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Magic Instant Straw Activated Carbon and Ultrafilter Membrane PH and Turbidity Analysis

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Abstract: Water can contain dirt, minerals, chemicals and other impurities that make it smell and taste bad. Unwanted substances present in drinking water can be hazardous to health. Water can also harbor microscopic organisms and bacteria that can cause serious illness. This leads to the research and production of water filter also known as MiSACUM (Magic Instant Straw by Activated Carbon and Ultrafilter Membrane). The coconut shell is used to make the activated carbon by cleaning, and burning until it becomes charcoal which will be mixed with calcium chloride before being washed, drain, and dried in the oven. Raw water from Sarawak River (Sample A) and water flows in the drain at Politeknik Kuching Sarawak (Sample B) are collected and then filtered by using MiSACUM. Filtered water change colour from brownish/yellowish to colourless, tasteless and also become odourless. The level of pH and turbidity of the water are tested. As a result, the water filtered by MiSACUM for sample A and B, both have pH of 7.15. Meanwhile the turbidity test measured at 1 NTU and 0.5 NTU respectively. This proves that the water filtered by MiSACUM meet the standard requirement for the drinking water in terms of pH and turbidity levels.

Key words: instant water filter, coconut based activated carbon, drinking water

1. Introduction

Water filters are to clean water so that it is safe to drink and tastes good. Filtering water is essential to keep harmful bacteria and parasites from drinking water. Giardiasis and Cryptosporidium are among parasite that can cause harm to humans and has a resistant to chlorine and must be filtered out with mechanical filters. These pathogens are effectively removed by passing water through filters listed as micro-, ultra-, nano-, and hyper-filters [1].

Filtration is any of various mechanical, physical or biological operations that separate solids from fluids by interposing a medium through which only the fluid can pass. The fluid that passes through is called the filtrate. In physical filters, oversize solids in the fluid are retained and in biological filters, particulates are trapped and ingested and metabolites are retained and removed. However, if the separation is not complete; solids will be contaminated with some fluid and filtrate will contain fine particles (depending on the pore size, filter thickness and biological activity). Filtration occurs both in nature and in engineered systems; there are biologic, geologic, and industrial forms.

Clean and filtered water are easily available at home. But during outdoor activities such as hiking, climbing or jungle trekking, clean water are not available as they are at home. The water from the lake or river is unfiltered and might be contaminated. The water filters available in the market are big and heavy which is hard to carry on adventure. Thus, the innovation to reduce the size of big and heavy water filter to a smaller filter which is ideal for hiking, backpacking, camping, travel and emergency preparedness.

1.1 Supply Chain Management in Emerging Markets

Nowadays, there's plenty of home water filter technology, however that still limits the access to clean

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water outdoor. Whether it be for outdoor work, sport, traveling, camping, hiking etc. Therefore, a decision to create an instant water filter that has the potential to filter out any contamination from water from any sources consequently making it safe to drink.

2. Literature Review

This project consists of three main objectives:

(1) To produce activated carbon from the coconut shell and apply in MiSACUM.

(2) To produce a portable instant water filter.

(3) To test the level of pH and turbidity of the filtrate.

3. Methodology

The materials used are coconut shell picked from Satok area and Calcium chloride lab grade. Coconut shell is used to produce carbon. Calcium chloride is added to the process in order to activate the carbon produced from coconut shell. Activated carbon is a type of carbon which has a slight electro-positive charge added to it, making it even more attractive to chemicals and impurities.

Two different water sources are chosen as samples to be analysed. The first sample was taken from Sarawak River and the second sample was from drain in Politeknik Kuching Sarawak. Obtained data then compared to the established standards published by Ministry of Health Malaysia, Engineering Services Division to confirm the water was safe for consumption.

3.1 Portable Instant Water Filter

The production of the instant water filter is divided into 2 parts. The first part is the prototype design and the second one is the filtration process.

Prototype design emphasise on the portability of the finish product. The final product must be light in weight to carry around and easy to handle. Two different diameter of PVC pipes stack together to form a straw type filter. The water inlet end is a bit larger than the water outlet end. A multi size PVC pipes are interconnected by using three pipes accessories "reducing union" which shaped the final product of the prototype and determine the inlet and the outlet of the MiSACUM.

The filtration process consists of selecting material and process for the filtration component inside MiSACUM. Filtrates that flows through MiSACUM are divided into 4 stages. The first stage, is the pre filter which act to eliminate any suspended particle in the water. Activated carbon from coconut shell is placed in the stage 2 of the filtration process. Almost 85-90% surface area of coconut shell of activated carbon exists as micro-pores. The large surface area makes it a very good adsorbent for many contaminant in drinking water. In the third stage, a pre filter by micro filter net is used and act exactly like one that is used in the first stage. This is to ensure the water are clean, tasteless, colourless and odourless after flows through activated carbon before directed to the final stage. In the final stage water will pass through an ultra-filter. The range of ultra-filter pore size is varied between 0.005-0.5 μm. This filter can hold suspended solid, bacteria and also virus from passing through. Only water, monovalent ions and multivalent ions are passed through at the outlet of the MiSACUM [2].

3.2 pH and Turbidity Test

pH analysis is an important part in the water treatment process. Extreme pH levels can determine presence of particulate matters, accumulation of toxic chemicals and increasing alkalinity levels are common problems in untreated water. These matters are considered as serious environmental issues and hence municipal and industrial waste water treatments are critical before it enters to lake, rivers, canals and other water bodies.

Turbidity is the cloudiness or haziness of a fluid caused by suspended solids that are usually invisible to the naked eye. The most common measurement for turbidity in the United States is the Nephelometric

Turbidity Units (NTU). Government regulations set the level of turbidity that is permissible of drinking water.

4. Result and Discussion

As the water passes over the positively charged carbon surface, the negative ions of the contaminants are drawn to the surface of the carbon granules. Carbon block filters generally have a higher contaminant removal ratio [3].

Two different water sources are chosen as samples to be analyzed. The first sample was taken from Sarawak River and the second sample was from drain in Politeknik Kuching Sarawak. To ensure the water is safe to drink, two parameters that have been measured. The parameters are pH analysis and turbidity.

4.1 pH Analysis

The importance of pH analysis is for neutralisation, precipitation, coagulation and other biological treatment process. The pH analysis is probably the most recommended method for water treatment. The pH reading is measured on the scale of 0 to 14, with lower values indicating high hydrogen ion (more acidic) and higher values indicating low hydrogen ion activity (less acidic).

A pH of 7 is considered as neutral. Table 1 shows the mean pH values for both water samples was at 7.15 are in range for a good drinking water quality standards pH value which are ranged between 6.5-9.0 [4]. These results also showing the filter does neutralise the pH level of the water that run into MiSACUM.

4.2 Turbidity

When trying to determine the quality of water, the measurement of turbidity is an important test. Some of the particles are large enough and heavy enough to eventually settle to the bottom of a container if a sample is left standing. The smaller particles will only settle slowly. The particles caused the water to look turbid.

As a result, the turbidity control cannot exceed 5.0 NTU [4]. Table 2 shows, both results for sample A and sample B are below 5 NTU (maximum acceptable value) for turbidity test are 1 NTU and 0.5 NTU respectively. The result clearly shows that the particles inside the water are trapped by the activated carbon and the ultrafilter inside the MiSACUM.

Table 1 PH analysis on MiSACUM filtrate.

Samples	pH values before	pH values after	Drinking water quality standards
Sample A	6.42	7.15	6.5-9.0
Sample B	6.74	7.15	6.5-9.0

Table 2 Turbidity test analysis on MiSACUM filtrate.

Samples	Turbidity before	Turbidity after	Drinking water quality standards
Sample A	13.4 NTU	1 NTU	5 NTU
Sample B	10.2 NTU	0.5 NTU	5 NTU

5. Conclusion

This study shows that, activated carbon from the coconut shell can be applied in MiSACUM and the water is good for consumption according to pH and turbidity parameter.

A portable instant water filter can be produced by using connected pipes and by arranging a set filtration process or water filtration thus, producing MiSACUM. This instant filter can be used anywhere and anytime like a straw. User just needs to put inlet of the MiSACUM in the water such as river, lake, reservoir and etc. then drink it immediately.

However, further analysis on the water quality analysis and microbiological contain of should be conducted to determine the water filtered from MiSACUM are ready for market.

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