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Study on pH Reduction Between Ceramic Flat and Sand Filtration Method in Kangkar Senangar, Parit Sulong, Johor

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Abstract: Sand filtration methods are used to filter groundwater water from tube wells in the Johor villages of Kampung Lama Orang Asli Leboh, Kangkar Senangar, Parit Sulong, Batu Pahat. For more than 50 years, residents in this town have struggled to obtain safe drinking water. Despite having an established sand filtering system, the problem of clean water sources remains unsolved due to a lack of an efficient maintenance system. The ceramic flat membrane was brought in to enhance efficiency of pH reduction of the groundwater. The ceramic flat was provided with water from the tube well, before and after attaching it to the tubewell, the pH value was determined. The pH of the filtered water was measured using a WTW 251210 pHotoFlex® Turb/SET Portable LED filter photometer accordance to APHA 2005. Both result coming from the filtration method were at the same with no significant increase or decreasse. This happen may due to corrosion reactions that occur somewhere along the extended down-hole equipment, while reduction reactions occur where the current direction is inward. If this occurs in the sampled borehole section, the pH of the samples will be high. Moreover, contamination also may came from the pump equipment, such as deterioration of plastic materials and oxidation processes. This is the first study that determine the pH reduction of groundwater using Ceramic Flat Membrane in Kampung Kangkar Senangar, Parit Sulong, Batu Pahat.

Keywords: Groundwater, Ph Value, Ceramic Flat, Sand Filters.

1. Introduction

Water may be found practically anywhere on Earth's surface, including beneath hills, mountains, plains, and deserts. It is not always available or fresh enough to use without treatment, and it can be difficult to find, measure, and define. This water can be found close to the land's surface, as in a marsh, or hundreds of feet below the surface. Water at extremely shallow depths may be only a few hours old; water at intermediate depths may be 100 years old; and water at large depths or after

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flowing long distances from points of entry may have been in the earth for several thousand years. Groundwater is a component of the hydrological cycle. Some precipitation that falls on the ground surface percolates into the subsoil. Groundwater recharge is the portion that goes downhill through the soil until it reaches saturated rock material. Water travels slowly in the saturated groundwater system and may ultimately will discharge into streams, lakes, and seas.

Generally, minerals, pollutants, chemicals, soil or bedrock composition, or any other impurities which interacts with a groundwater lead to an imbalance in the water's natural pH of 7. In essence, environmental conditions, whether high or low, are the most significant contributors to water pH. In chemistry, the pH scale is used to define whether acidic or basic an aqueous solution is. The pH of acidic solutions is lower, whereas the pH of basic (or alkaline) solutions is greater. The ph level can varies from 1 to 14, with the natural pH being about 7.

The pH of ground water will differ depending on the composition of the rocks and soils that surround the recharge groundwater infiltrating stream. The chemistry of groundwater will also vary based on how long the present groundwater is in touch with a certain rock. The bedrock's chemical composition tends to stabilize (buffer) the pH of ground water. The longer the contact duration, the greater the influence of rock chemistry on the composition and pH of ground water. Groundwater that has passed through carbonate-rich rocks (such as lime stones and marbles) will usually have a pH greater than 7 because the acidic water has been "neutralized."

If the pH of a drinking water source fluctuates dramatically in a short amount of time, it may be an indication that it is polluted with pollutants and hence unsuitable to drink. Highly alkaline water can also have an unpleasant odor and flavor. It can also damage pipelines and cause appliances to wear out faster. When a new well is dug and if the well has never been tested, it is necessary to test the pH level. If the pH is not within the EPA's suggested range, limestone or marble chips may be used to raise the pH or caustic soda (sodium hydroxide) treatments may be used to lower the pH. These treatments are inexpensive, simple to maintain, and may be put by a professional. Before utilising untreated water, test the water to ensure if the pH has to be corrected.

1.1 Background of Study

The pH of a solution is an essential parameter that represents its chemical conditions. The pH can influence nutritional availability, biological functioning, microbial activity, and chemical behaviour. A pH of 7 is considered neutral, whereas a measurement less than 7 is considered acidic, and one more than 7 is considered alkaline or basic. As a result, monitoring and managing the pH of the water is critical before utilizing it for daily use.Thus, this study allows us to examine the pH level of the groundwater, treated water from Ceramic Flat Membrane and Conventional Sand Filtration method. The location of the study is in Kampung Lama Orang Asli Leboh. It is located at Jalan Gambir Kangkar Senangar 83500 Parit Sulong. The location of the village is very near to the Ban Dung Palm Oil Industries. The village accommodate about 22 family with 12 houses.

2. Methodology

A strategy is a fundamental approach to project management that includes specific requirements for the completion of each step. This section exposes every previous brilliant revolutionary action in order to identify the activity's basic component. The flowchart for the project depicts the entire process from beginning to end. This chapter describes the methods used in this study, which focuses on the efficacy of groundwater treatment using ceramic flat and sand filtration. The pH efficiency of both methods will be compared in this study.

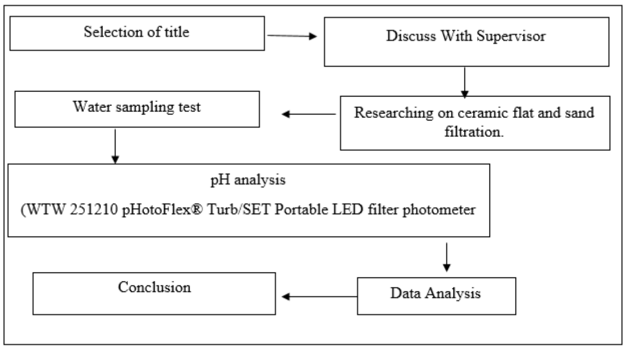


Figure 1: Flow chart of the study.

2.1 Research Design

The research is in need as the indigenous community in Kangkar Senagar able to prevent any possible threats from toxins in groundwater to the community. Design strategy that been use to tackle the problems occurs in Kangkar Senagar community is by using ceramic flat membrane and sand filtration method to integrate the different components. These two method has the stratergic and high possibilities to investigate the Ph value of treated groundwater.

2.1.1 Ceramic Flat Membrane

Is a unique form of high temperature plate porous ceramic membrane created by sintering inorganic materials such as alumina at high temperatures. Offers the benefits of superior chemical stability, dependability, extended service life, and strong anti-pollution capacity over organic film. The ceramic flat sheet membrane is a new generation of inorganic ceramic membrane formed of inorganic materials such as Al2O3, ZrO2, TiO2, SiO2, SiC, and other inorganic materials. Some advantage of ceramic flat membrane :

Longevity with no degradation

i. Strong acid, alkali, and organic solvent resistance; suitable for all types of wastewater including solvents and chemicals.

ii. Strong hydrophilic and anti-pollution properties.

2.1.2 Sand Filtration

Sand filtering removes suspended materials as well as floating and sinkable particles. The wastewater is gravity-fed vertically through a fine bed of sand or gravel. Absorption or physical encapsulation are used to eliminate particles. If the filter experiences considerable pressure loss, it must be disinfected. Pollutants are discharged and washed away by the rinse water. The filtration process can then resume. The yield of a sand filter is determined by two sand filter functions: surface filtering and depth filtration.

i. Rapid Sand Filtration

ii. Slow Sand Filtration

iii. Sand Filtration with Tilapia Fish Scale Macrocomposite Adsorbent

2.2 Research Procedure

The pH value of the water samples in the feed and treated water tanks were tested as part of the water quality testing. After aeration and filtration, a water sample was collected from tank 1, tank 2, and the storage tank. A total of 7 sampling points will be sampled within a month, and the pH value will be examined for 7 consecutive months. Two method been use to do the water sampling which is flat ceramic membrane and sand filtration method.

2.2.1 Water Sampling of Sand Filtration Method

A groundwater sample was obtained from a tube well, and a water sample was collected after aeration and filtration from tanks 1, 2, and storage tank in the settlement of Kampung Orang Asli Kangkar Senagar, Parit Sulong. The groundwater sample was taken in an empty container from a faucet linked to the pump and tube well. Moreover, water samples were obtained from tanks 1 and 2 as well as the storage tank. Water samples were also taken from the tubewell to compare the pH efficiency of the filtration method. A clean, empty bottle was used to collect water from the sampling location. Testing specimens then must be washed with distilled water prior to sampling. The samples are then placed in specimens. Before inserting the sample bottle into the WTW 251210 pHotoFlex® Turb/SET Portable LED filter photometer, it is carefully cleaned. Make sure the sample specimen is appropriately positioned to minimize reading mistakes. After clicking the "START" button, the pH measurement is obtained. After collecting data, sampling specimens must be washed before evaluating samples from other sites. The method was repeated for the other sample sites.

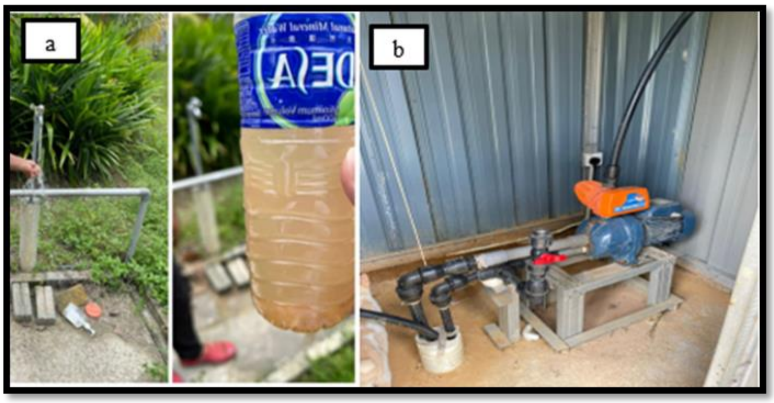


Figure 2 & 3 : Groundwater sample collection from (a) faucet connected to the (b) pump of tubewell.

Figure 4 : Arrangement of Sand Filtration water tank

(a) (b)

Figure 5 & 6 : (a) Water samples labelled for each station, (b) pH reading were tested WTW 251210 pHotoFlex® Turb/SET Portable LED filter photometer with integrated IR turbidity and pH measurement (APHA 2005).

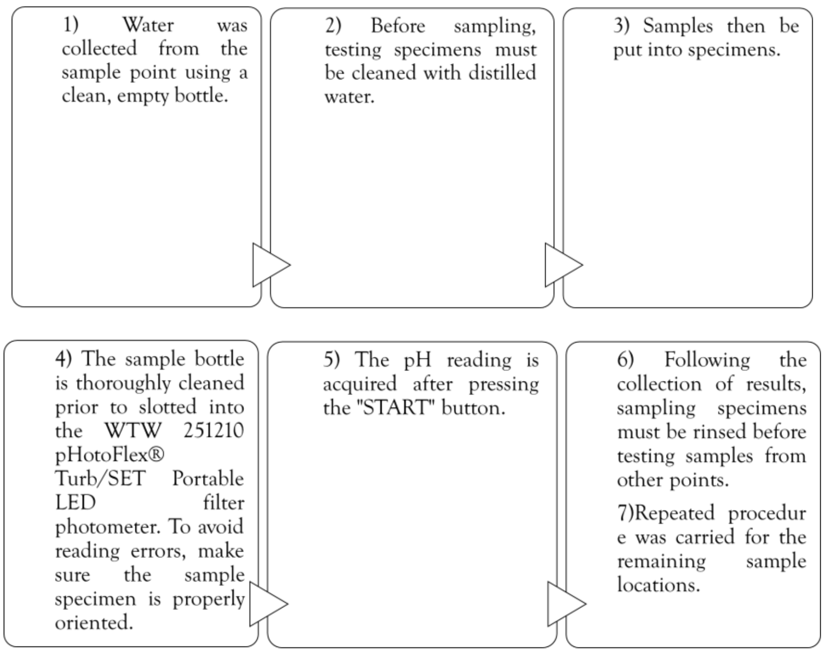


Figure 7 : Procedure for Using Portable WTW 251210 pHotoFlex® Turb.

2.2.2 Water Sampling of Ceramic Flat Membrane

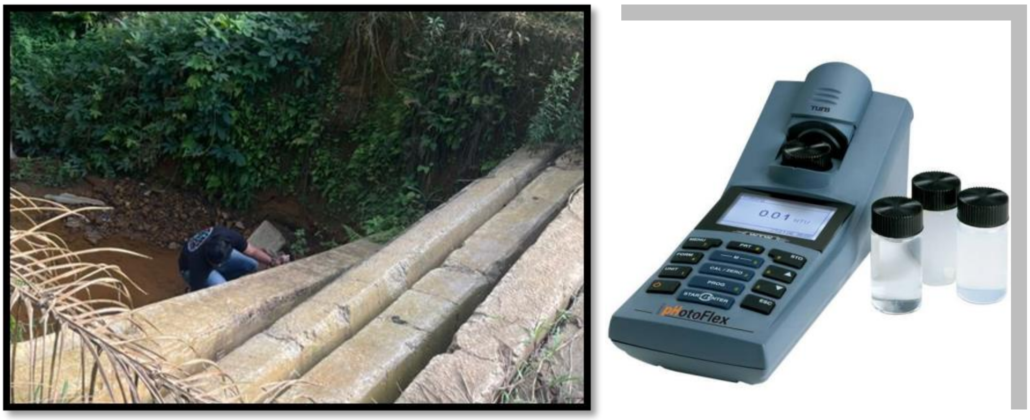
The groundwater was obtained from a faucet that connected directly form the tube well and a water sample was collected after entering the Ceramic Flat Membrane. Water samples were taken after 20seconds, 40 seconds and 60 seconds. Water samples were also taken from the tubewell to compare the pH efficiency of the filtration method. Testing specimens were cleaned with distilled water prior to sampling. The samples are then placed in specimens. Before inserting the sample bottle into the WTW 251210 pHotoFlex® Turb/SET Portable LED filter photometer, it is carefully cleaned. The sample specimen then appropriately positioned to minimize reading mistakes. The reading collected after the pHotoFlex was stable.

(a) (b)

Figure 8 & 9: (A) The Groundwater Run Through The Ceramic Flat Membrane, (B) Water Sample Were Taken For Ph Measurement.

2.3 Research Instrument

The water used by the villager sample was collected from a tube well and river in the hamlet of Kampung Orang Asli Kangkar Senangar, Parit Sulong, Johor. The community is surrounded by woods and palm oil plantations. River water samples were collected in a water bottle, and groundwater samples were collected in a water bottle from a faucet connected to the pump and tube well, as shown in Figure 10. The pH of the water sample is then determined using the WTW 251210 pHotoFlex® Turb/SET Portable LED photometer.



(a) (b)

Figure 10 & 11: (a)A river water sample was collected, (b) WTW 251210 pHotoFlex® Turb/SET Portable LED filter photometer with integrated IR turbidity and pH measurement (APHA 2005)

Water quality testing was performed on parameter of pH for samples from Ceramic Flat Membrane and Sand Filtration Method. According to APHA 2005 a WTW 251210 pHotoFlex® Turb/SET Portable LED filter photometer with integrated IR turbidity and pH measurement was used to measure pH concencatration of the water sample. The sample tube was clean with a distilled water and wiped with a tissue before immersed into the pHotoFlex. The measurement of pH then taken after the reading is stable.

3. Results and Discussion

The efficiency of pH was determined by the WTW 251210 pHotoFlex® according to APHA 2005. The efficiency of Ceramic Flat Membrane and Sand Filtration Method was investigated toward the water quality parameter which is pH. The data obtained was tabulated and analysis in graphs. The overall aim of this study was to determine the efficiency of pH between Ceramic Flat and Sand Filtration Method..

3.1 Results

The results demonstrates that the method used in the research is inadequate and cannot be used to lower the pH to a drinkable level according to the Water Quality Index (WQI), which states that a good WQI should have a value less than 9. This result fails to meet the desired parameters from either method and fails to meet the WQI standard. The people of Kangkar Senagar desperately need clean water to drink and go about their daily lives.

3.2 Discussions

Both methods used in this study, Sand Filtration Method and Ceramic Flat Membrane, produce the same results at all flowrates and time intervals. It is important to follow proper sampling techniques when handling and measuring the pH of the water samples to ensure accurate results. As a result, existing methods must be renewed and improved. Some possible reasons why these methods may not be effective at adjusting the pH of the water could include:

- The pH of the water was already within a safe range before filtration: If the pH of the water was already within a safe range before filtration, the filters may not have had a significant effect on the pH of the water.
- The filters were not properly set up or maintained: It is important to properly set up and maintain the filters to ensure that they are functioning correctly. If the filters are not set up or maintained properly, they may not be effective at removing contaminants or adjusting the pH of the water.
- The water contains substances that cannot be removed by the filters: Some substances, such as certain types of minerals or chemicals, may not be removable by ceramic flat filters or sand filters. In these cases, the filters may not be effective at adjusting the pH of the water.

Since both method having trouble adjusting the pH of the water, it may be necessary to try other methods or techniques, such as chemical treatment or reverse osmosis, to adjust the pH of the water

Table 1 : Average Flow Rate and pH of 20 seconds, 40 seconds and 60 seconds.

TIME(S)	AVERAGE VOLUME (ml)	AVERAGE FLOWRATE (ml/s)	AVERAGE pH
20	1189.6	59.48	9.82
40	1977.4	49.435	9.43
60	1505.2	25.086	9.954

3.4 Figures

According to the table 1 and figure 12 , 20s of time intervals give an average of 9.82 pH value, 40s of time intervals give an average of 9.43 pH value, and 60s of time intervals give an average of 9.954 pH value, with a difference of 0.13 - 0.52 pH value differences. This result does not meet the desired parameters from either method and does not meet the WQI standard.

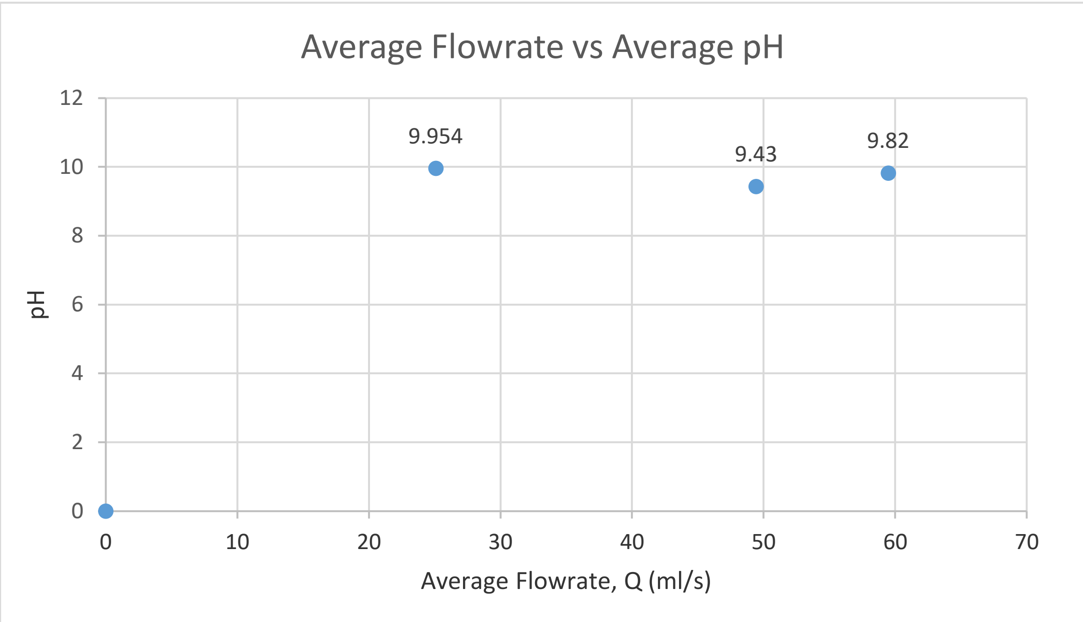


Figure 12 : Graph of average flowrate and average pH

4. Conclusion

Groundwater that has come into touch with decomposing organic matter can have pH values as low as 4.0, and water that has interacted with iron sulfide minerals in coal or shale can have even lower pH values. Groundwater pH normally ranges from 6.0 to 8.5 in the absence of coal or iron sulfide minerals, depending on the kind of soil and rock affected. Groundwater reactions with sandstones produce pH values between 6.5 and 7.5, but groundwater running through limestone layers can produce values as high as 8.5. The data shows the groundwater obtained from tubewell in Kampung Lama Orang Asli Laboh, Kangkar Senagar, Batu pahat is at 10.94 pH which determine that the groundwater sources may contain carbonate, bicarbonate, or hydroxide chemicals, which dissolve and circulate with the water. These mineral deposits also raise the water's alkalinity. Drinking either acidic or basic solutions will not affect body plasma pH levels since the human body seeks to maintain a homeostatic neutral state of roughly 7 pH. However, high pH levels in water might signal the presence of contaminants or undesired compounds, which can be hazardous to health.

In summary, these several processes or reactions might also have affected the groundwater pH:

- Corrosion reactions occur somewhere along the extended down-hole equipment, while reduction reactions occur where the current direction is inward. If this occurs in the sampled borehole section, the pH of the samples will be high.
- Contamination from the pump equipment, such as deterioration of plastic materials and oxidation processes.
- Deterioration of cement that may occur in the borehole section or the standpipe (unlikely). This will raise the pH and introduce calcium and silicon into the system, followed by calcite precipitation.

Some recommendation that be done are sand in this filtration also can be put in the bag as to easily maintenance the filter. This will keep the filter in top quality form and to measure the effectiveness of the pH, the effect of prolonged contact time in the sand filter process on the water quality parameters can be examined.

Acknowledgement

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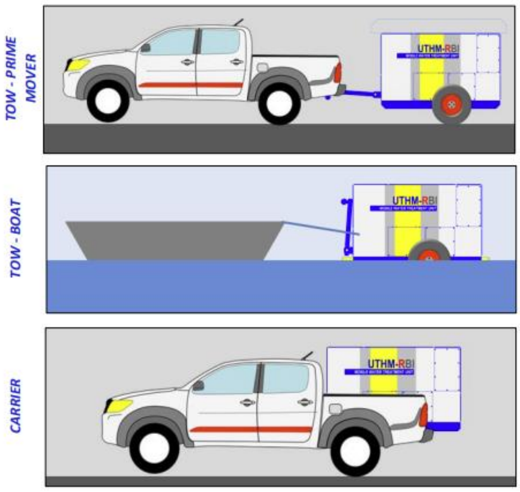
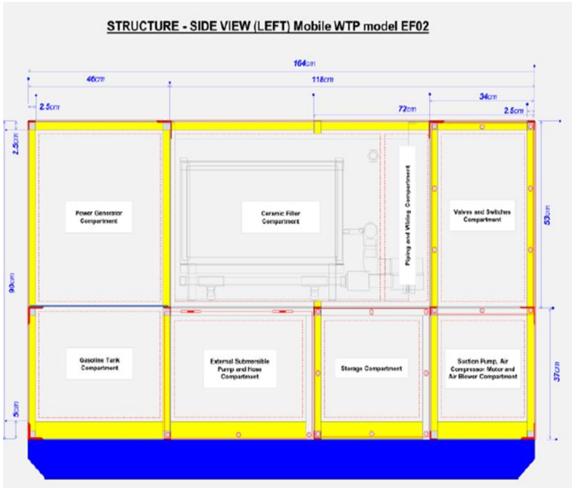
Appendix A





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