Analysis of Activated Carbon for Water Purification System

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Abstract

The activated carbon powder, sands and two different sizes of rocks such as small and large materials are used for water filtrationprocess.Activated carbon powder was produced from Coconut shell coir, Coconut hard shells and loofahs .These were heated to make activated carbon with temperature 500°C for 3 days in furnace. Coconut shell coir was used as activated carbon in this research. Layer by layer of filtering materials were put into water bottle and water is seeping through these layers. It was found that this system was sufficient to remove contaminants and bad smell from unclean water by using materials which can obtain in local places. Source of water get from lake inside of Pyay University and Ayeyarwaddy river in Pyay Township.

Keywords: activated carbon, water filtration,coconut shell coir,turbidity

Introduction

Water from surface sources is often contaminated by microbes, whereas groundwater is normally safer, but even groundwater can be contaminated by harmful chemicals from human activities or from the natural environment. Rainwater captured by a rooftop harvesting system or with small catchment dams is relatively safe, provided that the first water is allowed to flow to waste when the rainy season starts. The amount of water to be treated should also be assessed. This can be estimated by assuming that each person will need a minimum of 20-50 litres of water a day for drinking, cooking, laundry and personal hygiene. This research is studied for water filtration process and treatment system.A community should consult when choosing a water-treatment system and should make awareness of the costs associated with the technology. In particular, community members should promoteawareness of the behavioural and cultural changes which needed to make the system effective over the long-term and thus be acceptable to them. Communities may also need to be educated about protecting water sources from animal or human contamination, and mobilization. It should be emphasized that all the positive effects of a water-treatment system could be jeopardized if the water is not drawn, stored and transported carefully.

Experimental Setup

This research is to study water purification system and treatmentprocess. The coconut shell coir, the coconut hard shell and loofah were collected for raw material of activated carbon powder. Each material was washed for two hours and dry in air under sun light for seven days. The completely dry coir is bumped by hand with bumping stick for six hours. All samples were put into the clay pot and pounded which is then each put into the brick burning furnace at temperature 500°C and cooled down for two days. Activated carbons were obtained and ready to use for water filtration process. In this research,the sand, small stones and large stones are collected for water filtration process and these four types of materials are put into the water bottle layer by layer. Firstly, one inch thick purified sand layer is put at the bottom of the tank. Secondly, 0.5 inch thick activated carbons are carefully spread on the sand layer and press the

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two layers by a roller. Small stones and large stones are spread out over the activated carbon layer. These water samples were collected from different places such as lake water, in front of four storey building,Pyay University and water in middle of Ayeyarwaddy river near Pyay harbour. When the water is dropped into the water bottle, the water is flowing through the large stones layer, the small stones layer, the activated carbon layer and finally passed through the sand layer. The water before after filter condition is investigated by pH, TDS, water conductivity, turbidity, and hardness for water quality.The arsenic concentration of all water samples weremeasured by AAS (Atomic Absorption Spectroscopy). The block diagram of activated carbon making procedure was shown in figure 1. The block diagram of surface water filtration process was shown in figure 2.Sample preparation to make activated carbon and water filtration process were shown in figure 3, figure 4,figure 5,figure 6, figure 7 andfigure 8 .This research was emphasized for people living in rural area. The water filtrationprocess is made by four kinds of filter materials and water bottle for filtering of lake water and river water in Pyay district.

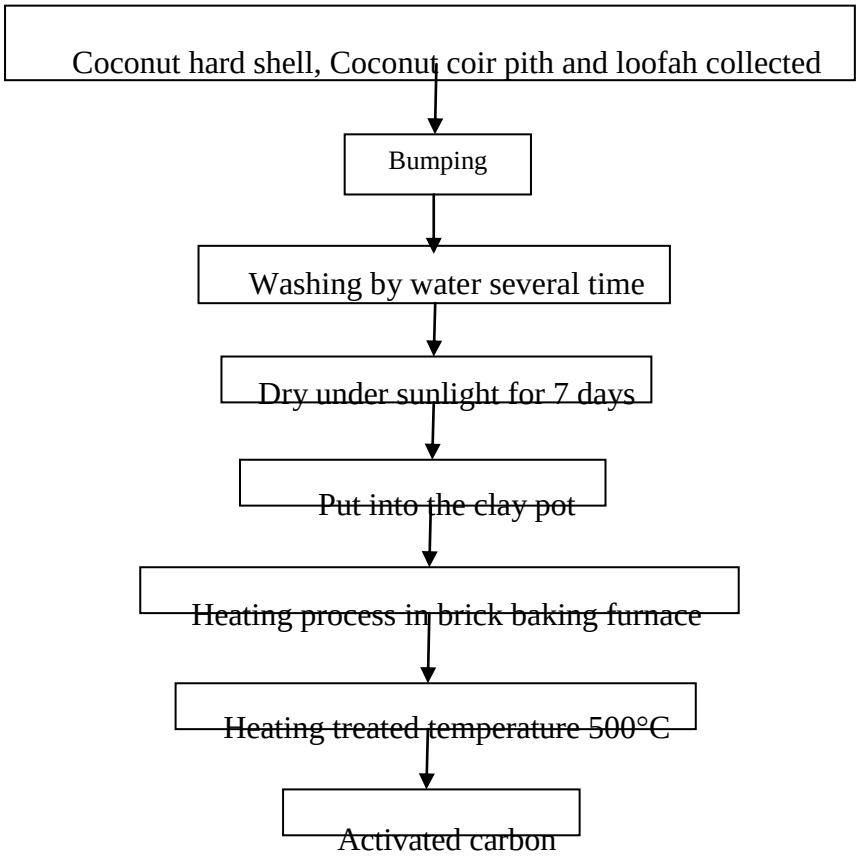


Figure 1 The block diagram of activated carbon making procedure

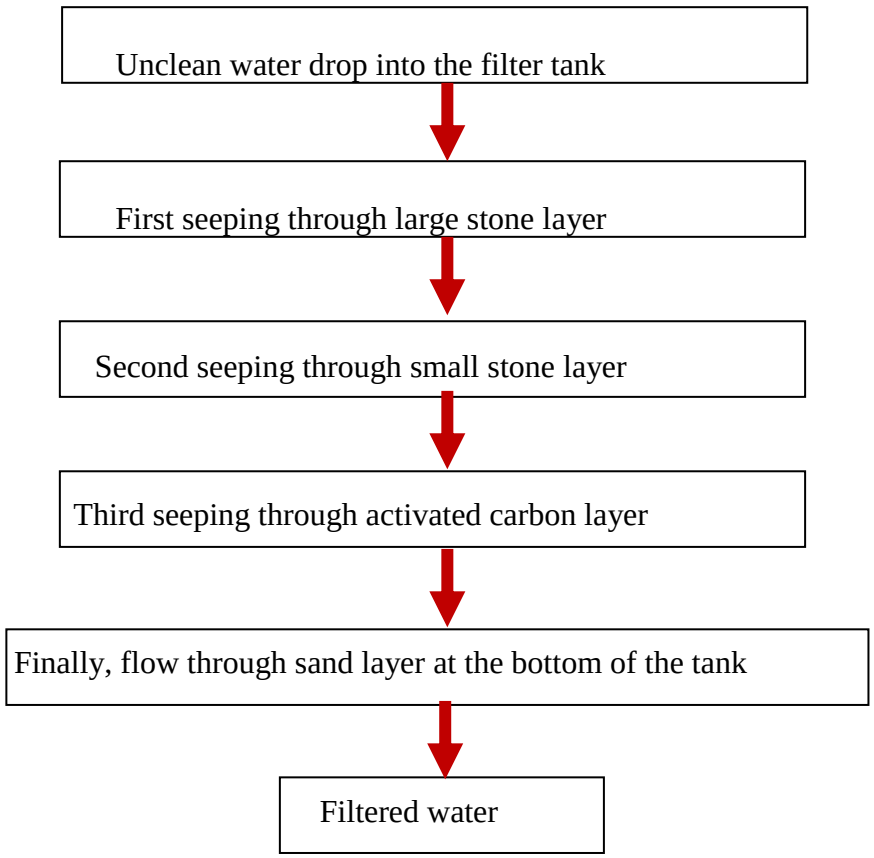


Figure 2 The block diagram of surface water filtration process

Figure 3 Sample preparation(drying) of coconut shell coir ,coconut hard shell and loofah by heating process

Figure 4 Sample preparation of coconut shell coir, hard and loofah by heating process in furnace

Figure 5 Sample of activated carbon by coconut shell coir and coconut hard shell at temperature 500° C

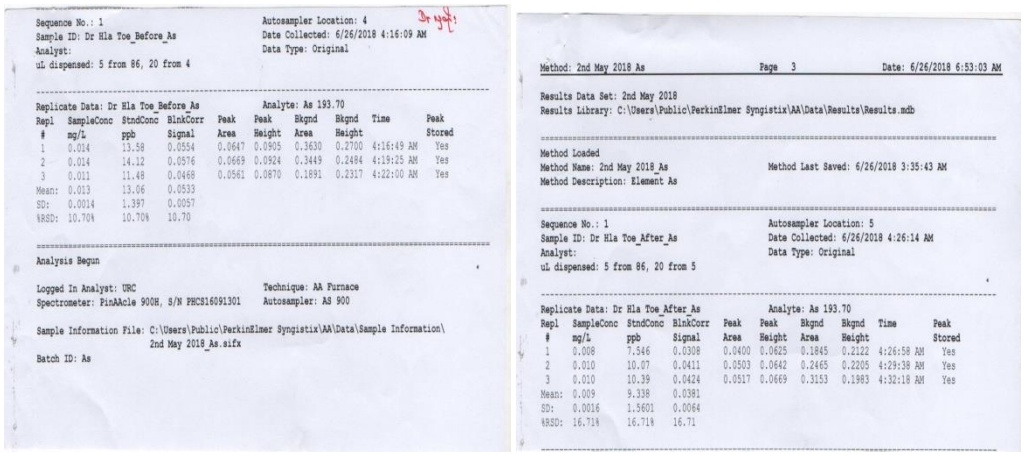
Figure 6 photo of lake water, in front of four storey building,Pyay University

Figure 7 Water filtration process for rural area application

Figure 8 Before and after filtering water

Results

AAS analysis of filtered water (before& after)was shown in figure 9.Actomic Absorption Spectroscopy AAS analysis of filtered water and unfiltered water were compared. According to the measurement results, filtering process reduces the arsenic amount to 0.004 mg/L. The water filtration process is effective for surface water purification system. These amount of arsenic is not hazard for drinking water and comparable to WHO standard data.Before filter condition, arsenic level is larger than MCL and it is below the MCL limit after filter condition. The U.S. Environmental Protection Agency (U.S. EPA) set an arsenic maximum contaminant level(MCL) for public water supplies at 0.010 mg/L. This is equivalent to 0.010 parts per million (ppm), 10 micrograms/liter (µg/L), or 10 parts per billion (ppb). The EPA also sets the MCL Goal (MCLG) for drinking water.The purification analysis of lake water and river water with different activated carbons is shown in table 1 and 2.



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Sample ID: Dr Hla Toe_Before_As
Analyst:
uL dispensed: 5 from 86, 20 from 4

Autosampler Location: 4
Date Collected: 6/26/2018 4:16:09 AM
Data Type: Original

Replicate Data: Dr Hla Toe_Before_As — Analyte: As 193.70

Repl #	SampleConc mg/L	StndConc ppb	BlnkCorr Signal	Peak Area	Peak Height	Bkgnd Area	Bkgnd Height	Time	Peak Stored
1	0.014	13.58	0.0554	0.0647	0.0905	0.3630	0.2700	4:16:49 AM	Yes
2	0.014	14.12	0.0576	0.0669	0.0924	0.3449	0.2484	4:19:25 AM	Yes
3	0.011	11.48	0.0468	0.0561	0.0870	0.1891	0.2317	4:22:00 AM	Yes
Mean:	0.013	13.06	0.0533						
SD:	0.0014	1.397	0.0057						
%RSD:	10.70%	10.70%	10.70						

Analysis Begun

Logged In Analyst: URC
Spectrometer: PinAAcle 900H, S/N PHCS16091301

Technique: AA Furnace
Autosampler: AS 900

Sample Information File: C:\Users\Public\PerkinElmer Syngistix\AA\Data\Sample Information\2nd May 2018_As.sifx
Batch ID: As

Method: 2nd May 2018 As — Page 3 — Date: 6/26/2018 6:53:03 AM

Results Data Set: 2nd May 2018
Results Library: C:\Users\Public\PerkinElmer Syngistix\AA\Data\Results\Results.mdb

Method Loaded
Method Name: 2nd May 2018_As
Method Last Saved: 6/26/2018 3:35:43 AM
Method Description: Element As

Sequence No.: 1
Sample ID: Dr Hla Toe_After_As
Analyst:
uL dispensed: 5 from 86, 20 from 5

Autosampler Location: 5
Date Collected: 6/26/2018 4:26:14 AM
Data Type: Original

Replicate Data: Dr Hla Toe_After_As — Analyte: As 193.70

Repl #	SampleConc mg/L	StndConc ppb	BlnkCorr Signal	Peak Area	Peak Height	Bkgnd Area	Bkgnd Height	Time	Peak Stored
1	0.008	7.546	0.0308	0.0400	0.0625	0.1845	0.2122	4:26:58 AM	Yes
2	0.010	10.07	0.0411	0.0503	0.0642	0.2465	0.2205	4:29:38 AM	Yes
3	0.010	10.39	0.0424	0.0517	0.0669	0.3153	0.1983	4:32:18 AM	Yes
Mean:	0.009	9.338	0.0381						
SD:	0.0016	1.5601	0.0064						
%RSD:	16.71%	16.71%	16.71						

Figure 9 AAS analysis of filtered water (before& after)

Sr	Samples Measurement Types	Before filter	After filter			
			Coconut shell coir	Coconut hard shell	Loofah	Drinking standard
1	pH	8.9	7.97	9.3	9.7	6.5-8.5
2	Turbidity	6 FAU	<5 FAU	<5 FAU	<5 FAU	≤ 10FAU
3	Conductivity	0.6 mS/cm	1 mS/cm	2.18mS/cm	1 mS/cm	≤ 2.5 mS/cm
4	Total dissolved solids	314 mg/L	144 mg/L	1160 mg/L	922 mg/L	NG
5	Hardness	230 mg/L	100 mg/L	290 mg/L	60 mg/L	≤60 mg/L

Table 1 The purification analysis of lake water by different activated carbons

Sr	Samples Measurement Types	Before filter	After filter			
			Coconut shell coir	Coconut hard shell	Loofah	Drinking standard
1	pH	8.3	6.5	9	9.6	6.5-8.5
2	Turbidity	190 FAU	<5 FAU	<5 FAU	<5 FAU	≤ 10FAU
3	Conductivity	0.1 mS/cm	0.9 mS/cm	0.7 mS/cm	1 mS/cm	≤ 2.5 mS/cm
4	Total dissolved solids	481 mg/L	69 mg/L	376 mg/L	667 mg/L	NG
5	Hardness	34 mg/L	21 mg/L	60 mg/L	60 mg/L	≤60 mg/L

Table 2 The purification analysis of river water by different activated carbons

Discussion

The water purification system is setup with water bottle. The four kinds of filter materials are large stone, small stone, activated carbon and sand. Among them, different kinds of activated carbon are studied; there are coconut shell coir, coconut hard shell and loofah. The sample portable filter equipment was designed by useing water bottle. It is easy to make, easy to carry and very cheap for everyone.Strengths of water filtration system are

- Easy to find raw materials for activated carbon.
- This filtration process is easy for everybody.
- Low cost filtration process.
- Easy to do by themselves
- After filtration process ,the water is clearer than unclean water
- The activated carbon successfully absorbs the contaminants of water
- This system is reallyhelpful to rural area community

Conclusion

The surface water purification system was successfully done in Pyay University. This system includes water bottle, different size of rock, sand and activated carbon. In this research, activated carbon was made from coconut shell coir, coconut hard shell and loofah at temperature at 500°C. Coconut shell coir, coconut hard shelland loofah were used for filtration process. Among these four types of materials for activated carbon, coconut shell coir is the best condition of activated carbon for surface water purification system.According to comparison study of surface water filtration with before and after condition , pH level and arsenic level were dropped to safe level. The water color of before filtering water is light green and after filtering the water is clear and transparent without contamination. Coconut shell coir activated carbon can control water color and absorbs smell of water.

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References

[1] Bach, Annette, and Darnell Lundstrom. 1988. Household Water Treatment. HE-430, North Dakota State University Extension Service, Fargo, North Dakota.

[2] Mesner, Nancy. 2005. How to Protect Your Well Water. WQFA 1.Fact Sheet 1, Utah State University Water Quality Extension, Utah State University.

[3] Seelig, Bruce, Russell Derickson, and Fred Bergsrud, "Treatment Systems for Household Water Supplies: Iron and Manganese Removal."AE-1030, North Dakota State University Extension Service (1992) 89.

[4] Utah State University,2005 Water Quality. www.extens ion.usu.edu/water quality. Wagenet, Linda, and Ann Lemley. 1988.