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# WASTEWATER MANAGEMENT FILTRATION USING COCONUT SHELL ACTIVATED CARBON

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## ABSTRACT

***The study examined the physical and chemical characteristics of water and the effectiveness of coconut shell-activated carbon as a wastewater purifier. The physical characteristic of water as to its turbidity and odor was measured through a survey questionnaire checklist. Analysis of data revealed that the respondents agreed that after filtration, the water became clear and there was odorless proving that coconut shell-activated carbon can be an effective water purifier. Relatively, the laboratory test conducted on the sample of purified water to determine its chemical characteristics and revealed total dissolved solids, total suspended solid, pH at 25oC, and Chemical Oxygen Demand (COD) obtained a passed mark. Therefore, coconut shell-activated carbon infused in water can be a safe alternative to consume purified water.***

## 1. INTRODUCTION

Water is the second most important need for life to exist after the air. Water quality is a measurement of the condition of water relative to the requirements of any human need or purpose and the earth is widely known to contain a large percentage of water. However, only 3% of that water is fresh water and available to humans with only 0.06% easily accessible to humans for use.

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 the natural environment. Water pollution is a major problem in the global context has been suggested to be the leading worldwide cause of death and diseases. With this in mind, the researcher gives priority to conduct a study concerning water.

Nowadays, water quality has become a popular global issue. People are increasingly concerned about contaminants in their drinking water that cannot be removed by water softeners or physical filtration. Therefore, it needs treatment to make it safe for human. As such, a way to reduce water pollution

may be utilized by using activated carbon for wastewater treatment.

In line with the above discussion, activated carbon can be produced from different raw carbon resources like lignite, peat, coal, and biomass resources such as wood, sawdust, bagasse, and coconut shells (Ioannidou and Zabaniotou, 2016). However, the abundant supply of coconut shell as a waste product from the coconut oil and desiccated coconut industry makes the production of activated carbon from this material more viable. Furthermore, besides being an amorphous form of carbon that can absorb many gases, vapors, and colloidal solids, coconut shell-activated carbons are advantageous over carbons made from other materials because of their high density, high purity, and virtually dust-free nature. These carbons are harder and more resistant to attrition. Also, coconut-shell-based activated carbons are predominantly micro-porous and are the least dusty, thus, they are very efficient when it comes to organic chemical adsorption.

Thus, this study will investigate the efficiency of activated carbon from coconut shells as the potential effective absorbent material in water filters due to its nature of greater micro-pores, inexpensive and abundantly available over other agricultural by-products. As activated carbon comes from many sources, this study will focus more on activated carbon from coconut shells.

## 2. OBJECTIVES

The aim of this study is to determine the level of effectiveness of the coconut shell activated carbon from coconut shell in terms of physical characteristics as to turbidity and odor? Determine the level of effectiveness of the activated carbon from coconut shell in terms of chemical characteristics as to COD, Total suspended solids, pH at 25 degree Celsius, Salinity and Total dissolved solids and lastly find the significant difference between the assessments made by the two groups of respondents

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on the effectiveness of activated carbon from coconut shells to purify water in terms of turbidity and odor.

## 3. METHODOLOGY

The descriptive method was used to determine the coconut shell-activated carbon as an effective absorbent to purify water.

Steven (2016) defines the descriptive method in research as to develop, test, and evaluate research instruments and methods. It explores phenomena in real-life situations and uses a survey method. Common data gathering methods are questionnaires, interviews, and observation.

The instrument that will be used in the study is a survey questionnaire checklist to get ample assessment and evaluation of the purified water using coconut shell-activated carbon as an effective absorbent as to its physical characteristics.

The sample of this study comprised of two (2) groups of respondents. The first group consists of twenty (20) workers from coprahan and twenty (20) science teachers to give ample evaluation of the purified water using coconut shell-activated carbon as to physical characteristics. On the other hand, a laboratory test will be made on the sample of purified water to determine its chemical characteristics.

## 4. LITERATURE REVIEW

The use of activated carbon to remove harmful impurities like organic contaminants from water has been practiced since Roman times. Activated carbon is the generic term used to describe a family of carbonaceous adsorbents with a highly amorphous form and extensively developed internal pore structure (Shankar, 2018).

Aljeboree (2017) also discussed that activated carbon, a widely used adsorbent in industrial processes, is composed of a microporous, homogenous structure with high surface area and shows radiation stability. The process for producing high-efficiency activated carbon is not completely investigated in developing countries. However, there are many problems with the regeneration of used activated carbon. Nowadays, there is a great interest in finding inexpensive and effective alternatives to the existing commercial activated carbon.

Exploring effective and low-cost activated carbon may also contribute to environmental sustainability and offer benefits for future commercial applications (Akhir et. al, 2017). The costs of activated carbon prepared from biomaterials are very low compared to the cost of commercial activated carbon. Waste materials that have been successfully used to manufacture activated carbon in the recent past include waste wood.

Activated carbons also play an important role in many areas of modern science and technology such as purification of liquids and gases, separation of mixtures, and catalysis (Reinoso, 2016). Many experiments and studies have been carried out regarding the characterization of the activated carbon which was synthesized from a source such as fluted pumpkin seed, groundnut shell, palm oil waste, Karanja oilseed, rubberwood sawdust, etc.

## 5. DISCUSSION

**Table 1** Level of the Coconut Shell Activated Carbon's Effectiveness on Eliminating Water Turbidity.

| Statements | Households | | |
|---|---|---|---|
| | **Mea** | **SD** | **REMARKS** |
| After passing through the coconut shell- activated carbon, water is clear and does not absorb light. | 4.6 | 0.52 | **StronglyAgree** |
| Water has a slight blue color that becomes a deeper blue as the thickness of the observed sample increases | 3.9 | 0.99 | **Agree** |
| Processed water, when compared to purified water, perceives the same appearance. | 4 | 0.82 | **Agree** |
| Water does not have any hint of color that may pertain to high mineral content. | 4.7 | 0.67 | **Strongly Agree** |

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| | | | |
|---|---|---|---|
| Small or big particles in water that perceive any other color than clear were unrecognizable. | 4.5 | | **Strongly Agree** |
| **Weighted Mean (WM): SD** | **4.50: 1.054** | | |
| **Verbal Interpretation** | **Strongly Agree** | | |

| **Statements** | **Teachers** | | |
|---|---|---|---|
| | **Mean** | **SD** | **REMARKS** |
| After passing through the coconut shell- activated carbon, water is clear and does not absorb light. | 5 | 0 | **Strongly Agree** |
| Water has a slight blue color that becomes a deeper blue as the thickness of the observed sample increases | 2.8 | 0.52 | **Moderately Agree** |
| Processed water, when compared to purified water, perceives the same appearance. | 4.4 | 0.52 | **Strongly Agree** |
| Water does not have any hint of color that may pertain to high mineral content. | 5 | 0 | **Strongly Agree** |
| Small or big particles in water that perceive any other color than clear were unrecognizable. | 4.8 | 0.42 | **Strongly Agree** |
| **Weighted Mean (WM): SD** | **4.49 : 1.084** | | |
| **Verbal Interpretation** | **Strongly Agree** | | |

Both household and the workers in coprahan agreed that after passing thru the coconut shell-activated carbon the water does not show any hint of particles and appears clear.

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**Table 2. Level of the Coconut Shell Activated Carbon's Effectiveness on Eliminating Water Odor**

| Statements | Households | | |
|---|---|---|---|
| | **Mean** | **SD** | **Remarks** |
| Coconut shells activated carbon, when incorporated with water, removes any unwanted odor | 4.9 | 0.32 | **Strongly Agree** |
| Water does not have any smell that can be distinguished because of the nose receptors | 4.8 | 0.42 | **Strongly Agree** |
| Odorless water is evident | 4.9 | 0.32 | **StronglyAgree** |
| No unwanted odor is observed in the water | 4.9 | 0.32 | **Strongly Agree** |
| Using coconut shell-activated carbon to purify water does leave no odor such as earthy, moldy, musty, and earthy odor. | 4.7 | 0.67 | **Strongly Agree** |
| **Weighted Mean (WM) :SD** | **4.86 : 0.377** | | |
| **Verbal Interpretation** | **Strongly Agree** | | |

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| Statements | Teachers | | |
|---|---|---|---|
| | Mean | SD | Remarks |
| Coconut shells activated carbon, when incorporated with water, removes any unwanted odor | 4.8 | 0.63 | **Strongly Agree** |
| Water does not have any smell that can be distinguished because of the nose receptors | 4.7 | 0.67 | **Strongly Agree** |
| Odorless water is evident | 4.6 | 0.7 | **Strongly Agree** |
| No unwanted odor is observed in the water | 4.8 | 0.42 | **Strongly Agree** |
| Using coconut shell-activated carbon to purify water does leave no odor such as earthy, moldy, musty, and earthy odor. | 4.9 | 0.32 | **Strongly Agree** |
| **Weighted Mean (WM) :SD** | **4.76 : 0.597** | | |
| **Verbal Interpretation** | **Strongly Agree** | | |

Coconut shells activated carbon, when incorporated with water, removes any unwanted odor, odorless water is evident and no unwanted odor is observed in the water.

**Table 3. Level of the Coconut Shell Activated Carbon's Effectiveness on Eliminating COD, Total Suspended Solid, pH at 25oC, salinity and Total Dissolved Solid**

| Analysis | Analytical Method | Before | |
|---|---|---|---|
| | | Results | Remarks |
| *COD* | *Closed Reflux Dichromate (SMEWW 5220C)* | *110.0 mg/L* | *Failed* |
| *Total Suspended Solids* | *TSS Dried at 103-105 C (SMEWW 2540D)* | *14.0 mg/L* | *Passed* |
| *pH @25$^0$C* | *Electrometric (SMEWW Part 4500-$H^+$* | *8.191* | *Passed* |
| *Salinity* | *Electrometric Method (SMEWW 2520)* | *20.00%* | . . . . . |
| *Total Dissolved Solids* | *Conductometric Method* | *240.0 mg/L* | . . . . . |
| ***Total Remarks: Passed*** | | | |

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| Analysis | Analytical Method | After | |
|---|---|---|---|
| | | Results | Remarks |
| *COD* | *Closed Reflux Dichromate (SMEWW 5220C)* | *20.0 mg/L* | *Passed* |
| *Total Suspended Solids* | *TSS Dried at 103-105$^0$C (SMEWW 2540D)* | *20.0 mg/L* | *Passed* |
| *pH$^0$@25 C* | *Electrometric (SMEWW Part 4500-H$^+$* | *8.16* | *Passed* |
| *Salinity* | *Electrometric Method (SMEWW 2520)* | *0.20%* | *. . . . .* |
| *Total Dissolved Solids* | *Conductometric Method* | *183.0 mg/L* | *. . . . .* |
| ***Total Remarks: Passed*** | | | |

Table 3 shows the Analytical Test Results for water, in terms of COD with the analytical method of Closed Reflux Dichromate (SMEWW 5220C) has a test result of 110.0 mg/L to 20.0 mg/L and below the standard measurement of 100.0 mg/L has a remark of Passed. The Total Suspended Solids with the analytical method of TSS Dried at 103-1050C (SMEWW 2540D) has a test result of 14.0 mg/L to 20.0 mg/L and below the maximum measurement of 100 mg/L has a remark of Passed. And the pH @250C with the analytical method of Electrometric (SMEWW Part 4500-H+ has a test result of 8.191 to 8.16 and below the scale measurement of 6.0 – 9.5 has a remark of Passed. While the Salinity with the

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analytical method of Electrometric Method (SMEWW 2520) has a test result of 20.00% to 0.20% and the Total Dissolved Solids with the analytical method of Conductometric Method has a test result of 240.0 mg/L to 183.0 mg/L.

This means that the level of effectiveness of the coconut shell activated carbon from coconut shell in terms of chemical characteristics of water as to COD, Total Suspended Solids, pH @250C, Salinity, Total Dissolved Solids of Ground Water help them to identify that this coconut shell activated carbon to be infused in water will be a safe alternative to consume clean water.

## 6. CONCLUSION

Based on the foregoing findings, the following conclusion was drawn. Based on the data, it is shown that there is no significant difference between the assessments made by the groups of respondents on the effectiveness of activated carbon from coconut shells to purify water at a 0.05 level of significance. It shows that the null hypothesis stating that "There is no significant difference between the assessments made by the groups of respondents on the effectiveness of activated carbon from coconut shell to purify water" is accepted, it can be inferred that there is "no significant" difference between them.

## 7. RECOMMENDATION

Based on the drawn conclusions resulted to the following recommendations:

1. Coconut shell-activated carbon, in terms of physical characteristics of water, only applies to eliminating its odor and turbidity but is not proven to emit TSS or Total Suspended Solids. Finding another component to solve this problem may be recommended to make the most of making the coconut shell-activated carbon effective in water.
2. Furthermore, this research could also be used larger water treatments and be observed for a long time as this would allow for a better generalization of the data.
3. Feedbacks and observations garnered should be taken into consideration to determine the progress of the researchers in achieving their objectives.
4. Finally, this research can also use another raw material in making activated carbon for comparison

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