah Y, Sani S. (2023). Keefektifan metode filtrasi sederhana dalam menurunkan kadar Mn (mangan) dan Fe (besi) air sumur di Kelurahan Talang Ubi Kabupaten Musi Rawas. Jurnal Deformasi, 8(1). 90 – 99.

Tumimomor F, Palilingan S, & Pungus M. (2020). Pengaruh Filtrasi Terhadap Nilai Ph, Tds, Konduktansi Dan Suhu Air Limbah Laundry. Charm Sains: Jurnal Pendidikan Fisika UNIMA, 1(1). 1 – 9.

UNESCO, UN World Water. The United Nations world water development report 2018: nature-based solutions for water. 2018. Available from: https://unesdoc.unesco.org/ark:/48223/pf0000261424

Utari P, Masrulita, Ibrahim I, Suryati, & Sulhatun. (2022). Efektifitas Pengolahan Air Sumur Menggunakan Media Zeolit, Pasir Silika, dan Karbon Aktif pada Alat Roughing Filter

Aliran Horizontal. Chemical Engineering Journal Storage. 2(3): 127 – 142. https://doi.org/10.29103/cejs.v2i3.6023

Valiant R. Tantangan dalam pengelolaan sumberdaya air untuk mencapai lingkungan lestari berkelanjutan: potret Daerah Aliran Sungai (DAS) Brantas. Makalah disajikan untuk Seminar Pekan DAS Brantas 2014. (2014). Available from: https://www.academia.edu/download/33954522/201404_PDB_DT_Kualitas_Lingkungan_Brantas_LowRes_7.pdf