WATER ANALYSIS USING ACTIVATED CARBON FROM COCONUT SHELL

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Abstract- Activated carbon is produced mainly from coconut shell that is highly available in the region of Dhofar, Sultanate of Oman. The material is activated using chemical activation process which comprises the following activation agents; calcium chloride, sodium chloride and zinc chloride. The product form into a powder, in a specified particle size of 250 microns. The shell-based activated carbon is used for purification of three water samples; fog water, ground water and potable water. Activated carbon prepared from coconut shell has been found to be effective for the removal of salts in various water samples. Also the effectiveness varies on the type of activating agent. The activated carbon prepared from zinc chloride has the highest capacity of salts removal and the activated carbon from calcium chloride has the lowest capacity of salts removal. The study also confirmed that the activated carbon prepared could also be used for decolorization of liquid.

1. INTRODUCTION

Activated carbon is form of carbon species that is processed and prepared to have high porosity and vary large surface area available for adsorption[1]. The main aim of this study is to remove the salts presence in the water by using activated carbon with the following objectives to determine the physical and chemical properties of the activated carbon. The primary raw material used for activated carbon is an organic materials comes from coconut shell. Also the water samples tested comes from different location; fog, potable and ground water (Darbat). Activated carbon can produced by two main process namely physical reactivation and chemical activation. In this project the process selected is base in chemical activation using chemicals such as sodium chloride, zinc chloride, and calcium chloride for different concentration. To identify the effectiveness of the activated carbon, the sample water is being check before and after using the following tests. pH determination, metal contents by flame photometry and total dissolved solid test using TDS meter. After analyzing the samples with different parameters it showed the improvement of pH by decreasing the pH value. From the total dissolve solids it's showed that the TDS due to its removal efficiency [2].

2. MATERIALS AND METHODS

2.1. Samples

Coconut trees have a smooth, columnar, light grey-brown trunk, with a mean diameter of 30-40 cm height, and topped with a terminal crown of leaves. Tall selections may attain a height of 24-30 m; Shell charcoal is an important product obtained from coconut shell. Shell charcoal is used widely as domestic and industrial fuel. It is also used by blacksmiths and goldsmiths and in laundries. Shell charcoal is also used to produce activated carbon. Activated Carbon produced from coconut shell has certain specific advantages as the raw material can absorb certain molecular species [3].

2.2. Process Selected

Activated carbon is a form of carbon species that is processed and prepared to have high porosity and very large surface area available for adsorption. The large surface area implies a high capacity for adsorbing chemicals from gases and liquids. There are two types of activation of carbon

Chemical Activation :

Chemical activation commonly used because it is easier and required low temperature and less time.
Chemical activation is doing by activating chemical solution to activate the carbon. Chemical solution can be strong acid or strong base or salt for example (sodium chloride, zinc chloride and calcium chloride).
The carbon structure is fill with pores which is closed, so by this chemical solution, the pores will opened and then impurities will stuck in that pores of activated carbon.

2.3. Apparatus

A Flame photometric was used for the determination of metal atoms such as Na, K, Li, Ba and Ca. Atoms are formed from their solution, during atomization in the flame at about 1700^0C.

2.4. Experiments

Collected dry coconut shell which is available in large size and make it into small particles by using harmer or heavy tools. Weighed the dry coconut shell by using electric balance for 6 samples of equal amount at 30 g for each. Then burned the coconut shell using furnace instrument for 3 hr at 350^0C. After burning it was crushed into different sizes using monitor and bustle. Then by using different concentrations of NaCl, $CaCl_2$ and $ZnCl_2$ activated the adsorbent. Then contacted the adsorbents with different samples of solutions and tested for different parameters.
Keep going to stirring the different samples black carbon

beakers using plate and magnetic stirrer for 24 hours. After stirring, wash different samples of black carbon by distill water for 3 times using different filter paper and butcher funnel. Next, move them to the oven at temperature of 100 C and for 12 hours. Finally, the activated carbon become ready to applied some test and properties and used for its propose [4].

3. RESULTS AND DISCUSSION
3.1. Physical Tests:
3.1.1. Physical Tests of Activated Carbon

The physical properties							
Properties	Theoretical data	After adding activated carbon					
		Nacl		$CaCl_2$		$ZnCl_2$	
		25%	50%	25%	50%	25%	50%
State	Solid	Solid					
Color	Black	Black					
Odor	No odor	No odor					
Moisture	5-10%	5.23%	5.811%	5.66%	6.081%	6.56%	6.68%
Density	0.4-0.6 g/ml	0.412 gm/l	0.47 g/ml	0.412 g/ml	0.457 g/ml	0.46 g/ml	0.52 g/ml
Ach continue	4-6%	4.51%	5%	4.44%	5.5%	4.47%	6.16%

Table.3.1.1. Physical Tests

3.2 Chemical Tests:

Fog Water		Before Adding A.C	After Adding A.C					
			NaCl		$CaCl_2$		$ZnCl_2$	
			25%	50%	25%	50%	25%	50%
Flame Test	K	3.1	3.2	2	7	7.6	3.7	4.3
	Na	4.6	5.5	5.7	2.2	3.8	3.7	3.6
	Ca	0.1	0	0	0	0	0	0
	Ba	0	0	0	0	0	0	0
	Li	0	0	0	0	0	0	0

3.2.1. Physical Tests of Activated Carbon

Properties	NaCl		$CaCl_2$		$ZnCl_2$		Theoretical data
	25%	50%	25%	50%	25%	50%	
pH	6.17	5.77	5.21	5.71	5.12	5.58	5-7

Table. 3.2.1. Chemical Tests

3.3. Flame Photometry Test:
3.3.1. Flame Photometry Test for Fog Water:

Table 3.3.1.1: Flame Photometry Test for Fog Water before and after adding A.C
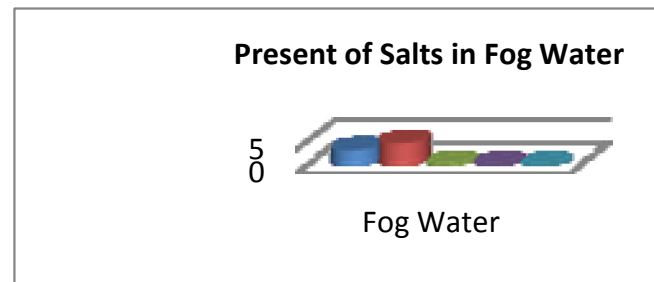

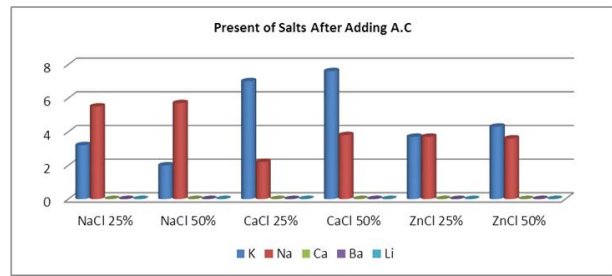Figure 3.3.1.1 Present of Salts in Fog Water before adding A.C

Figure 3.3.1.2 Present of Salts in Fog Water after adding A.C

It can be seen from the results that the amount of some elements well be reduced from the fog water after adding activated carbon, but in some cases it well increasing. For example, in case of potassium, it is increase when we use activated carbon which is activated by $CaCl_2$ and $ZnCl_2$, but the amount decreasing when we use activated carbon which is activated by NaCl. In addition the amount of the sodium reduced from the fog water when we adding the activated carbon which are activated by $ZnCl_2$ and $CaCl_2$, but when we use the activated carbon which is activated by NaCl the amount is increase, may be because present of sodium elements in both, fog water as well as activated carbon. On the other hand, the calcium that is present in the fog water decreased or removed by all three activated carbon [5].

3.3.2 Flame Photometry Test for TAP Water:
Table 3.3.2.1 Flame Photometry Test for Tap Water before and after adding A.C

Tap Water		Before adding AC	After adding AC					
			NaCl		$CaCl_2$		$ZnCl_2$	
			25%	50%	25%	50%	25%	50%
Flame Test	K	1.1	1.8	1.6	5.7	5.9	2	3.1
	Na	4.2	5.9	4.8	3.8	3.4	3.8	3.5
	Ca	0.1	0	0	0	0	0	0
	Ba	0	0	0	0	0	0	0
	Li	0	0	0	0	0	0	0

Figure 3.3.2.1 Present of salts for Tap Water before Adding A.C
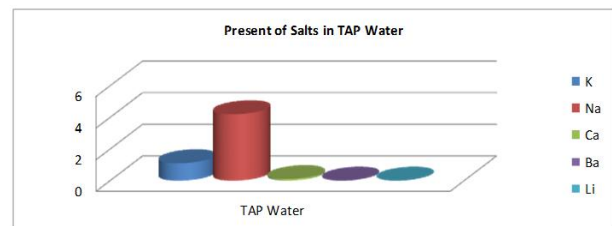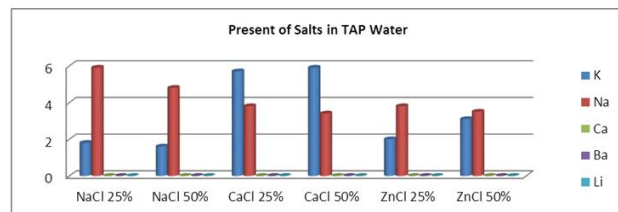

Figure 3.3.2.2 Present of salts for Tap Water after Adding A.C

The result show that the tap water content high amount of sodium, and this amount is reduced after the activated carbons which are activated by $CaCl_2$ and $ZnCl_2$ are adding to the tap water, but when we add the activated carbon which is activated by NaCl to the tap water the amount of sodium which present increase. However the amount of coliseum which is present in the tap water is removed by all three activated carbon, the amount of potassium which present in the tap water increase when we tested with all three activated carbon separately [6].

3.3.3 Flame Photometry Test for Tap Water:

3.3.3.1 Flame Photometry Test for TAP Water before and after adding A.C

Figure 3.3.3.1 Present of salts in well Water before adding A.C

The table show that the amount of potassium and sodium which are present in the well water cannot removed or reduced when we tested with the activated carbons which are activated by NaCl, $CaCl_2$ and $ZnCl_2$, except when the water are tested with the activated carbon which is activate by NaCl 25%, the amount of the sodium which present in well water reduced by small amount. On the other hand, the amount of calcium which present in well water was removed when we tested with all three sample of activated carbon separately [7, 8].

4. CONCLUSION

Activated carbon is form of carbon species which is processed and prepared to have high porosity and vary large surface area available for adsorption. Aim of the study is to remove salts that present on the water using activated carbon includes determination of physical and chemical properties of activated carbon. The raw material of the study is activated carbon from coconut shell. In addition, the sample of water which has being analyzed comes is from different location; fog, potable and ground water (Darbat). The production of activated carbon can be done by two processed called chemical activation and physical activation. In this project the process selected is base in chemical activation using chemicals such as sodium chloride, zinc chloride, and calcium chloride for different concentration. To identify the effectiveness of the activated carbon, the sample water is being check before and after using the following tests; pH determination, metal contents by flame photometry and total dissolved solid test using TDS meter. After analyzing the samples with different parameters it showed the improvement of pH by decreasing the pH value. From the total dissolve solids it's showed that the TDS due to its removal efficiency. Unfortunately, in flame photometry test none of elements decrease after adding activated carbon exception calcium. After researching and analyzing we found that activated carbon is not good agent for remove some element for example potassium.

Well Water		Before Adding A.C	After Adding A.C					
			NaCl		$CaCl_2$		$ZnCl_2$	
			25%	50%	25%	50%	25%	50%
Flame Test	K	1.3	1.8	1.4	3.5	4.6	1.8	2.1
	Na	2.8	2.6	3.5	2.7	3	2.7	2.4
	Ca	0.1	0	0	0	0	0	0
	Ba	0	0	0	0	0	0	0
	Li	0	0	0	0	0	0	0

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