A Review on Efficiency of Corncobs and Sugarcane bagasse in removal of Oil and Grease from Automobile service center waste water

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Abstract:

Waste water from automobile garages and workshops is an important contributor to the water pollution. This paper compares the effectiveness of corncobs and sugarcane bagasse in treating the wash water collected in two different samples from automobile service station in Pune city. The samples are collected from Patole motor service center, Akurdi, Pune. The effluent was characterized for different parameters like pH, turbidity, conductivity, total solids, oil and grease, COD, BOD, chlorides, sulphates and total hardness. Experiments were conducted to investigate the effectiveness of corncobs and sugarcane bagasse by using them in different proportions for treating the waste water from service center. This paper presents a review of comparative study of corncobs and sugarcane bagasse for the treatment of oil and grease in the waste water collected from garages.

Keywords: Corncobs, Sugarcane bagasse, COD.

1.0 Introduction:

The conservation of the natural sources such as air, water etc. is the responsibility of each human being for their next generations. Water conservation is one area which requires a significant attention. It is reported that in underdeveloped countries about 80% of the water used for irrigation contains pollutants to a level more than their limits. In day to day life water is polluted in many ways. Industries are one of the major sources of water pollution. These include industries like oil and gas production units, oil refineries, edible oil industries, textile industries. Industries pollute the water with different contaminants. Water from oil and gas industries, petroleum and petrochemical industries contains large amount of oil. One of the major contributors of pollution from such industries is the oil and grease generated and used in their daily operations. Similarly, the events like oil spills have affected the balance of an entire marine life.

There are several pollutants that can harm our environment. Oil and grease are one of the examples of a pollutant that can cause a severe environmental problem. The highest concentration of oil and grease inside the sewer system can cause the sewer to clog that can lead to overflow. It can affect not only to the environment but can also affecting our health.. Dosage and contact time are the parameter used for performance studies, to see the ability of adsorbents in removing oil and grease. Various pollutants are emerging in our environment. One of the pollutants that can cause an environmental problem is the present of oil and grease inside water system.

2.0 Toxic Effects of Oil and Grease

Spilt oils can pollute rivers, streams if it soaks through the soil and rock, ground water. Oil is toxic to plants and animals and a threat to their habitats. Just one litre of oil can

contaminate one million litres of water. Oil pollution can have a devasting effect on water environment. It spreads over the surface in a thin layer that stops oxygen getting to the aquatic animals and plants.

Oil pollution also causes serious damage to soils, due to the multistep physicochemical processes leading to a change in the forms and distribution of organic matter, in the range of carbon, water, nitrogen, and phosphorus. As soil is an environment for a variety of microorganisms and higher living organisms, its contamination with petroleum-based lubricants becomes hazardous and a detrimental effect on biological life may occur. The proper functioning of the ecosystem may be disturbed.

Oil and grease prevent the photosynthesis in plants as well as disrupts the food chain. It also has a great impact on human life as it can contaminate water which makes it unsuitable for irrigation. Oil and grease added in water above the permissible limits can also make drinking water sources unfit for use.

2.1 Illeffects on sewer systems

O&G layer reduces biological activity of treatment process where oil film formed around microbes in suspended particle and water. This lead to decrease dissolved oxygen levels in the water. To avoid the clogging of various unit processes in ETP, the skimming tank is provided for the removal of oil and grease, but the skimming tank has high maintains cost. oil-water mixture with droplets size ranging treatment plants but the main disadvantage of these methods is their low efficiency of removal .The remaining oil causes clogging of pipes in treatment units that need cleaning and sometimes replacement of pipes .This lead to increase maintenance and inspection cost.

3.0 Objectives of work

Overall objective of this study was to investigate the oil and grease removal from wastewater by adsorption using natural materials like sugarcane bagasse and corncobs.

The specific objective of the study area

1. Using low-cost natural adsorbents for treatment of oil and grease in waste water.
2. Efficiency removal of physio-chemical parameters by using sugarcane bagasse and corncobs in different proportions.
3. To evaluate effect of the following factors on the removal of oil and grease by adsorption on oil and grease by using these materials.
    - Time of contact.
    - Dose of adsorption.
4. To supply treated water use for Irrigation, toilet flushing, car washing, gardening, firefighting etc.

4.0 Materials

4.1 Raw sugarcane bagasse

The raw sugarcane bagasse is obtained from local juice stall in Akurdi and it is several times washed with distilled water to remove dirt, impurities and sweet content from bagasse, then the bagasse is dried in sun light before drying in oven then it is dried in oven at temperature of 105oc for 24hours. Then the bagasse is powdered and sieved from 230 micron and obtained as a raw sugarcane

bagasse adsorbent.

4.2 Corn cobs

Corn cobs are collected from local market of Pimpri and sun dried for one month. The sample is collected from the source. Various physical and chemical tests are carried out on waste water. The optimum dose of adsorbent is found after carried out experiment by

varying time of contact and dose of adsorbent.

5.0 Adsorption Method

It is adhesion of atom or molecule of from a gas liquid or dissolved solid to a surface. This process creates a film of the adsorbate on the surface of the adsorbent. This process differs from absorption, in which a fluid (the adsorbate) is dissolved by a liquid or solid (the adsorbent). Adsorption is surface based process. Similar to surface tension, adsorption is consequence of surface energy. Adsorption is present in much natural physical biological and chemical system and is widely used in industrial application. Adsorption is a surface phenomenon with common mechanism for organic and inorganic pollutants removal. When a solution containing absorbable solute comes into contact with a solid with a highly porous surface structure, liquid–solid intermolecular forces of attraction cause some of the solute molecules from the solution to be concentrated or deposited at the solid surface. The solute retained (on the solid surface) in adsorption processes is called adsorbate, whereas, the solid on which it is retained is called as an adsorbent. This surface accumulation of adsorbate on adsorbent is called adsorption. This creation of an adsorbed phase having a composition different from that of the bulk fluid phase forms the basis of separation by adsorption technology. The rate of adsorption was directly proportional to the surface area of the adsorbate. Adsorption is the process of transferring material from a fluid phase to a solid phase.

5.1 Laboratory procedure for Oil and Grease removal from waste water

1) Introduction:

Three methods for oil and grease estimations are

i) The partition-gravimetric method,
ii) The partition infrared method and
iii) The Soxhlet extraction method.

Though the partition-gravimetric method, does not provide the needed precision, it is widely used for routine analysis of samples because of its simplicity and it needs no special instrumentation and partition infrared method is identical to hydrocarbons. In Soxhlet extraction method adequate instrumentation allows for the measurement of as little as 0.2 mg oil and grease.

A. Partition-gravimetric method

1) Principle

Dissolved or emulsified oil and grease is extracted from water by intimate contact with n-hexane, petroleum ether (40°C/60°C) or hexane. Unsaturated fats and fatty acids oxidize readily hence precautions regarding temperature to solvent vapors displacement are included in the procedure.

2) Apparatus and equipment

a. Separator funnel, 1L with TFE (Teflon) stopcock
b. Distilling flask, 125ml
c. Water bath
d. Filter paper, 110mm dia. (What's man No. 40 or equivalent).
e. Weighing balance

3) Reagents and standards

a. Hydrochloric acid: HCl (1+1)
b. n-hexane
c. Petroleum ether (BP 40°C-60°C) or Hexane
d. Anhydrous sodium sulphate-Na_2SO_4

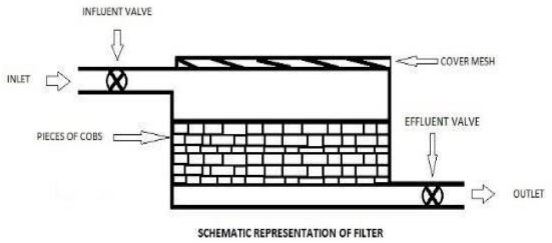
The solvent should leave no measurable residue on evaporation; distill if necessary. Petroleum ether 40°C/60°C or hexane can

also be used. Plastic tubes should not be used to transfer solvent between containers.

4) Sample collection, preservation and storage :
Collect a separate sample for oil and grease and do not subdivide in the laboratory. Samples collected at different intervals of time may be examined individually for knowing average concentration of oil and grease. The glass bottle container should be rinsed with the solvent to remove contaminants adhered to the side walls.

5) Procedure
a. Collect about 1L sample and mark sample level in bottle for later determination of sample volume. Acidify to pH 2 or lower. generally, 5 ml HCl (1+1) is sufficient. Transfer to a separatory funnel. Carefully rinse sample bottle with 30 ml n-hexane and add the solvent washings to separatory funnel.
b. Preferably shake vigorously for 2 min. However, if it is suspected for a stable emulsion, shake gently for 5 to 10 min.
c. Let the layers separate. Drain solvent layer through a funnel containing solvent-moistened filter paper and 10 g Na_2SO_4 into a clean, tared distilling flask. If a clear solvent layer cannot be obtained and emulsion exists, centrifuge the solvent and emulsion. Transfer centrifuged material to a separating funnel and drain solvent layer through a funnel with a premised filter paper and 10 g Na_2SO_4.
d. Extract twice more with 30 ml solvent each but first rinse sample container with each solvent portion. Combine extracts in tared distilling flask and wash filter paper with an additional 10 ml to 20 ml solvent.
e. Distill solvent from distilling flask in a water bath at 70°C for solvent recovery. Place flask on a water bath at 70°C for 15 min and draw air through it with applied vacuum for the final 1min after the solvent has evaporated. If the residue contains visible water, add 2ml acetone, evaporate on a water-bath and repeat the addition and evaporation until all visible water has been removed. Cool in a desiccator for 30 min and weigh.

6) Calculations
Total gain in weight A, of tared flask and less calculated residue B, from solvent blank is the amount of oil and grease in the sample is mg/L.
Oil and grease= (A –B) x 1000 / ml sample.
Along with the results, mention the solvent used for extraction.
Field setup for treatment of waste water



SCHEMATIC REPRESENTATION OF FILTER

5.2 Methodology

A sample is collected from outlet of Patole motor service center, Akurdi, Pune.The sample is taken at peak day (Saturday and Sunday). Sample of water may get less or more polluted depending upon time of washing. At morning water is more contaminated from oil and grease. The sample is collected from the source i.e car washing center. Various physical and chemical tests are carried out on waste water to determine chemical and physical properties of water. The optimum dose of adsorbent is found after carried out experiment by varying time of contact and dose of adsorbent. (Constant time i.e. 10, 20, and 30. min) then sample were tested for four

different dosage 25, 50, 75, 100 mg/lit by using corncobs and sugarcane bagasse each Percentage efficiency removal is found out at various time intervals by using varying dosage of adsorbents. The graphs were plotted to study and compare the efficiency of both the adsorbents.

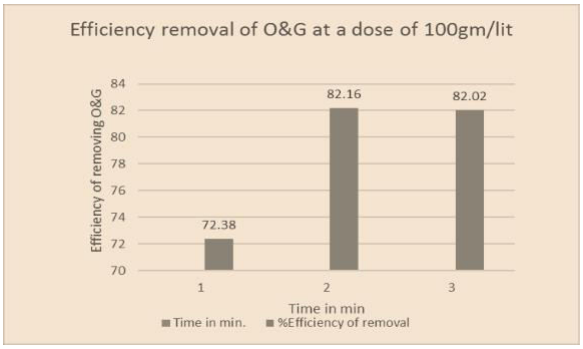
Table No 4.1- Initial Characteristics of Automobile

Service Centre waste water.

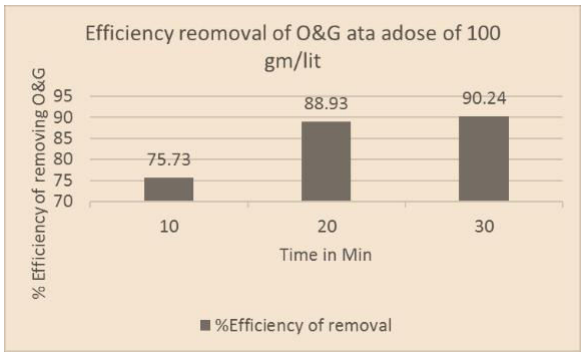
Initial Concentration various parameters of waste water	
PARAMETER	CONCENTRATION
pH	6.69
BOD	189.4 mg/lit
COD	800 mg/lit
TDS	147 mg/lit
OIL& GREASE	34.14 mg/lit

6.0 Results and Discussion

6.1 *Graph No.1- Graph of oil and grease removal efficiency for corn cobs a dose of 100gm/lit.*



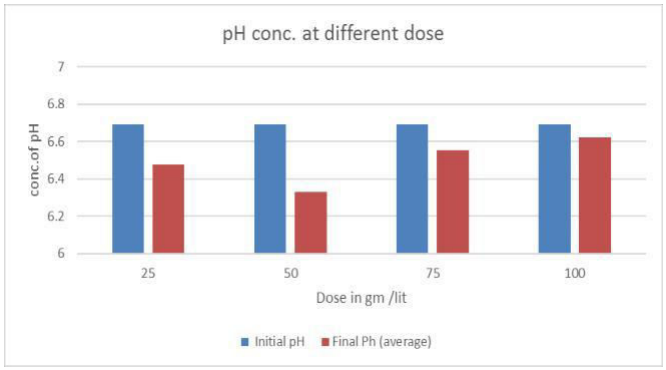
6.2 *Graph No. 2- Graph of oil and grease removal efficiency for sugar cane bagasse dose of 100gm/lit*



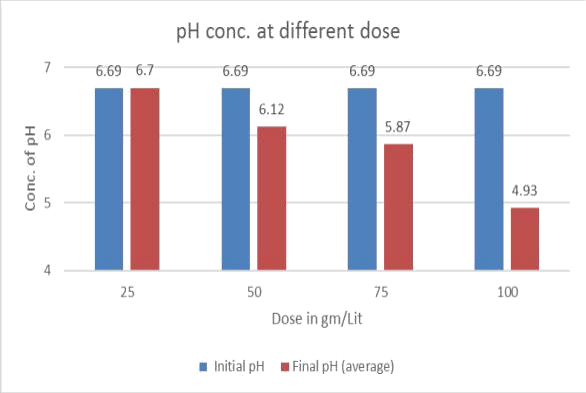
6.3 Effect on pH by using both adsorbents

Effect of pH of waste water due to application of corn cobs and sugarcane bagasse is also calculated and graphs are plotted to compare effect of both adsorbents.

Following graph shows effect of corncobs on pH of waste water



Following graph shows effect of sugarcane bagasse on pH of waste water



7.0 Conclusion

The studies on oil and grease removal are carried out using batch process. The adsorbent used in the study include agricultural waste i.e. corn cobs and sugarcane bagasse. Following are the conclusions drawn based on the present study-

- The study shows that for maximum removal of oil and grease the contact time and adsorbent dosage are parameters which influences the most.
- The performance of corn cobs and sugarcane bagasse shows very good efficiency in removing the oil and grease from waste water.
- Langmuir and Freundlich isotherm is applicable for the present study and shows good value.
- The removal efficiency for oil and grease is 75% to 80% using corncobs and it is 78%to 90% by using sugarcane bagasse.
- For both the adsorbents, the adsorption rate was found to be dependent on pH, contact time, concentration, adsorption dose and temperature but in case of sugarcane bagasse it is found that the efficiency of SB is the most when the contact time is increased even at low adsorbent dose is used.
- Hence the consideration of both agro-waste materials as suitable adsorbents is economical relative to the use of expensive chemicals and equipment's.
  Sugarcane bagasse gives more better results if it is activated by adding coagulants in it while removal of oil and grease so when SB is to be used as a primary material for oil and grease removal it is recommended to use activated sugarcane bagasse instead of raw sugarcane bagasse

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