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Waste Water Treatment Using House Hold or Agricultural Waste As Adsorbents

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Abstract
Industrial, agricultural and domestic activities of humans have affected the environmental system, resulting in drastic problems such as global warming and the generation of waste water containing high levels of pollutants. Water pollution due to organic contamination is serious issue because of toxic chemicals and carcinogenic nature of the pollutants. Among various water treatment methods, adsorption is supposed as the best one due to its inexpensiveness. The utilization of all such materials as adsorbents for the treatment of waste water can reduced waste and minimize cost.
Byproducts from agricultural, household and industrial sector have been recognized as sustainable solution for waste water treatment. They allow achieving the removal of pollutants from waste water and same time to contribute to waste minimization, recovery and reuse. For this scope, adsorbents have been divided into several groups like agricultural waste, house hold waste, industrial byproducts, sea materials soil etc .The affinity of adsorbents removing various pollutants from waste water can be discussed. These adsorbents have been found to remove various organic pollutants ranging from 80 to 90%. The present article describes the conversion of waste products into effective adsorbents and their application for water treatment.

Key Words: *Adsorbents, Activated carbon, COD, BOD, DO, Hardness of water etc.*

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I. Introduction

Industrial development is backbone to economic development of the nation. It is a contribution to socio economic development of the nation. Now a days industrial sector goes on increasing rapidly ,also there is growth of science and technology is increasing highly. and it is the main reason to spread of the heavy industries. Industries help to the country for achieving economic development. There are large number of various industries such as sugar industries, Refineries, Electroplating industries, Power plants etc. which generate thousands liters of waste liquid which contain high degree of COD, BOD, DO, Suspended solids etc. which affect our environment and cause various pollutions, it is unhygienic for the environment and gives immediate result in the gradual disappearance of many natural resources. It causes the air pollution, land pollution, water pollution.

It generates a large amount of waste water, if it is discharged without treatment get affected on aquatic organism or also land get affected. Over the year quality of water is deterioration mainly due to the various activities due the rapid industrialization and unskilled utilization of natural water resources, so treatment of waste water should be necessary for the discharge of waste water for further use.

In this article we prefer for the waste water treatment using agricultural or house hold adsorbents instead of activated carbon. Adsorbents such as banana peel, orange peel, rice husks, Bagasse can be used, for the treatment of waste water instead of using various harmful chemicals. Adsorption process is consider a better alternative in water and waste water treatment because of convenience, ease of operation and simplicity of design.

LOW COST ADSORBENTS

Adsorbents plays an important role for the treatment of waste water, adsorption is present in many natural, physical, biological and chemical system and is widely used in industrial application such as act as catalyst, activated carbon etc, In industrial adsorbents can be used as removal of heavy metals, trace contaminants from waste water. Activated carbon as adsorbent is an expensive material. instead of activated carbon we can be use adsorbents such as Banana peel, Orange peel, Bagasse, Rice husk which can be a easily available with low cost. Among the various technologies investigated, adsorption considered the most widely applied technology for safe environment remediation. therefore inexpensive adsorbents should be explored and their feasibility for the removal of heavy metal should be studies in detail, which reduced its PH, COD, BOD, DO, Cl etc. results shows that low cost adsorbents can be essential or beneficial for the removal of waste water.

II. Materials And Method

- **BANANA PEEL:** Peels of Bananas are to be collected from domestic waste, Banana peel contains lipids (1.7%), proteins (0.9%), fiber (31%) and carbohydrates (59%), Potassium(78.10mg/l),manganese (76.20mg/l) and iron (0.61mg/l).peels of banana can be used as adsorbents by making its as activated carbon. so banana peels can be washed with distilled water so that dirt can be removed then wet banana peel after washing dried in hot air oven at 80’C for 24 hour so that it get completely free of moisture. dried material was finely ground and screened through the sieves of size 150-212mm.

Fig . Banana Peel

- **Orange peel:** Orange peel powder was selected as adsorbent for carbon dioxide. oranges were collected from market .Peels were wash with distilled water to remove dirt and dried in hot air oven after drying peels were crushed into small sieve size then can be used for further treatment as adsorbent.

Fig .Orange Peel

- **Rice husk:** Rice husk is an agricultural waste material generated in rice production. Dry rice husk contains 70-80% of (cellulose, sugar etc)In recent days it can be studied that rice husk material can be used as adsorbents so it can have ability to remove some heavy metals such as lead and copper from aqueous solution of waste water so it can be used as adsorbent

Fig . Rice husk

- **Bagasse:** Bagasse can be easily available from any market or local area, Bagasse (sugar cane) used as a bio adsorbents can be a better adsorptive capacity so that it can remove dye from waste water. The sugar cane Bagasse after washing can be dried at room temperature then crushed it can be now used as adsorbents. All these four selective material now can be used as adsorbents by making its activated carbon of each material.

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Fig . Bagasse

Preparation Of Activated Carbon From Low Cost Adsorbents:

Activated carbon be prepared out of these material used, i.e Banana peel, Orange peel, Rice Husk and Bagasse. after washing all these materials can be treated homogeneously for activation,100 gm of sample treated chemically by adding activation agent 2% HCl or $NaHCO_3$. The solution is placed in oven for 24hrs the sample is then washed with 2% HCL and again then dried in hot air oven. Now activated carbon is prepared for characterization of the effluents. these activated carbon can help as a adsorbents which can be used for the treatment of waste water can help us to check its Hardness ,COD, BOD,PH,DO etc.

Procedure of Measuring Parameters:
Determination of Ca and Mg:

This method, called a complexometric titration, is used to find the total calcium and magnesium content of waste water , sea water and various solid materials. It can also be used to determine the total hardness water .The combined concentration of calcium and magnesium ions is considered to be the measure of water hardness. The method uses a very large molecule called EDTA which forms a complex with calcium and magnesium ions. EDTA is short for ethylene diamine tetra acetic acid. A blue dye called Eriochrome Black T (ErioT) is used as the indicator. This blue dye also forms a complex with the calcium and magnesium ions, changing color from blue to pink in the process. The dye–metal ion complex is less stable than the EDTA–metal ion complex. For the titration, the sample solution containing the calcium and magnesium ions is reacted with an excess of EDTA. The indicator is added and remains blue as all the Ca_2 and Mg2+ ions present are complexes with the EDTA. A back titration is carried out using a solution of magnesium chloride. This forms a complex with the excess EDTA molecules until the end-point, when all the excess EDTA has been complexes. The remaining magnesium ions of the magnesium chloride solution then start to complex with ErioT indicator, immediately changing its color from blue to pink.

Method: Sample Preparation

For samples that are already in solution, such as waste water, freshwater, seawater etc no further preparation is needed.

Standardization of the EDTA Solution

1. Pipette a 10 mL sample of the EDTA solution into a conical flask.
2. Add 10 mL of ammonia buffer solution and 1 mL of Eriochrome Black T indicator solution.
3. Titrate the EDTA with the magnesium chloride solution until the endpoint is reached – a permanent color change from blue to pink.
4. Having determined the average titer of the magnesium chloride solution, determine the number of moles used.
5. Given the $Mg2^+$: EDTA ratio of 1 : 1, calculate the concentration of your EDTA solution.

Titration Method for waste water and other Solid Samples:
1.Pipette 10 mL of the sample solution into a conical flask
2.Add 20 mL of 0.05 mol L−1 EDTA solution.
3. Add 10 mL of ammonia buffer, 50 mL of distilled water and 1 mL of Eriochrome Black T indicator solution.
4. Titrate the sample with the standard 0.025 molL−1 magnesium chloride solution until a permanent pink color appears.

Procedure For Determination of COD

The Chemical Oxygen Demand (COD) method determines the quantity of oxygen required to oxidize the organic matter in a waste sample, under specific conditions of oxidizing agent, temperature, and time. Since the test utilizes a specific chemical oxidation the result has no definite relationship to the Biochemical Oxygen Demand (BOD) of the waste or to the Total Organic Carbon (TOC) level. The test result should be considered as an independent measurement of organic matter in the sample, rather than as a substitute for the BOD or TOC test. The method can be applied to domestic and industrial waste samples having an organic carbon concentration greater than 50 mg/L. For lower concentrations of carbon such as in surface water samples, the Low Level Modification should be used. When the chloride concentration of the sample exceeds 2000 mg/L, the modification for saline waters is required.

Reagents

Distilled water: Special precautions should be taken to insure that distilled water used in this test below inorganic matter.

Standard potassium dichromate solution (0.250 N): Dissolve 12.259 g $K_2Cr_2O_7$, primary standard grade, previously dried at 103°C for two hours, in distilled water and dilute to 1000 mL.

Sulfuric acid reagent: Conc. H_2SO_4 containing 23.5 g silver sulfate, Ag_2SO_4, per 4.09 kg bottle. With continuous stirring, the silver sulfate may be dissolved in about 30 minutes.

Standard ferrous ammonium sulfate (0.25 N): Dissolve 98.0 g of $Fe(NH_4)_2$ $(SO_4)_2$ $6H_2O$ in distilled water. Add 20 mL of conc. H_2SO_4, cool and dilute to 1 liter. This solution must be standardize daily against standard $K_2Cr_2O_7$ solution.

Standardization: To approximately 200 mL of distilled water add 25.0 mL of 0.25 N $K_2Cr_2O_7$ solution. Add 20 mL of H_2SO_4 and cool. Titrate with ferrous ammonium sulfate using 3 drops of ferroin indicator . The color change is sharp, going from blue-green to reddish-brown.

Mercuric sulfate: Powdered $HgSO_4$.

Phenanthroline ferrous sulfate (ferroin) indicator solution: Dissolve 1.48 g of 1-10 (ortho) phenanthroline monohydrate, together with 0.70 g of $FeSO_4$ 7H $_2$O in 100 mL of water. This indicator may be purchased already prepared.

Silver sulfate: Powdered Ag $_2SO_4$.

Sulfuric acid : Concentrated H_2SO_4

Procedure

Place several boiling stones in the reflux flask, followed by 50.0 mL of sample or an aliquot diluted to 50.0 mL and 1 g of $HgSO_4$. Add 5.0 mL conc. H_2SO_4; swirl until the mercuric sulfate has dissolved. Place reflux flask in an ice bath and slowly add, with swirling 25.0 mL of 0.025 N K_2Cr $_2O_7$. Now add 70 mL of sulfuric acid-silver sulfate solution to the cooled reflux flask, again using slow addition with swirling motion. Caution: Care must be taken to assure that the contents of the flask are well mixed. If not, superheating may result, and the mixture may be Blown out of the open end of the condenser. If volatile organics are present in the sample, use an align condenser and add the sulfuric acid-silver sulfate solution through the condenser, while Cooling the flask to reduce loss by volatization. Apply heat to the flask and reflux for 2 hours. For some waste waters, the 2-hour reflux period is not necessary. The time required to give the maximum oxidation for a wastewater of constant or known composition may be determined and A shorter period of refluxing may be permissible. Allow the flask to cool and wash down the condenser with about 25 mL of distilled water. If a round bottom flask has been used, transfer the mixture to a 500 mL Erlenmeyer flask, washing out the reflux flask 3 or 4 times with distilled water. Dilute the acid solution to about 300 mL with distilled water and allow the solution to cool to about room temperature. Add 8 to 10 drops of ferroin indicator to the solution and titrate the excess dichromate with 0.25 N ferrous ammonium sulfate solution to the end point. The color change will be sharp, changing from a blue-green to a reddish blue. Simultaneously run a blank determination using low COD water in place of sample.

Calculation
Calculate the COD in the sample in mg/L as follows:
where:
A = milliliters of $Fe(NH_4)_2(SO_4)_2$ solution required for titration of the blank,
B = milliliters of $Fe(NH_4)_2$ $(SO_4)_2$ solution required for of the sample,
N = normality of the $Fe(NH_4)_2(SO_4)_2$ solution, and
S = milliliters of sample used for the test.

Procedure For Determination Of BOD
Materials required
Alkaline-iodide-azide solution, Manganese sulphate, Concentrate Sulphuric acid, Starch solution,0.025N sodium thiosulphate, BOD bottle, Water bottle, Pipettes, Measuring cylinders, BOD Incubator, Burette and burette stand, Standard flask, Magnetic stirrer, Stir bar, Glass funnel.

Procedure
1. Collect the water sample from a pond.
   Carefully fill a BOD bottle with sample water without making air bubbles.
2. Add 2ml of manganese sulfate to the BOD bottle carefully by inserting the pipette just below the surface of water. So that you can avoid the formation of air bubbles.
3. Add 2 mL of alkali-iodide-azide reagent in the same manner.
4. Close the bottle and mix the sample by inverting many times. A brownish cloud will appear in the solution as an indicator of the presence of Oxygen.
5. Allow the brown precipitate to settle out to the bottom.
6. Add 2ml of Conc.H_2SO4 carefully without forming air bubbles.
7. Close the bottle and mix the solution well to dissolve the precipitate.
8. Keep the bottle in BOD incubator for 5days of incubation.
9. After incubation, titrate 50 ml of sample water with 0.025N Sodium thiosulphate to a pale yellow color.
10. Then add 2ml of starch solution. So the sample turns blue in color.
11. Continue the titration till the sample gets clear and note the readings.
12. The concentration of dissolved oxygen in the sample is equivalent to the number of milliliters of titrant used.

III. Result And Discussion:

Parameters	Before filtration	After filtration			
		Banana Peel	Orange peel	Rice husk	Bagasse
Ca	0.28mg	0.19mg	0.18mg	0.12mg	0.11mg
Mg	0.70mg	0.098mg	0.544mg	0.47mg	0.22mg
Cl	8CC	NILL	NILL	5.5CC	6.8CC
COD	16.8cc	11.2cc	14.7cc	13.3cc	12.2cc
BOD	15.3cc	15.0cc	11.4cc	10.4cc	7.8cc
DO	28.6cc	25.5cc	23.1cc	20.9cc	18.11cc

IV. Conclusion:

From above results we concluded that adsorbents play an important role for the treatment of waste water, so by using agricultural or house hold adsorbents explores a new approach of development in the field of purification of water through minimal energy input, less labor and low investment. Thus it can be conclude that Banana peel, Orange peel ,Rice husk and Bagasse which are discard as a waste material can help a lot for the treatment of waste water , thus we can studied that efficiency of banana peel is more as compared to others materials. The main advantage of these agricultural or house hold waste can be reduced and the low cost adsorbents if developed can reduced the pollution of waste water at reasonable cost

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