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A Comparison Study On Sand Filter with Membrane On Kitchen Waste Water

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Abstract : Grey water is defined as wastewater from the kitchen and dishwashing. This grey water can be purified using filtration process so that it can be used for other purposes. In order to get optimum quality of output filtration process, the combination of filter material is essential. The aim of this study is to create a kitchen waste water sand filter with a membrane. Kitchen waste water that was taken from residential students University Tun Hussein Onn Malaysia Pagoh campus. Silica sand, activated carbon, fiber and membrane are the material used for this filtration system. For this study, a total of 7 sample of kitchen waste water are used in order to get the best result with two different types of filter. For the overall test, all the filtering systems function well, leaving a favorable impression with the pure colour of the output water. The results show that Filter 1 that contains fine sand is the most suitable filter in filtering waste water as potential pf hydrogen(Ph), total dissolved solid (TDS) and the color of the water after the filtering show a better result.

Keywords: Kitchen Waste, Filtration, Activated Carbon, Membrane

1. Introduction

One of the most vital aspects of human life is water. Waters must be treated effectively in order to obtain acceptable quality water. Apart from that, the water sector has played a significant role in Malaysia. The Malaysian government invested a significant amount of money to update the country's water distribution system for its citizens.

Today's society is aware of the positive aspects of water and the benefits it provides. People tend to make sure that the water is clean before utilizing it on this occasion. Most homes in our country have at least one water filter that aids in the purification of raw water. This water filter is necessary to ensure that the water is safe to drink and free of harmful bacteria. Water filter systems using filtering media such as silica, activated carbon, sand, polypropylene, UF membrane, zeolite, and fibre are available on the market.

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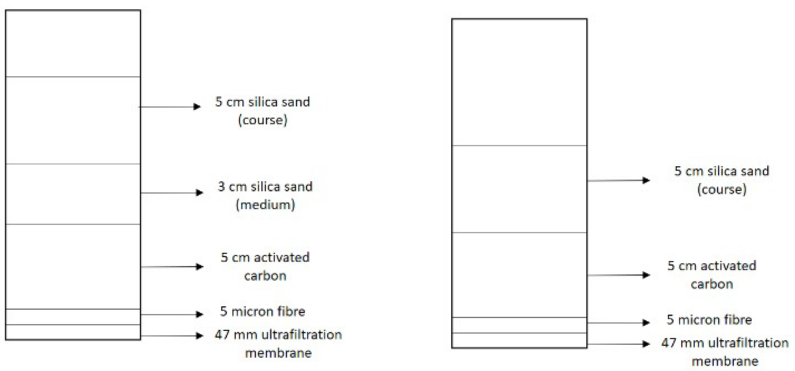
Table 1: List of articles with similar topic of debate

Reference	Type of filter system
1	Bio-Sand Filter (BSF) [1]
2	Reverse Osmosis Filtration System [2]
2	Reverse Osmosis Purification System [2]
2	Water Purification Innovative Technology [2]
2	Healthy Ionized Water [2]

From another article with a similar topic of debate, which creates a filter system from other materials as listed in **Table 1**. Because of advances in water filter technology, it is now possible to filter kitchen waste water as a substitute for clean water. This research aims to develop a comparative study between two type of filter media combination in order to propose the effective kitchen waste water filtration.

2. Materials and Methodology

The methodology part, often known as the materials and methods section, explains all of the information required to produce the study's results. Microporous Membrane filter were used in this study. The nominal pore size of the membrane is 0.45µ with 47mm length. Activated carbon is made from coconut shells and has holes that are mostly in the micro pore range. Micro-pores cover almost 85 to 90 percent of the surface area of coconut shell activated carbon. Because of the narrow pores, it is more effective at absorbing gas or vapor as well as removing color and odor from chemicals. Silica sand was sieved using sieve analysis. The sand particles pass through sieve mesh to get the size of the coarse and the fine sand. This water filter is constructed of glass wool, which is made up of very tiny glass fibres. As the layer is progressed, the design has been chosen. The system use four layer it is coarse and medium silica sand, activated carbon, fiber filter and the last are membrane as shown in **Figure 1(a)**. Filter 2 used almost similar with Filter 1 but without medium silica sand layer only as shown in **Figure 1(b)**.



(a) (b)

Figure 1: Design for (a) Filter 1 and (b) Filter 2

The first filter layer is silica sand (course), which removes large particles, sediment, muck, and suspended in water sand grains form a coating that penetrates the water and prevents larger particles from acting as a sieve at the gaps between grains. The second layer is made up of silica sand that is medium in size. This sand will remove filth and protect against infections including typhoid, cholera, and amoeba. Activated carbon is the third layer of water, which removes iron and manganese while leaving some chlorine in the water. Activated carbon is frequently utilized in wastewater treatment because of its great efficiency and effectiveness [3]. Its purpose is to remove iron from the water. The filter's final layer is a membrane that removes the tiniest particles from the water.

Sample wastewater collected from student resident were taken to test the value of pH and TDS using filtration. Some of the quality indices that were determined experimentally include TDS and the pH values. The pH and TDS of sample have been tested using pH and TDS measurement disposable tool before and after the waste water sample through the filter system for one week and the data was recorded to analysis..

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3. Results and Analysis

TDS stands for total dissolved solids, which refers to the inorganic salts and small amounts of organic matter that are present in solution in a water sample. Mineral content, usually measured as total dissolved solids (TDS), is also the primary determinant of consumer liking in the absence of unwanted odors [4]. Water can be used again for other purposes after it has been filtered. Water with a pH of 6.5 to 8.5 is considered clean and nevertheless, excessively alkaline water might have an unpleasant odor or flavor. Water with more free hydroxyl ions is essential as it's acidic. All samples were double-checked, once before and once after going through the filter. Two filters were built to evaluate the material's efficiency. One that utilizes all the materials indicated in Figure 1 and one that does not use fine silica. Its goal is to evaluate the effectiveness of fine silica in the filtering system.

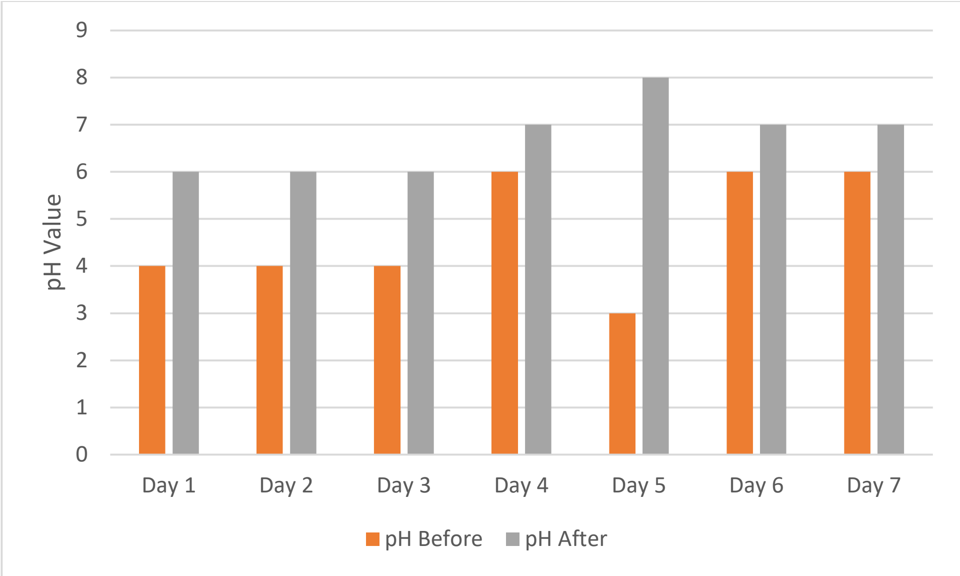
This stage denotes that the water filters are societally acceptable and can be employed in the future. The filter type was thoroughly discussed and designed in order to ensure that the filter was in good working order as soon as possible. Finally, creativity will be necessary in the future to bring the nation up to par with a nation with technology to increase by one percent efficiently.

3.1 Effectiveness of filter

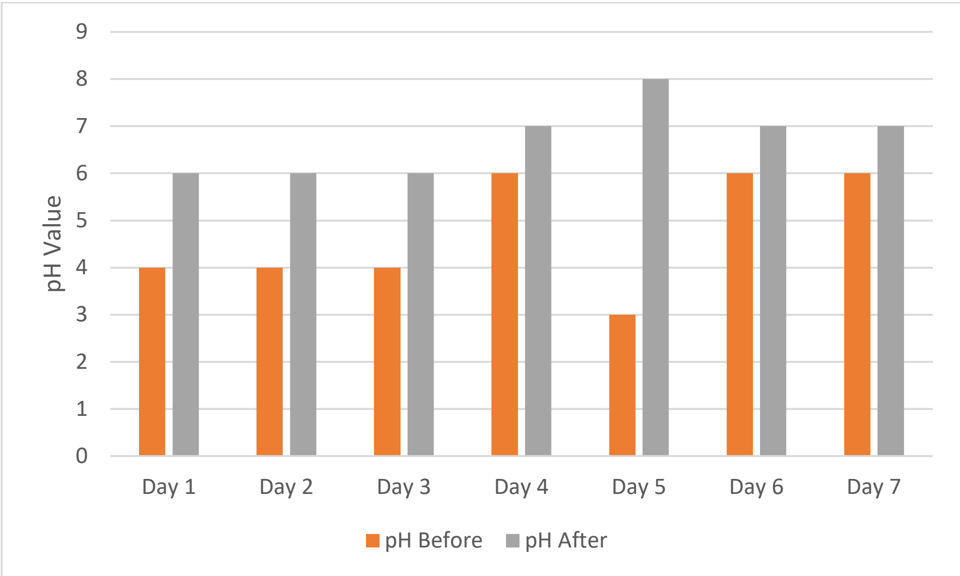
Based on the first filter and the second filter, the reading of TDS meter and pH paper indicates a positive result. The TDS meter shows the reading of PPM decrease a little bit and the color on the pH paper went from acid to neutral. Besides, the color of the water from the daily sample also changes from murky to clear a bit. The result of water from the first filter is clear than the second filter. However, the reading on the TDS meter from the second filter is lower than the first filter. The result from the pH paper shows the same result for both filters. Water with a pH less than 7 is considered acidic, whereas water with a pH greater than 7 is called basic.

The Ph chart in **Figure 2** shows the value of acidity or alkalinity before and after the waste water sample. The results demonstrate that the pH before the test is acidic compared to the pH after the test. This improved the pH value, which showed a correct functioning of the filter system. The pH value is such because activated carbon's primary function is to absorb acidity and reduce the acidity of the water sample. Powdered activated carbons for the taste and odor control and elimination of organic pollutants are utilized by water treatment facilities. The average different value between pH before and after are 2 for one weeks. The different average value between two periods of test are affected of amount of materials used. For one week, the average difference in pH between before and after is 2. The amount of materials used was influenced by the different average values between the two test periods. The average pH difference for filters 1 and 2 is comparable as the material used in filters 1 and 2 is still activated carbon, which differs from fine silica, therefore the pH value is the same.

When the results were compared to other filtering systems [5], the percentage of minimum removal in pH was found to be 1.23% after treatment. The value was close, indicating that the effective filter system in terms of pH is comparable to previous research.



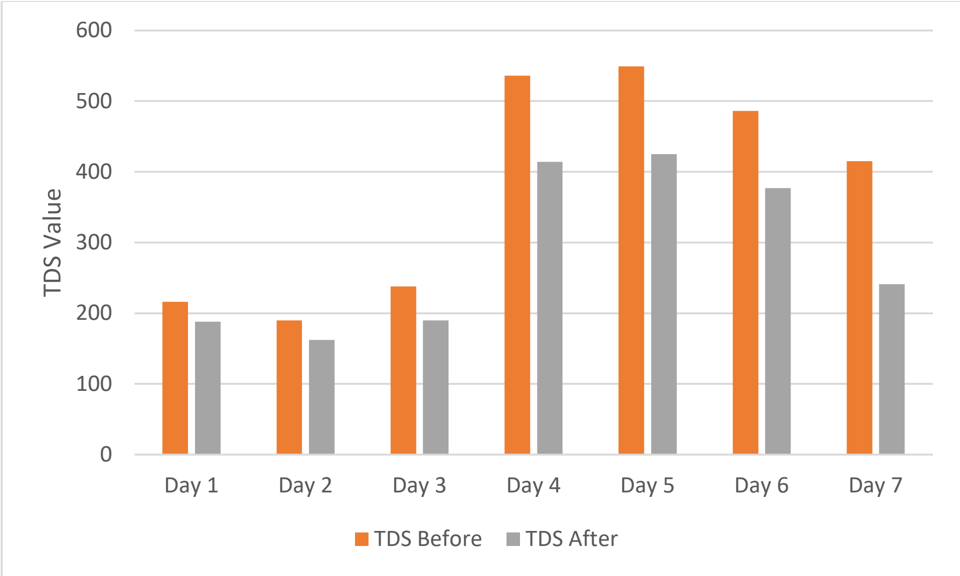
(a)



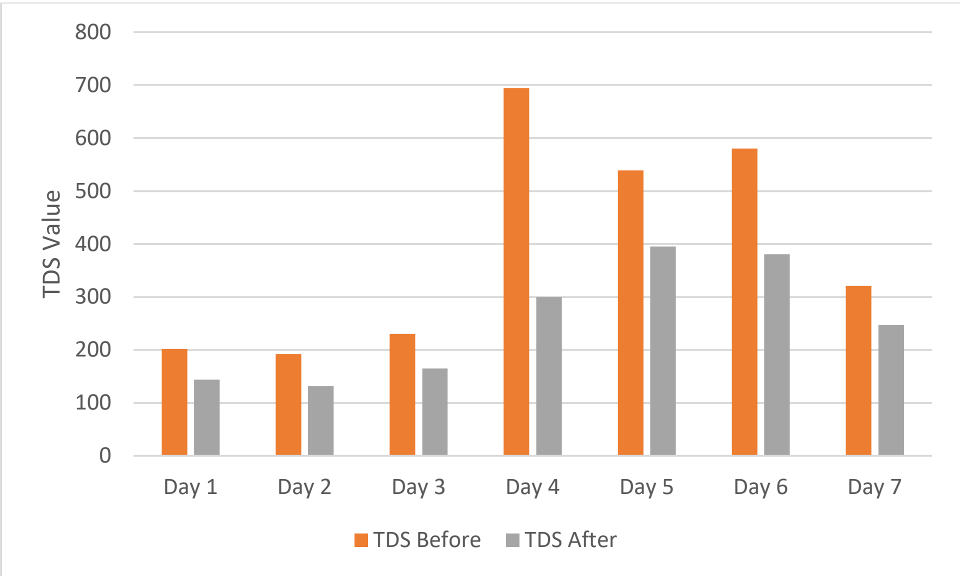
(b)

Figure 2: pH values for (a) Filter 1 and (b) Filter 2

TDS refers to the inorganic salts and trace amounts of organic components present in water in solution. The most prevalent components are calcium, magnesium, sodium, and potassium cations, as well as carbonate, hydrogen carbonate, and other compounds. Refrring to **Figure 3**, after filter 1 has been tested, the average result is 285 and filter 2 is 252. In TDS filter 1, the average reduction is 86.6. The results suggest filter 2 is better than filter 1 as regards TDS.



(a)



(b)

Figure 3: TDS values Filter 1 (a) and Filter 2 (b)

The water quality may be assessed by color. It is colorless pure water. Color is not always an issue in wastewater treatment but rather an indicator of wastewater condition. It is defined as the condition of their color and odor qualitatively. Light brownish grey is the fresh wastewater color. Waste water's color goes from grey to dark grey consecutively and finally dark when the collecting system travels (flow is changing). More and more septic situations are evolving and more anaerobic.

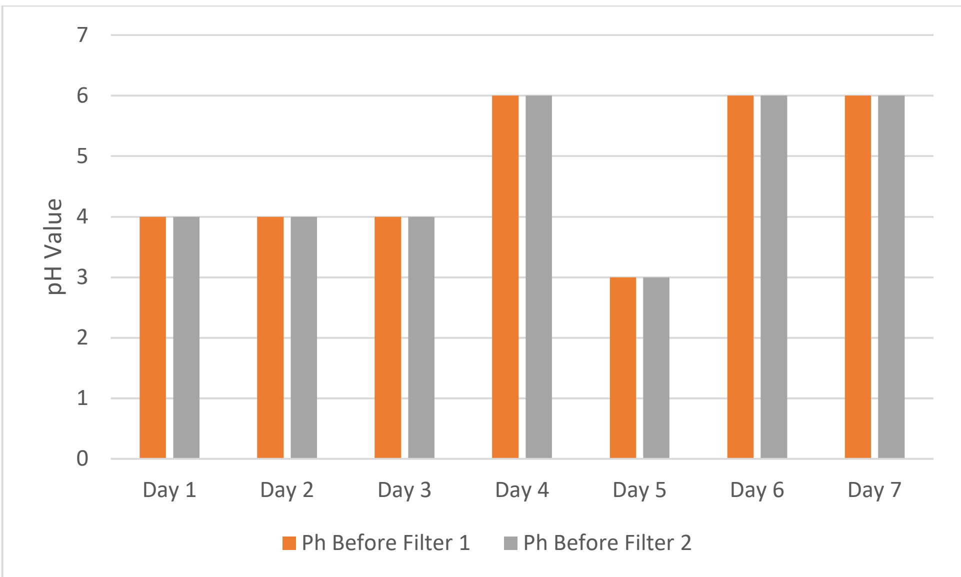
The different color for Filter 1 and 2 as shown in **Figure 4** shows the color of the sample before and after the test, indicating that the filtration system is working properly and that the color has changed from orange to pure. Color of a water sample before testing full oil, so that the color is the same. All the oil had been removed after passing through the filter.

(a) (b)

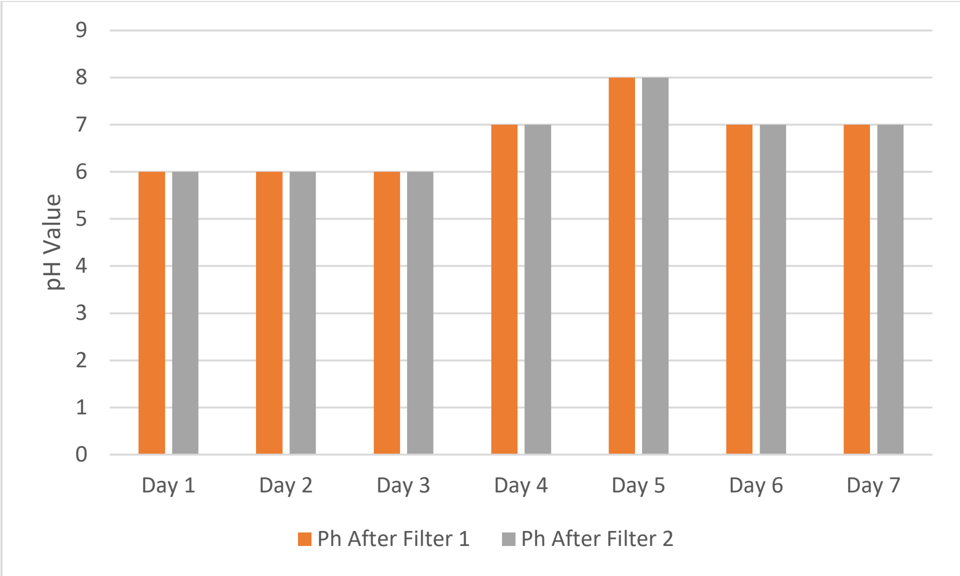
Figure 4: Sample of water (a) before and (b) after the test

3.2 Comparison of filter

Based on the comparison between the two filter which is filter 1 and filter 2, the best filter can be determined for testing pH and TDS values. Based on the bar chart of the results (**Figure 5**), it is observed that the results of pH values did not show a significant difference between Filter 1 and Filter 2 as both filter contain activated carbon that contributed in the change of the pH value. Mostly the filters change the pH value within the range of 6 to 8.



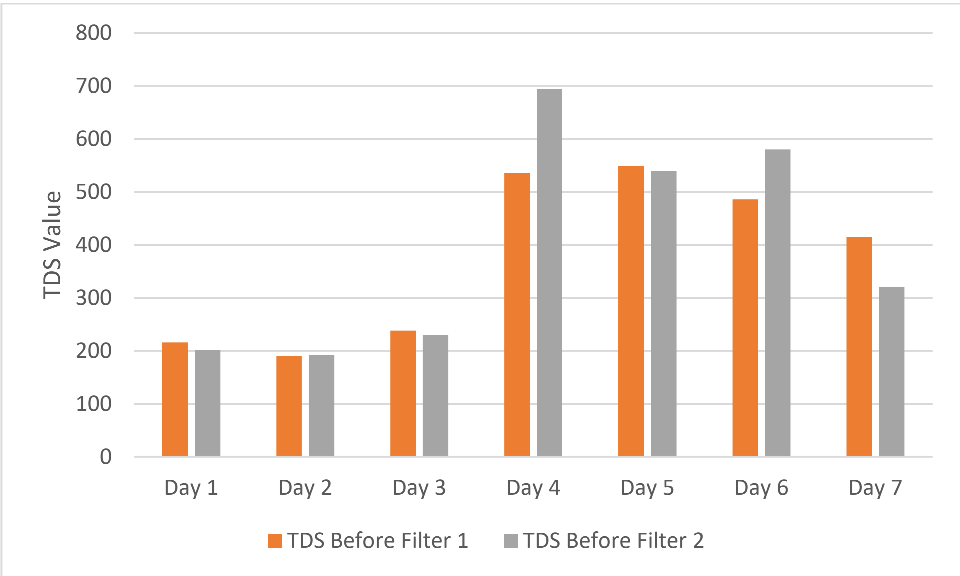
(a)



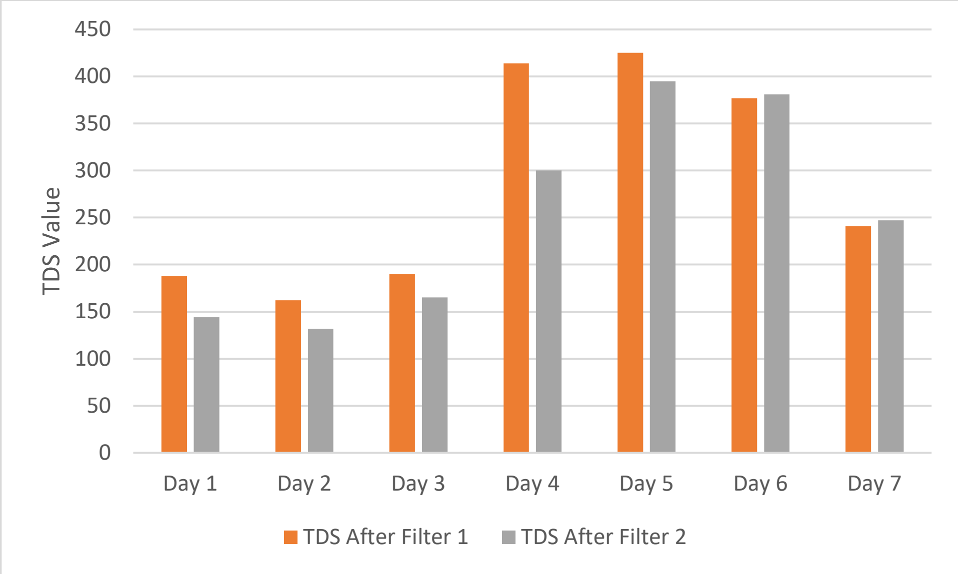
(b)

Figure 5: pH values (a) before and (b) after test

Analysis of TDS values result by bar charts on **Figure 6** showed that the TDS values after filtering is lower in Filter 2 than Filter 1. In sample 4, TDS values in Filter 2 show a better result compare to Filter 1 which is 43% and 77% respectively because of its materials in the filter that give impact in the change of TDS values.



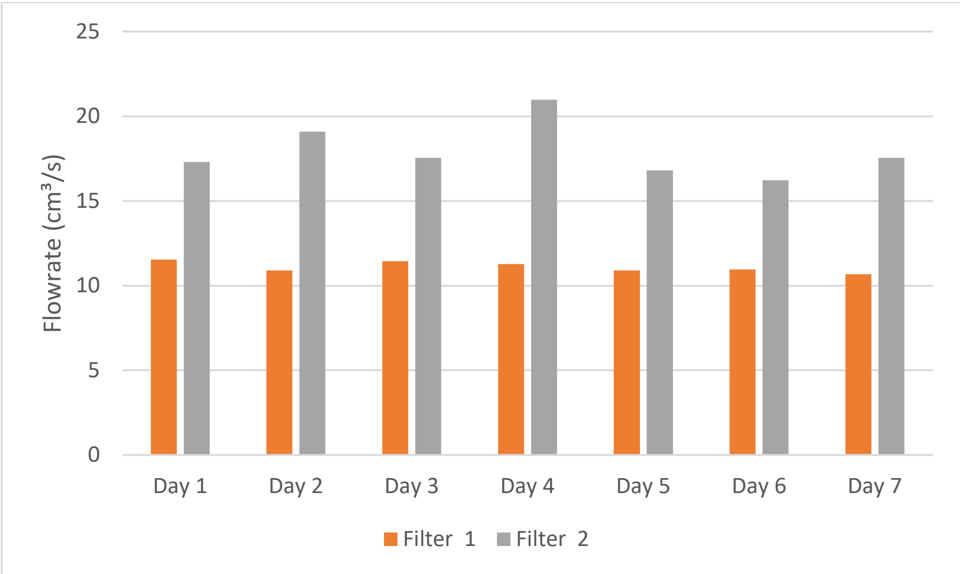
(a)



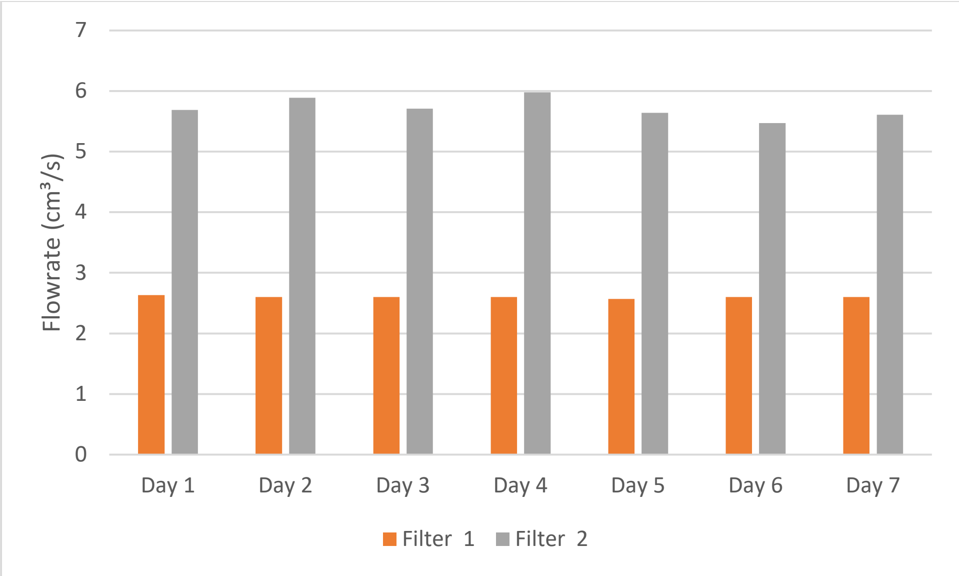
(b)

Figure 6: TDS values (a) before and (b) after test

Flowrate value can be obtained by measuring the volume of the filter over time in second. Based on the bar chart in **Figure 7**, it showed that flowrate of Filter 2 is lower than Filter 1. This happen because of Filter 2 has less material inside compare to Filter 1 that has fine sand in it. That means waste water sample is easier to pass through Filter 2 due to less material barrier than Filter 1.



(a)



(b)

Figure 7: Flowrate values (a) in and (b) out

4. Conclusion

To sum up, this project has achieved its aim and objectives to determine if a sand filter with a membrane can treat the wastewater from the kitchen. This is because all the samples that have been tested for 7 days show an improvement in term of TDS reading and the color of wastewater also changes from murky to clean a bit. Besides, pH for the sample of wastewater indicates from acidic to neutral means all the dirt from the wastewater stuck at the silica sand and the murky color of it has been clean by activated carbon. The last layer which is the membrane will get rid of the smallest particle in the wastewater. From the results, it is concluded that Filter 1 is more suitable in filtering waste water. It is because of the better result in pH, TDS and the color of the sample. This study give a huge contribution to people as this filter can develop clean waters from wastewater to be used for other activity. The recommendation for this project is to add two more experiments which is biochemical oxygen demand (BOD) and chemical oxygen demand (COD). The biochemical oxygen demand (BOD) test is a bioassay process that determines how much oxygen bacteria consume during the degradation of organic waste. While chemical oxygen demand (COD) is determining the concentration of organic matter in wastewater samples. COD is the most commonly used alternative test to BOD. The other recommendation is to add more samples to get an accurate result. The more sample used the more accurate the result because it is will prevent from mistake data collected

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