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CREATE WATER PURIFIER FROM PARTICULATE MATTER COLLECTED FROM VEHICLE EXHAUST

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Abstract: Vehicle pollution is major cause of Air pollution. Particulate matter has been captured from different vehicle. A filter was prepared in which aluminum foil was wrapped inside the filter with two layer inside it. Filter containing particulate matter was dipped in SLS (Sodium lauryl sulphate) surfactant solution of 800 ml with a concentration of 10 mM to separate particle present in aluminum foil paper and was filtered out. Filtered Particulate matter was immersed in $CaCl_2$ solution to obtain Activated carbon. Activated carbon is used for metal extraction, medicine, water purification, Air filter, etc. Difference between waste water and water passing through the activated carbon from a waste filter was determined. Analysis has been carried out in which water pH, was analyzed by wet analysis process, conductivity and turbility was analyzed by Nephelometer. BOD and COD were analyzed by DO meter. Pure form of water was obtain which passed through the Activated carbon compared to the waste water.

Keywords: Particulate matter, Activated carbon, SLS , $CaCl_2$, waste water, filter.

1.INTRODUCTION

Water contamination is the existence of some foreign, inorganic, biological, radiological or physical material in water. These substances contaminate water by degrading their quality that can cause danger to health or decrease water profit.

There are two main sources of water, outside water and land water. Surface water comes from flood, pond, rivers, shallow wells and deposits created by mumming. Most surface waters carry suspended solidified, organic and inorganic substances, microbes and other biotas. If these substances are existing in the water at an optimum level, they do not cause contamination.

The presence of heavy metals (such as arsenic, lead, etc.) in waters, especially groundwater, has become a global problem in recent decades. The current regulation of the drinking water standard has become stricter and requires that the arsenic content from being reduced to some parts by billions. There are arsenic removal method numbers, which include adsorption, coagulation followed by precipitation, membrane separation, anion exchange, etc.

The use of low-cost adsorbent obtained from a material that is respectful with the environment, has been investigated as a replacement for current costly methods to eliminate the arsenic of the solution.

Natural materials or waste products of certain industries with a high capacity for arsenic can be obtained, employed and removed with little cost. The modification of adsorbents can also improve adsorption capacity.

The technical feasibility of various low-cost adsorbents for arsenic removal from contaminated water has been reviewed.

Some of the contaminants such as lead (Pb), arsenic (As), mercury (Hg), chromium (Cr) especially hexavalent chromium, nickel (Ni), barium (Ba), cadmium (Cd), Cobalt (Co), Selenium (Se), Vanadium (V), Oils and Grease, Pesticides, etc. They are very harmful, toxic and poisonous even in the range of PPB (parts by one billion).

There are some compounds such as cyanides, thiocyanides, phenolic compounds, fluorides, radioactive substances, etc. that are detrimental to both humans and animals.

2. LITERATURE REVIEW

2.1 Introduction

Environmental contamination as a result of modern industrial development is one of the century's most serious issues. In recent decades, the poisoning of water resources by hazardous chemicals has gotten a lot of attention. This is due to its negative health impacts, both acute and chronic.

2.2 Waste Water Treatment

Heavy metal removal from wastewater treatment alternatives For the removal of heavy metals from industrial effluent, various solutions are currently available. Chemical precipitation with lime or caustic soda is the most typical treatment when metal or water recovery is not a concern. This method has a number of significant drawbacks, including residual metal solubility, a high need for chemical products, and the formation of a huge volume of sludge that must be carefully removed in subsequent processes. Other therapies, including as ion exchange, reverse osmosis, and electro dialysis, need a significant upfront investment and ongoing operating costs. Adsorption is by far the most versatile and extensively utilized method for metal ion elimination. For almost three decades, activated coal has been the gold standard for the treatment of industrial wastewater.

2.3 Adsorption

Adsorption could be a viable alternative to standard metal ion removal treatments. Adsorption has been observed in non-living biomass such as potato peel waste, untreated Cocos Nucifera, crab shell, and untreated coffee grounds, as well as live biomass such as microbial cells, moss, yeast, fungi, algae activated carbon, and orange peel.

It has been shown that adsorption is an excellent way to treat effluents of industrial waste, offering important advantages such as low cost, availability, profitability, easy to operate and efficiency.

The use of microbial biosorbents for the removal of heavy metals, toxic wastewater, offers a relatively low cost method with a metal recovery potential. Adsorption has different advantages over conventional methods: the process does not produce sludge that require more elimination, it could be highly selective, more efficient, easy to operate, can handle large volumes of wastewater containing low metal concentrations. The capacity of metal sequestration of microorganisms, such as yeast, bacteria, fungi and algae, have been investigated and reported. The publication technology based on the use of dead biomass offers certain main advantages, such as the lack of toxicity restrictions, without nutrient supply requirements and recovery of metallic species attached by desorption.

2.3.1 Types of Adsorbents

In recent decades, alternative sorbents have been investigated for the treatment of heavy metal contamination. There is a large volume of literature related to the performance of different biosorbents for the elimination of the variety of heavy metals. Agricultural residues seem to be preferred that green coconut shells are a more appropriate example for the elimination of adsorption and organic products. The plant components are mostly cellulose-based, which can adsorb heavy metal cations in aqueous solution. There are several sources of waste biomass present in nature, including rice husk, dust, tea and coffee leftovers, orange peanut shells, and leaves, all of which have been shown to exhibit some experimental adsorption capabilities. Dry Tree And Bark With Activated Carbon. In the literatures, the studies were performed using the banana peel for (III) and the watermelon shell for Ni (II) and Co (II).

Azouaou et al. (2010) used untreated coffee grounds as an adsorbent to investigate the effect of various factors on adsorption capacity. They found that the adsorption process is a function of the adsorbent concentration, pH, metal ion concentration and temperature.

2.3.2 Adsorption Mechanisms

Because of the adsorption structure's intricacy, the metal can be collected by the cell in a variety of ways. As a result, there are a variety of adsorption mechanisms, some of which are still unknown. Metal adsorption and biosorption in agricultural leftovers is a complicated process influenced by a number of factors. Quantification, complexation, the complexity of the adsorption of the surface and pores, the exchange of ions, the micropressive, the condensation of heavy metal hydroxide in the biosuperficiency, and the adsorption of the surface are all mechanisms involved in the biosorption process. The following criteria can be used to categorise them.

2.3.2.1 Transport of the metal across the cell membrane

This phenomenon is associated with cellular metabolism. It implies that this type of adsorption can take place only in viable cells. Unfortunately, it is the toxicity of some elements that does not allow the investigation of adsorption in the presence of high concentrations of metal. In fact, there is little information available on this type of mechanism. Heavy metals can be transported through the microbial cell membrane using the same process that transports important metabolic ions like potassium, magnesium, and sodium. The existence of heavy metal ions with the same load and radius of ions can be confused with the metal transport system.

This type of mechanism is frequently used following the cell surface junction, which is linked to metabolic activity. There are many examples in the literature where it has been shown that adsorption by viva microorganisms comprises two basic steps. First, the metabolism, the independent union to the cell walls and, secondly, the intracellular uptake dependent on metabolism, so that the metal ions are transported through the cell membrane to the cell.

2.3.2.2 Physical adsorption

Van der Waals forces of attraction between the metal and the cell surface are involved in physical adsorption, which is independent of cell metabolism. The biosorption of thorium and uranium by Rhizopus arrhizus fungal biomass is based on physical adsorption in the cell-wall chitin structure, according to Tsezos and Volesky (1982). Kuyucak and Volesky (1989) suggested that uranium, cadmium, zinc,copper and cobalt biosorption by dead biomass of algae, fungus and yeast takes place through electrostatic interaction between ions in solution and cellular walls. Rhizopus arrhizus biosorption of copper, nickel, cadmium, zinc, and lead is also due to physical adsorption.

2.3.2.3 Ion exchange

In heavy metal adsorption, ion exchange is a crucial topic. According to Ozer et al. (2003), the biosorption capabilities of Pb^{2+}, Ni^{2+}, and Cr^{3+} rose in the order of $Pb^{2+} > Ni^{2+} > Cr^{3+}$ as the atomic number grew. The biosorption characteristics of Cu^{2+}, Zn^{2+}, and Cd^{2+} onto chitin were examined by Benguella and Benaissa (2002), and the results revealed that biosorption capacity was associated with ionic potential and ionic radius.

Ion exchange involves interaction between functional groups on the cell surface and the metal ions. Cell wall of microorganism contains polysaccharides as basic building blocks. The ion exchange capabilities of natural polysaccharides have been well investigated, and it is well known that bivalent metal ions exchange with the polysaccharide's counter ions.

Alginates of marine algae usually occur as natural salts of K^+, Na^+, Ca^+ and Mg^{2+}. These metallic ions can exchange with the counter ions such as Co^{2+} ,Cu^{2+} ,Cd^{2+} and Zn^{2+} resulting in the biosorptive uptake of the metals . Ion exchange was proposed to be the mechanism of copper biosorption by fungi Ganoderma Iucidum and Aspergillus niger.

Ion exchange is thought to be involved in the adsorption of Ni(II), Cd(II), and Pb(II) from aqueous solution by hazelnut and almond shells, according to Yasemin and Zeki (2007). Lignin, tannins, and other phenolic chemicals are the main components of the polymeric material in shell.

3. EXPERIMENTAL SECTION

3.1 Materials used

- Waste filter of tractor
- Aluminium foil
- SLS (Sodium Lauryl Sulphate)
- Oil
- Soap water
- Distilled water
- Calcium chloride ($CaCl_2$)
- Waste water

3.2 Procedure

- First we have collected waste filter from tractor garage. Then wash it by soap-water to remove dust and other impurities. Then again wash 2 times by distilled water. Stand it to dry for 1hour. Make Aluminium foil electrostatic by oil using brush. Aluminium foil was wrapped inside the filter in two layer.
- First was placed on the above region of JCB and particulate matter was obtained in filter.
- 10mM Concentration solution of SLS surfactant (Sodium Lauryl Sulphate) have been made in 800ml distilled water.
- First was dip in SLS (Sodium Lauryl Sulphate) solution for about 1 day.
- Solution was filtered after 1 day using ordinary filter paper.
- Then dry this filter paper containing particulate matter.

Fig.1 Collection of particulate matter from vehicle exhaust

Fig.2 Dip the filter in SLS solution

Fig.3 Collected particulate matter

3.2.1 Conversion of particulate matter into activated Carbon

- Prepare solution of 120gm $CaCl_2$ dissolving in 360ml distilled water with a ratio of 1:3.
- Transfer particulate matter in it amd shake well.
- Cover it by Aluminium foil for 24 hours.
- After 24hrs impurities have been removed from upper layer of $CaCl_2$ solution containg particulate matter.
- Collect activated carbon from remaining solution.
- Dry in oven at 150^0C for 6 hours.

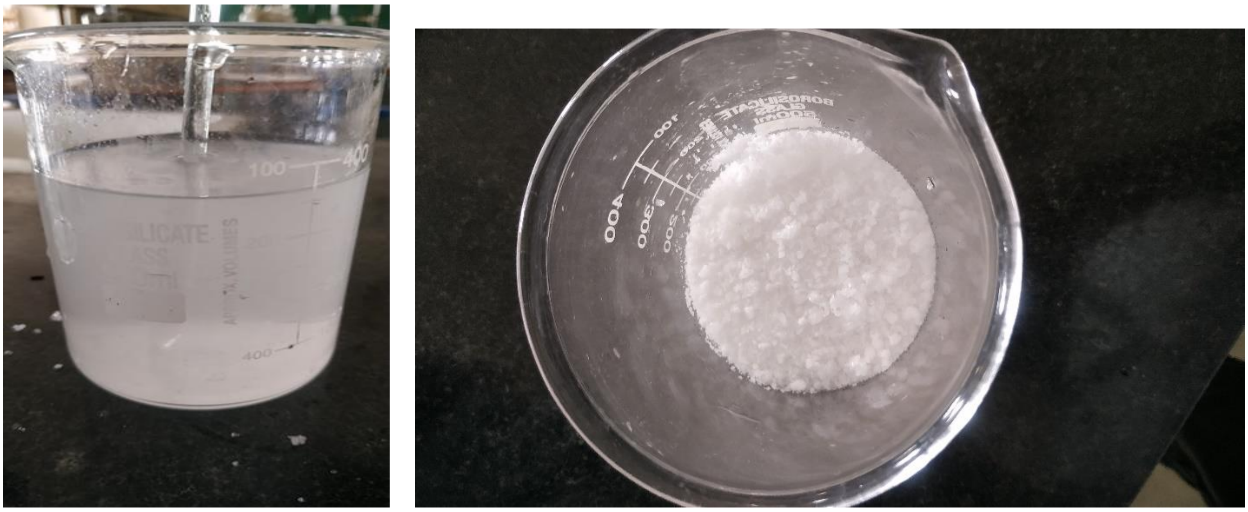

Fig.4 Solution of CaCl2

Fig.5 Dip particulate matter in CaCl2 solution

Fig.6 Dry activated carbon in oven at 1500C

3.2.2 Treatment of Waste water

- Fill the activated Carbon in filter.
- Cotton have been plugged on the filter.
- Then pass waste water through it. After this collected filterate is passed two more times from filter.

(1)

(3)

(2)

Fig.7 Pass waste water through filter

4. Result and Discussion

TEST RESULT

Water (Before Adsorption)

S.No.	Quality Characteristics	Units	Result	Test Method
1	Ph		7.80	IS 3025 (P-11) :1983 RA 2017
2	Turbidity	NTU	40.0	IS 3025 (P-10) :1984 RA 2017
3	Conductivity	µS/cm	424.0	IS 3025 (Part-14) :2013 RA 2019
4	COD	mg/l	0.0	IS 3025 (P-58) :2006 RA 2012
5	BOD (3 day at 27^0C)	mg/l	0.0	IS 3025 (P-44) :1993 RA 2009

Water (After Adsorption)

S.No.	Quality Characteristics	Units	Result	Test Method
1	Ph		8.10	IS 3025 (P-11) :1983 RA 2017
2	Turbidity	NTU	3.0	IS 3025 (P-10) :1984 RA 2017
3	Conductivity	µS/cm	647.0	IS 3025 (Part-14) :2013 RA 2019
4	COD	mg/l	0.0	IS 3025 (P-58) :2006 RA 2012
5	BOD (3 day at 27^0C)	mg/l	0.0	IS 3025 (P-44) :1993 RA 2009

DISCUSSION

1) **pH** : The pH value is determined by prescribers using electromatrical and colorimetric procedures. Both approaches can be used with any sort of water or wastewater.

The electromotive force of a cell consisting of an indicator electrode submerged in the test solution and a reference electrode is used to determine the pH value. A liquid connection, which is part of the reference electrode, is used to make contact between the test solution and the reference electrode. A pH metre, which is a voltmeter with a high calibrated impedance in terms of pH, is used to measure the electromotive force.

2) **Turbidity** : Prescribe the nephelometric technique for determining the turbidity of water. This method can be used with any sort of water.

It works by comparing the intensity of light dispersed by the sample under defined conditions to the intensity of light dispersed by a standard reference suspension under the same parameters.

Turbidity increases when the intensity of scattered light increases. Because it is more repeatable than other types of turbidity standards, the formazine polymer is often employed as a turbidity standard. The turbidity of a formazine suspension application is measured in jackson turbidity units (JTUs). When measured in the jackson candle turbidimeter, the identical suspension of formazine has a turbidity of about 40 units. As a result, the turbidity units derived from the formazine preparation are extremely similar to the jackson sailing turbidimeter derivatives, although they may not always be recognised.

3) **Conductivity** : The author describes a method for determining the conductivity of water. This method can be used with any sort of water.

The resistance of the unspecified solution between platinized electrodes of a standard conductivity cell is determined using a wheatstone bridge, in which a variable resistance is adjusted to be equal to the resistance of the unspecified solution between platinized electrodes of a standard conductivity cell.

The following relationship determines the cell constant:

Specific conductance = Conductance × Cell constant, or

$$\text{Specific conductance} = \frac{\text{Cell constant}}{\text{Resistance}}$$

With a standard solution of known conductance, the cell constant is calculated experimentally.

4) **COD** : The method for calculating the chemical oxygen demand (COD) in water and wastewater is prescribed in this rule (part 58).

When a mixture of potassium bichromate and sulfuric acid is heated to produce carbon dioxide and water, most organic matters are destroyed. Excess bichromate is entitled against ferrous ammonium sulphate when a sample is heated to reflux with a defined amount of potassium bichromate in sulfuric acid. Bichromate consumption is equal to the amount of oxygen necessary to oxidise oxidizable organic materials.

5) **BOD** : For the assessment of oxygen biochemical demand, this standard provides the oxygen depletion method based on the bio-assay test protocol.

The biochemical oxygen demand (BOD) test is primarily based on a bio-assay test process that assesses the amount of dissolved oxygen consumed by microbes while absorbing and rusting organic materials in aerobic circumstances.

The sample is incubated in a hermetic air bottle at dusk at a given temperature for a specific duration under normal test conditions.

5. CONCLUSION

The above study was to make an activated carbon from vehicle particulate matter which will be used in filter to obtain purity of water. CaCl2 solution plays an important role for synthesis of Activated carbon. A comparison of water and waste water passing through the activated carbon via. Filter has been carrried out by different type of analysis (conductivity, turbidity, pH, COD and BOD). From the result we can conculde that Activated carbon is good adsorbent for the purity of water.

6. Reference

1) Ayhan.D (2008) 'Heavy metal adsorption onto agro-based waste materials: A review' Journal of Hazardous Materials, Vol.157, pp. 220-229.

2) Azouaou.N,Sadaoui.Z,Djaafri.A and Mokaddem.H (2010) 'Adsorption of cadmium from aqueous solution onto untreated coffee grounds: Equilibrium, kinetics and thermodynamics' Journal of Hazardous Materials, Vol.184, pp. 126-134.

3) Barakat.M.A (2011) 'New trends in removing heavy metals from industrial wastewater' Arabian Journal Chemistry, Vol. 4, pp. 361-377.

4) Foo.K.Y and Hameed.B.H (2010) 'Insights into the modeling of adsorption isotherm systems: Review' Chemical Engineering Journal, Vol.156, pp. 2-10.

5) Horsfall.M.J,Abia.A.A and Spiff.A.I (2006) 'Kinetic studies on the adsorption of Cd2+,Cu2+ and Zn2+ ions from aqueous solutions by cassava (Manihot sculenta cranz)tuber bark waste' Journal of Bioresource Technology, Vol. 97, pp. 283-291.

6) Jiaping.P.C (2012) 'Decontamination of Heavy Metals: Processes, Mechanisms, and Applications' CRC Press , Print ISBN: 978-1-43981667-7

7) Lars.J (2003) 'Hazards of heavy metal contamination' British medical Bulletin Vol. 68, pp 167-182.

8) Paulo.C.G,Mauricio.P.F.F, Aderbal.G.S,Eduardo de.S.M and Andre.R.N (2001) 'Selectivity Sequence and Competitive Adsorption of Heavy Metals by Brazilian Soils' Soil Science

Society of America Journal, Vol. 65 (4), pp. 1115-1121.

9) Reena.S,Neetu.G,Anurag.M and Rajiv.G. (2011) 'Heavy metals and living systems: An overview' Indian Journal of Pharmacology, Vol. 43, pp. 246-253.

10) Volesky (1999) Biosorption for the next century. A part of invited Lectures to be presented at the International Biohydrometallurgy Symposium.

11) Ajmal.M,Rao.R.A.K,Ahmad.R and Ahmad.J (2000) 'Adsorption studies on citrus reticulate (fruit peel of orange): removal and recovery of Ni(II) from electroplating wastewater' Journal of Hazardous Materials, Vol. B 79, pp.117-131.

12) Nordiana Suhada Mohmad Tahiruddin & Siti Zubaidah Ab Rahman ,World Journal of Science and Technology Research
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