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Clean Water Processing through a Filtration System using a Multimedia Filter on River Water in Babak Village, West Lombok Regency

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Abstract: The quality of river water is influenced by natural factors and human factors. For humans, the river becomes a place to carry out various activities. The type of research used is an experiment and the object of the research is the water of the Babak River, West Lombok Regency which is processed using a filtration method with a simple filtration system from PVC pipes designed with a filter media arrangement, namely zeolite with a thickness of 5 cm, silica sand with a thickness of 15 cm, activated carbon with a thickness of 10 cm, filter foam with a thickness of 5 cm. This study aims to determine the effects of river water quality testing before and after filtration, as well as the effectiveness of the filter media in reducing pollutant levels. The parameters tested are pH, TSS, TDS, COD, BOD, DO, and Total Coliform. Testing was carried out at the Environmental Laboratory of the Mataram Environmental Engineering College. The test results showed that the water from the Babak River did not meet the standards for clean water. The laboratory tests revealed that the water content value exceeded the quality standards for Class III, as specified in Government Regulation No. 22 of 2021, particularly for the BOD and DO parameters. Therefore, further testing was necessary. According to the filtering results, the effectiveness value of the filter media in the upstream part of the river was 35%, in the middle part was 40%, and in the downstream part was 33% for the BOD parameter. For the DO parameter, the effectiveness values of the filter media in the upstream, middle, and downstream parts of the river were 43%, 58%, and 64%, respectively. Filtration can be a medium to reduce BOD and DO levels, making it a renewable alternative that can be used for other water sources.

Keywords: Filtration; Filter Media; River Water.

Introduction

Water is a fundamental necessity for humans and other living organisms, as it is a vital requirement for survival. Clean water is water used for daily needs that meets health requirements [1]. Clean water is obtained from various water sources; however, not all water sources meet these needs due to pollution caused by both human activities and natural processes. The Earth's water area is larger than its land area, making water issues a significant problem, including the provision of clean water, water pollution, and water distribution [2].

Rivers are highly dynamic systems, and human activities in the river basin can affect water quality from upstream to downstream. Activities in the river basin, such as residential areas, agriculture, and industry, release pollutants into the river flow [3]. River water suitable for use and safe for health is water that meets the quality standards for physical, chemical, and biological parameters stipulated in Government Regulation Number 22 of 2021 concerning the Implementation of Environmental Protection and Management. To meet these quality standards, raw water must be processed into clean water before it can be used as potable water [4].

River water generally provides a significant amount of water supply, both quantitatively and continuously [5]. However, its quality is vulnerable to environmental pollution. River water quality, which is often raw water that does not meet health requirements, can lead to waterborne diseases, including dysentery, typhoid, gastroenteritis, and other illnesses [6].

Besides quantity issues, the problem of providing clean water also stems from ensuring water quality meets clean water specifications. Good water is clean, meaning it is odorless, clear, not cloudy, and does not leave sediment. While various minerals found in water are essential for the body, some are not necessary for human health and can even be harmful [7].

There are three groups of measures used to assess water quality in a water system: physical, chemical, and biological. Furthermore, water pollution is also influenced by the influx of liquid waste from agro-industry and organic waste from residential or household activities [8].

One effective method of clean water treatment is filtration. Filtration is a process that involves flowing water through a filtration medium composed of granular materials of a specific diameter and thickness. Filtration can also be considered a cost-effective clean water treatment method that is accessible to the public [9].

Filtration effectiveness is determined by the type and characteristics of the media used. The thicker and more abundant the material used, the cleaner the filtered water will be, as the impurities in the water have been filtered through the material. This is due to the material's thickness, which enables more effective impurity filtering [10].

Filtration is a water purification method that uses filters. Some of the materials in this filtration system are zeolite, silica sand, activated carbon, and sponges. These

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materials function as adsorbents to absorb organic and inorganic substances in the river flow. Zeolite filters out large debris in the water, such as leaves and moss, and creates gaps for water to escape through holes [11].

Activated carbon purifies the water, removes odors, and filters chlorine. Sand can optimally purify water. The thicker the sand used, the clearer the water produced. This is because the sand is the thickest in the filter. The sponge also absorbs sediment that makes the water cloudy [12].

The Babak River is a river in West Lombok Regency, flowing from Teratak Village in Central Lombok Regency and into Taman Ayu Village, Gerung District, West Lombok Regency. The river's water is also widely used by local residents for clean water. These activities include bathing, washing clothes, and fishing. The problem that arises is that the river water becomes a dumping ground for various types of waste, including organic, inorganic, and liquid waste. Based on this background, the researcher aims to conduct a study on testing river water quality using a filtration system with a multimedia filter to determine the effectiveness of the filter in reducing chemical parameters in river water.

Research Methods

This research is considered experimental and quantitative in nature. Experimental research is systematic, logical, and meticulous in its control over conditions. In conducting an experiment, researchers manipulate a stimulus, treatment, or experimental conditions and then observe the effects of the treatment or manipulation.

Sampling Location

Sampling locations were located at three points along the Babang River. he first point was in Teratak Village, North Batukliang District, Central Lombok, with coordinates 8°45'52"S 116°11'47"E. The second point was in Rumak Village, Kediri District, West Lombok, with coordinates 8°40'06"S 116°08'46"E. The third point was in Taman Ayu Village, Gerung District, West Lombok, with coordinates 8°39'34"S 116°04'08"E. The research location was the Environmental Laboratory of the Mataram Environmental Engineering College. The object of this study was to treat river water using a multimedia filtration system. The parameters tested were physical (temperature, TSS, TDS), chemical (pH, COD, BOD, DO), and biological (total coliform).

The tools used in this research include 3 inch 50 cm PVC pipe, 1/2 inch 5 cm PVC pipe, pipe glue, pipe joints, geotextile fabric, a pipe saw, a Thermometer, pH meter, beaker, filter paper, furnace, analytical balance, 100 ml Erlenmeyer flask, glass funnel, 100 ml graduated cylinder, and crush cup [13].

The materials used in this study were 4-30 mesh zeolite, 5-30 mesh silica sand, activated carbon, and foam filter mat and river water sample, Tissue, Manganese sulfate MnSO4 40% 1 ml, Alkali/potassium iodide azide (NaOHKl) 1 ml, Concentrated sulfuric acid (H2SO4) 1 ml, Titration solution Sodium thiosulfate(Na2S2O3) 0.25 N, Ferrous indicator, BGLB 2% media, LBDS media, LBSS media, sterile distilled water, 70% alcohol, and matches [14].

River Water Sampling Technique

River water sampling uses the grab sampling technique (instantaneous sampling), which is not affected by the season. Samples are taken at three points using the following sampling procedure: Prepare sterilized equipment before use in river water sampling, Rinse equipment or containers twice with the water sample to be collected, Place the sample bottle into the river water at a 45° angle against the river current and close the bottle cap, Label the bottle and place it in a cool box. The samples are ready to be taken to the laboratory for testing on the filtration equipment and for subsequent water quality testing before and after treatment [15].

Making Filtration Media

Cut a 3-inch PVC pipe into four pieces, each 40 cm long. Drill a hole in the bottom of the pipe to serve as an outlet and insert a 5 cm long ½-inch PVC pipe. Prepare the materials used for simple water filtration, including silica sand, zeolite gravel, pre-washed activated carbon, and an Aquadine filter mat sponge. Prepare the pipe glue, a 3-inch pipe cap, and the necessary pipe connections. Insert the materials into the cut pipes. Zeolite in pipe a, silica sand in pipe b, activated carbon in pipe c, and sponge in pipe d. Assemble the material inserted into the pipes. Use geotextile fabric as a barrier between the zeolite and silica sand, as well as between the activated carbon and the Aquadine sponge. Glue all pipe sections together using pipe glue and a glue gun to ensure there are no gaps at the pipe joints [16].

Phisycal Parameter Examation

Temperature

Immerse the thermometer directly into the test sample and leave it for 2 to 5 minutes until the thermometer shows a stable value. Record the thermometer reading without first removing the thermometer from the water [17].

TSS

Prepare 100 ml of sample in a 100 ml measuring cylinder. Weigh the empty filter paper and record the initial weight. Prepare the filtering apparatus and moisten the filter with a small amount of distilled water. Filter the sample into an Erlenmeyer flask using filter paper until the process is complete. Carefully transfer the filter paper using tweezers from the filtering apparatus to a crucible. Dry in a furnace/hot plate for 15-20 minutes at a temperature of 1030°C to 1050°C. Then, cool and weigh until a constant weight is achieved [18].

TDS

Prepare a 100 ml sample. Prepare a filtering apparatus, then moisten the filter with a small amount of distilled water. Stir the sample until homogeneous, then transfer 50 mL to a measuring cylinder. Then, place the sample into the filtering apparatus and wait until all the sample passes through the filter. Transfer 3 ml of the filtered sample to a crucible. Dry in a furnace/hot plate for 15-20 minutes at a temperature of 1030°C to 1050°C. Then, cool and weigh until a constant weight is achieved [19]

Chemical Parameter Examanation

pH

Universal pH / Litmus Paper is performed by dipping litmus paper into the sample to be tested for acidity for 5 seconds. Measure the pH of the sample and record the result [20].

COD

Prepare a river water sample. Pipette 10 ml of the water sample into a 100 ml Erlenmeyer flask. Add 5 ml of K2Cr2O7 to the 100 ml Erlenmeyer flask. Add 10 ml of concentrated H2SO4 and cover with a watch glass. Let stand for 30 minutes. After 30 minutes, add 7.5 ml of distilled water. Add a drop of ferroin indicator and mix until the sample turns slightly greenish. Titrate with 0.1 N ferrous ammonium sulfate solution (from the green solution to orange). Note and record the titration volume [21].

BOD and DO

Prepare river water samples. Incubate for 5 days in a dark room for the DO5 sample and without incubation for the DO0 sample. Each sample is 125 ml. Add 1 ml of 40% manganese sulfate (MnSO4) solution, homogenize, and let stand for several minutes. Add 1 ml of alkali/potassium iodide azide (NaOHKl), then let stand for several minutes until a brown sediment appears. Transfer 12.5 mL of the test sample, containing a large amount of sediment, to a new Erlenmeyer flask. Add 1 ml of concentrated sulfuric acid (H2SO4) solution until the sediment dissolves. This is done in a fume hood. Titrate with 0.25 N sodium thiosulfate (Na2S2O3) solution until a light-yellow color forms. Add starch indicator until a bluish color appears. Titrate again until the bluish color disappears. Record the total titration volume [22].

Biological Parameter Examination

Total Coliforms

The total coliform test begins with a multi-stage dilution. Prepare 9 test tubes and label each tube with 10-3, 10-4, and 10-5. Fill each test tube with 9 mL of sterile, distilled water, measured using a graduated cylinder. Add 1 mL of the river water sample to each tube containing sterile distilled water using a pipette. Use a dropper to mix the 10^{-3} dilution tube and shake until homogeneous. Add 1 ml of the 10^{-3} dilution sample to the 10^{-4} dilution tube and shake until homogeneous. Add 1 mL of the 10-3 dilution sample to the 10^{-5} dilution tube and vortex until homogeneous [24].

Next, conduct a presumptive test by fixing the mouth of the LBDS media tube in a Bunsen burner, then adding 5 mL each from the 10^{-3} dilution tube to three LBDS media tubes. Then, fix the test tubes and cap them with cotton. Fix the mouth of the LBSS media tube, then add 1 mL each from the 10-4 dilution tube to three LBSS media tubes. Then, fix the test tubes and cap them with cotton. Fix the mouth of the LBSS media tube, then add 0.5 ml each from the 10^{-5} dilution tube to three LBSS media tubes. Then fix the test tubes and cap them with cotton. Gently mix all the tubes to ensure the sample is evenly distributed throughout the medium. Incubate all the tubes at 37°C for 24-48 hours. Observe the presence of air bubbles in the Durham tube and note the code of the tube that positively emits gas, and observe the color change that occurs. Determine the MPN value for Coliform based on the MPN table.

The next step is to conduct a confirmatory test by taking water samples from the positive LBDS and LBSS tubes, which are indicated by the presence of bubbles in the Durham tube and a change in the color of the media. Incubate the BGLB media at 37°C for 24-48 hours. The presence of gas in the BGLB confirms the presence of coliform in the sample. Record the number of tubes that show a positive confirmatory test.

Data Analysis

A descriptive quantitative data analysis technique was used to calculate the effectiveness of water quality parameter reduction before and after the application of filtration equipment. Process effectiveness is a value that indicates the ratio between the value of the parameters entering a process and the value of the parameters leaving the process.

Results and Discussion

The Babak River Basin is one of the rivers located in Lombok, West Nusa Tenggara. Administratively, the Babak River Basin is located in West Lombok and Central Lombok Regencies. According to data from the Nusa Tenggara Water Resources Management Agency (BWS), the Babak River Basin covers 259.17 km², and the river is 54.89 km long. Geographically, it is located between 8°25'15.51" South Latitude and -8°40'20.98" East Longitude and 116°4'7.66" East Longitude to 116°24'50.95" East Longitude.

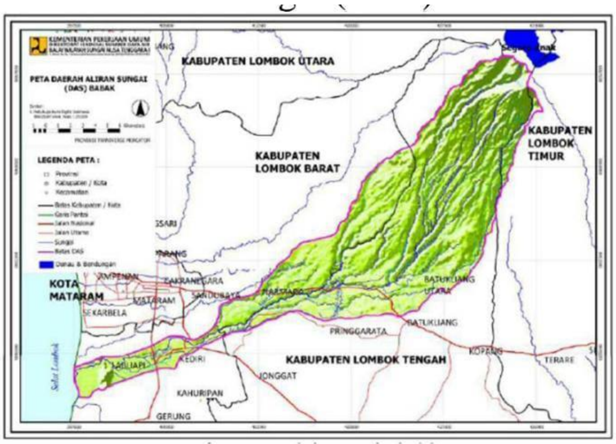


Figure 1. Babak Watershap Location Map.

The river water is used by the surrounding community for daily activities, such as washing, bathing, and fishing. The large amount of garbage and waste dumped into the river has caused pollution, which is evident both physically and through laboratory testing.

Initial parameter identification before filtration is carried out

Based on the results of initial testing of the water quality of the Babang River in the laboratory conducted on May 17-24, 2025, the following table 1. From the results of the initial tests conducted at the Mataram Laboratory (STTL), the results in Table 1 above showed that the BOD and DO parameters did not meet the quality standards set by Government Regulation No. 22 of 2021, so further research was needed using the filtration method using filter media to reduce the BOD and DO levels in the Babaka River water samples in West Lombok Regency.

Table 1. Initial Test results

Parameter	Result			Unit	PP RI No 22 Year 2021 Class III	Result Eligible
	Upstream	Middle	Donwstream			
Temperature	29 ºC	29 ºC	29 ºC		Deviation 3	
Ph	6.31	6.32	6.40		6-9	Not Eligible
TSS	0.167	0.167	0.181	Mg/L	100	Eligible
TDS	0.036	0.169	0.205	Mg/L	1000	Eligible
COD	24	32	28	Mg/L	40	Eligible
BOD	11.2	12.8	16	Mg/L	6	Not Eligible
DO	4.8	5.04	5.8	Mg/L	3	Not Eligible
Total Coliforms	9.30	2900	2100	MPN	10,000	Eligible

Temperature

Test results showed that the temperature of the Babang River ranged from 29°C upstream to downstream. This result is still below the river water quality standards stipulated in Government Regulation No. 22 of 2021. Temperature is a physical factor in water quality that can influence the development of various types of aquatic life. The benefits of temperature in water are crucial for aquatic life, health, industry, and climate, as temperature can impact oxygen solubility, the metabolic rate of organisms, chemical reactions in water, and the efficiency of water treatment. Additionally, warm water temperatures are beneficial for relaxation and therapy. while water temperature affects the behavior and survival of fish.

pH

Acidity is a crucial factor in water treatment processes that improve water quality. Ph measurements in the Babak River ranged from 6.31 to 6.40. The lowest pH value was found in the downstream area at 6.31, while the highest pH value was found in the middle of the river at 6.40 and upstream at 6.37. These results indicate that the pH of the Babak River still meets the quality standards set by Government Regulation No. 22 of 2021. The standard pH of river water is very important to maintain the balance of the ecosystem, the survival of aquatic organisms, and the quality of the water itself; optimal pH (around 7.0-8.5) ensures that minerals remain dissolved, prevents corrosion of infrastructure, supports the life of microorganisms, and is an important indicator of river health against pollution such as acid rain or industrial waste, so that river water remains suitable for various uses or ecosystems.

TSS

Total Suspended Solids (TSS) are solids or particles that make water cloudy. These particles are insoluble and cannot settle directly. TSS consists of small particles, including various forms of organic matter, which are lighter than sediment. TSS plays a role in increasing water turbidity. Laboratory tests on river water samples showed slightly different results. The test result for the upstream river sample was 0.167 mg/L, while the midstream sample was 0.167 mg/L, and the downstream sample was 0.181 mg/L. Therefore, these river water samples meet the Class III quality standards based on Government Regulation Number 22 of 2021 concerning River Water Quality Standards, as the maximum TSS limit is 400 mg/L. The upstream and midstream samples exhibited low TSS values, whereas the downstream samples showed higher values. This is due to the high levels of pollutants in the river, which cause high TSS levels, although they are still safe because they are below the quality standards [25].

TDS

Total Dissolved Solids (TDS) are solids dissolved in a solution. These TDS levels involve a number of inorganic and organic compounds present in water. Laboratory testing results showed that the TDS levels in the Babak River were 0.036 mg/L upstream, 0.169 mg/L in the middle, and 0.205 mg/L downstream. The TDS parameters in the Babak River are still below the quality standard values, in accordance with Government Regulation Number 22 of 2021, Class III. The TDS values at the three points do not differ significantly. The downstream TDS values are higher due to the presence of waste from human activities and agricultural runoff in the vicinity of the river [26].

COD

COD is the amount of oxygen required to oxidize organic substances in a water sample. COD is a measure of water pollution caused by organic substances that can naturally be oxidized through microbiological processes, resulting in a reduction in dissolved oxygen in the water. COD test results showed varying results. The COD levels in the upstream area were 24 mg/L, in the middle of the river 32 mg/L, and downstream 28 mg/L. Referring to Government Regulation No. 22 of 2021, these results comply with the quality standards of PP No. 22 of 2021 Class III.

BOD

Another important parameter for determining water quality is BOD. BOD indicates the amount of organic matter in water that can be biologically degraded. BOD is the amount of biological oxygen (ppm or mg/L) required for bacteria to decompose organic matter, thereby returning the wastewater to its clear state. Based on the COD test results, the upstream COD level was 11.2 mg/L, the middle of the river was 12.8 mg/L, and the downstream COD level was 16 mg/L. Referring to Government Regulation No. 22 of 2021, these results do not meet quality standards and require further testing. The high BOD value in the Babang River water is due to the large amount of household waste and garbage being dumped directly into the river. Furthermore, the Babang River is located in densely populated areas, making it a frequent dumping ground for various domestic waste, including human waste, food scraps, detergents, and other organic and inorganic waste. These organic materials trigger the activity of microorganisms in the water, which require oxygen for decomposition. This results in increased oxygen consumption and a drastic decrease in dissolved oxygen levels. High BOD levels in river water can be influenced by low numbers of microorganisms. The number and activity of microorganisms significantly influence the value. When microorganism numbers are low, biochemical breakdown processes do not occur [27].

DO

Dissolved Oxygen (DO) is the amount of oxygen present in water. This parameter is crucial in determining water quality, as low oxygen levels can be an indicator of aquatic environmental pollution. The presence of dissolved oxygen in water plays a crucial role in the reduction and oxidation processes, which helps reduce pollution levels in water bodies. Oxygen is a limiting factor; if its availability in the water is insufficient to meet the needs of biota, it will inhibit activity in the waters [28]. Low oxygen levels can impact biological functions, slow growth, and even lead to death. Test results for the Babak River's DO levels showed 4.8 mg/L in the upstream section, 5.04 mg/L in the middle section, and 5.8 mg/L. These results comply with the river water quality standards stipulated in Government Regulation No. 22 of 2021, Class III, and therefore require further testing.

Total Coliform

One type of bacteria that can indicate pollution or poor water quality is coliform. This bacterium has the potential to be toxic or entomopathogenic, posing a risk to human health. All points in the upstream, downstream, and middle reaches each contain coliform bacteria. However, laboratory testing results showed safe levels: 930 MPN in the upstream, 2,900 MPN in the middle reaches, and 2,100 MPN in the downstream. These levels are still in accordance with Government Regulation No. 22 of 2021, Class III. The Babang River is utilised by local residents for various activities, particularly in the middle reaches, including bathing, washing, and fishing. However, there is still the issue of household waste disposal. This is evidenced by the test results, which show that the total coliform count in the middle reaches is higher than the results in the upstream and downstream areas, although still within safe limits. These activities can lead to microbiological contamination due to the abundance of coliform bacteria, including fecal coliform and other pathogenic microorganisms [29].

Filtration

Filtration Tool

The media used in this filtration process are zeolite, silica sand, activated carbon and filter foam. Zeolite is located at the top with a thickness of 5 cm, which aims to remove large particles from entering the media below. Zeolite functions as an adsorbent. Its alumina-silica crystal structure has spaces capable of absorbing metal ions. Zeolite can be used as an adsorbent, molecular sieve, ion exchanger, and catalyst. Zeolite has pores that can be utilised as an adsorbent and molecular sieve, allowing it to absorb large numbers of small molecules or those of a specific size, depending on its pore size.

Silica sand has the highest thickness, at 20 cm. Silica sand can purify water. The thicker the silica sand, the clearer the water produced. Sand is composed of several compounds, including SiO2, Fe2O3, Al2O3, TiO2, CaO, MgO, and K2O. These compounds bond with each other, eliminating physical properties such as odor and cloudiness. Sand can optimally purify water. The thicker the sand used, the clearer the water produced. This is because the sand has the highest thickness in the manufacture of this filter.

Activated carbon functions to remove contaminants in water and eliminate odors. Activated carbon is a material in the form of amorphous carbon with a large surface area of 300-2000 m2/g. This large surface area is due to its porous structure. These pores give activated carbon its ability to adsorb. Activated carbon is used as an adsorbent for color removal, waste treatment, and water purification. Activated carbon forms an amorphous form, consisting largely of free carbon and having a hollow inner surface. It is black, odorless, tasteless, and has a much greater adsorption capacity than unprocessed carbon.

The filter foam is located at the bottom of the three other filter media and is 5 cm thick. This filter media functions to absorb water sediment that makes the water cloudy.

Test Result After Filtration

This research collected data on BOD and DO levels after the filtration process. The results of river water filtration before and after treatment using physical multimedia filtration are as follows:

Table 1. The Result of River Water Filtration in Upstream Section

Before	After
	

Table 2. The Result of River Water Filtration in the Middle Section

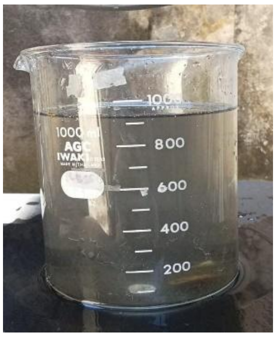
Before	After
	

Table 3. The Result of River Water Filtration in the downstream Section

Before	After
	

From the image above, you can see the difference in the quality of river water after filtration and before filtration; the level of water turbidity decreased drastically.

This research collected data on BOD and DO levels after the filtration process. The results of river water filtration before and after treatment using physical multimedia filtration are as follows:

Table 4. River Water Quality After Filtration

Parameter	Result						Unit	Quality Standars	Information
	Upstream		Middle		Downstream				
	Before	After	Before	After	Before	After			
BOD	11.2	7.2	12.8	7.6	16	12	mg/L	6	Not Appropriate
DO	4.8	2.7	5,04	2.1	5.8	2.1	mg/L	3	Appropriate

Identification of Test Results After Filtration

BOD

After applying the filtration device, the BOD level in the river water decreased from 11.2 mg/L to 7.2 mg/L in the upper reaches, from 12.8 mg/L to 7.6 mg/L in the middle reaches, and from 16 mg/L to 12 mg/L in the lower reaches. The filter media effectiveness was 35% for the upper reaches, 40% for the middle reaches, and 33% for the downstream reaches. The reduction in levels after filtration indicates that the filter media in the filtration device was able to reduce some of the organic matter dissolved in the water. The filter media in the filtration device reduce BOD (Biochemical Oxygen Demand) levels in river water through physical, chemical, and biological processes. The physical process occurs when silica sand and filter foam filter suspended particles and coarse organic matter, while the chemical process involves activated carbon, which adsorbs dissolved organic compounds that contribute to BOD. The combination of these three processes reduces BOD levels from their initial levels [30].

However, in this study, the final results still did not meet water quality standards due to suboptimal contact time or biological activity. Although there was a decrease in levels, the results did not meet the Class III quality standards stipulated in Government Regulation No. 22 of 2021. This was due to the insufficient thickness of the chemical filter media used, specifically activated carbon, which made it less effective in reducing BOD levels in the river. Another contributing factor was the insufficient contact time or retention time used, which also affected the final results of the filtration process. The condition of the river, based on its activity, also significantly influences its flow. The river passes through areas with the potential to cause high levels of river pollution, such as agricultural areas, densely populated residential areas, and market areas, namely Mandalika Market, the largest traditional market in Mataram City.

These conditions automatically affect the quality of the river's water. Furthermore, the Babakan River also passes through the Kebon Kongok Landfill in West Lombok, the largest landfill in West Lombok Regency. Therefore, for further testing, it is necessary to increase the contact time and thickness of the filter media, as well as combine it with other filter media/activated carbon to effectively reduce BOD levels in the river.

DO

After applying the filtration device, the DO levels in the river water at the upstream end decreased from 4.8 mg/L to 2.7 mg/L, at the midstream end from 5.04 mg/L to 2.1 mg/L, and at the downstream end from 5.8 mg/L to 2.1 mg/L. The filter media effectiveness was 43% for the upstream end, 58% for the midstream end, and 64% for the downstream end. These results meet the Class III quality standards stipulated in Government Regulation No. 22 of 2021. The decrease in DO levels after applying the filtration device can be attributed to the minimal direct contact between the water and the outside air. During the filtration process, the water flowing through the pipe through the filter media layer is not exposed to the outside air as is the case with water flowing in a river. Oxygen absorption from the outside air is limited because the water passes through a closed system. Although high DO levels in a river indicate that the river is not polluted, the filtration process does not automatically increase DO because its purpose is to remove physical, chemical, and biological compounds, not to add dissolved oxygen. Therefore, a decrease in DO after filtration does not mean the water is more polluted; rather, it reflects the filtration's focus on reducing the levels of pollutants in the water.

The decrease in filter media effectiveness, as indicated above, suggests that the filter media used has an impact on reducing these levels. The thickness of the filter media has a significant influence on the filtration process. The thicker the media and the more materials used, the cleaner the filtered water will be because the impurities in the water have been filtered by the materials used [31].

Conclusion

Based on the research results, it was concluded that the water quality of the Babang River still meets the quality standards stipulated in Government Regulation No. 22 of 2021, except for the BOD and DO parameters. Initial laboratory test results included a temperature of 29°C, mg/L, pH 6.31, TSS 0.167, TDS 0.036 mg/L, BOD 11.2 mg/L, COD 24 mg/L, DO 4.8 mg/L, and total coliform 930 MPN/ml for the upstream sample. The midstream sample yielded a temperature of 29°C mg/L, pH 6.32, TSS 0.167, TDS 0.169 mg/L, BOD 12.8 mg/L, COD 32 mg/L, DO 5.04 mg/L, and total coliform 2900 MPN/ml for the downstream sample. COD 28 mg/L, DO 5.8 mg/L and total Coliform 2100 MPN/ml. The efficiency of reducing parameters in river water using filter media was 35% for BOD in upstream samples, 40% for midstream samples, and 33% for downstream samples. The DO parameter was 43% effective in upstream samples, 58% effective in midstream samples, and 64% effective in downstream samples. Laboratory testing after filtration showed that the BOD level in river water in the upstream decreased from 11.2 mg/L to 7.2 mg/L, in the midstream from 12.8 mg/L to 7.6 mg/L, and in the downstream from 16 mg/L to 12 mg/L. The DO parameter decreased from 4.8 mg/L to 2.7 mg/L in the midstream, from 5.04 mg/L to 2.1 mg/L, and in the downstream, from 5.8 mg/L to 2.1 mg/L. The filter media effectiveness was 43% for the upstream, 58% for the midstream, and 64% for the downstream. The DO results meet the quality standards, but despite a decrease in levels, the final BOD results do not meet the Class III quality standards stipulated in Government Regulation No. 22 of 2021. Based on the research results, filtration effectively reduces BOD and DO levels in river water. In addition to reducing BOD and DO levels in river water, this filtration media can also be applied to other water sources, such as well water and others.

Author's Contribution

E. D. Wunda: Conducting sampling and making a filtration tool, T. Melinda: Conducting Data, Processing and analysing data and compiling a research article. H. Sholehah: Conducting Water quality parameters before and after filtration

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