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STUDY ON TREATMENT OF DISTILLERYAND DYE EFFULENT

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Abstract: Industrial waste problems can be solved using engineering systems, which when applied to industrial wastes implies combining the artful and scientific factors toward optimum solutions to treatment problems. The characteristics of industrial waste water generated from sources depends upon the type of raw material and the technology used, management practices, internal recirculation of the effluents for recovery and the amount of water being used in a particular process. The high organic and inorganic components tends the water to be toxic. Combinations of two or more physicochemical processes can be used for the enhancement of removal efficiencies and design of the setup. End-of-pipe treatment of waste waters can be accomplished by integration of traditional biological treatment processes with chemical. It is evident from the literature survey that various low cost adsorbents have shown good potential for the removal of various aquatic pollutants. Due to the effluent discharge in fresh water and oceanic regions, several aquatic parts of the world have become restricted to human consumption and aquatic life.Hence if the toxic effluent discharge from urban industries are treated and let in to water bodies, the major issues in today's world i.e., toxic pollutants and other inorganic compounds that leads to disastrous health issues can be given a full stop.

1. Introduction

1.1 Adsorption:

Adsorption is the adhesion of atoms, ions, or molecules 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 permeates or is dissolved by a liquid or solid (the absorbent). Note that adsorption is a surface-based process while absorption involves the whole volume of the material. The term sorption encompasses both processes, while desorption is the reverse of adsorption. It is a surface phenomenon. Adsorption is present in many natural physical, biological, and chemical systems, and is widely used in industrial applications such as activated charcoal, capturing and using waste heat to provide cold water for air conditioning and other process requirements synthetic resins, increase storage capacity of carbide-derived carbons, and water purification.

A GAC (granular activated carbon) filter after an intermediate ozonation has many purposes:

- To remove chemical compounds or ozonation by products by adsorption.
- To degrade such substances by biological activity on the surface of the GAC by bacteria.
- To destroy the residual ozone in the water fed to the GAC filter – this takes place in the top few centimeters of the GAC bed

In a GAC filter different competitive processes take place simultaneously:

- Fast adsorption;
- Slow adsorption;
- Biological effects; and
- Biological effects enhanced by ozonation.

1.2 COAGULATION:

Solids are removed by sedimentation (settling) followed by filtration. Small particles are not removed efficiently by sedimentation because they settle too slowly; they may also pass through filters. They would be easier to remove if they clumped together (coagulated) to form larger particles, but they don't because they have a negative charge and repel each other (like two north poles of a magnet). In coagulation we add chemical such as alum which produces positive charges to neutralize the negative charges on the particles. Then the particles can stick together, forming larger particles which are more easily removed. The coagulation process involves the addition of the chemical (e.g. alum) and then a rapid mixing to dissolve the chemical and distribute it evenly throughout the water. Coagulation is highly conserved throughout biology; in all mammals, coagulation involves both a cellular (platelet) and a protein (coagulation factor) component. The system in humans has been the most extensively researched and is the best understood. In waste water treatment, coagulation and flocculation are employed to separate suspended solids from water. Although the terms coagulation and flocculation are often used interchangeably, or the single term "flocculation" is used to describe both; they are, in fact, two distinct processes. Knowing their differences can lead to a better understanding of the clarification and dewatering operations of wastewater treatment.

1.3 FILTRATION:

Filtration is commonly the mechanical or physical operation which is used for the separation of solids from fluids (liquids or gases) by interposing a medium through which only the fluid can pass. Oversize solids in the fluid are retained, but the separation is not complete; solids will be contaminated with some fluid and filtrate will contain fine particles (depending on the pore size and filter thickness). Filtration is also used to describe some biological processes, especially in water treatment and sewage treatment in which undesirable constituents are removed by absorption into a biological film grown on or in the filter medium as in slow sand filtration.

1.4 TOTAL SUSPENDED SOLIDS:

Total suspended solids is a water quality measurement usually abbreviated TSS. It is listed as a conventional pollutant in the U.S. Clean Water Act. This parameter was at one time called non-filterable residue (NFR), a term that refers to the identical measurement: the dry-weight of particles trapped by a filter, typically of a specified pore size. However, the term "non-filterable" suffered from an odd (for science) condition of usage: in some circles (Oceanography, for example) "filterable" meant the material retained on a filter, so non-filterable would be the water and particulates that passed through the filter. In other disciplines (Chemistry and Microbiology for examples) and dictionary definitions, "filterable" means just the opposite: the material passed by a filter, usually called "Total dissolved solids" or TDS.

1.5 TOTAL DISSOLVED SOLIDS:

Generally the operational definition is that the solids must be small enough to survive filtration through a sieve the size of two micrometer. Total dissolved solids are normally discussed only for freshwater systems, as salinity comprises some of the ions constituting the definition of TDS. The principal application of TDS is in the study of water quality for streams, rivers and lakes, although TDS is not generally considered a primary pollutant it is used as an indication of aesthetic characteristics of drinking water and as an aggregate indicator of the presence of a broad array of chemical contaminants. Primary sources for TDS in receiving waters are agricultural and residential runoff, leaching of soil contamination and point source water pollution discharge from industrial or sewage treatment plants.

1.6 TOTAL VOLATILE SOLIDS:

Total solids are the sum of suspended solids and dissolved solids. Total solids analyses are important for assessing wastewater treatment processes such as digester efficiencies and sludge cake processing parameters. These tests are commonly performed on sludge samples when the concentration of solids is greater than 10,000 mg/L or 1%, thus making them very difficult to filter

1.7 BIOCHEMICAL OXYGEN DEMAND:

Biochemical oxygen demand or B.O.D is the amount of dissolved oxygen needed by aerobic biological organisms in a body of water to break down organic material present in a given water sample at certain temperature over a specific time period. The term also refers to a chemical procedure for determining this amount. This is not a precise quantitative test, although it is widely used as an indication of the organic quality of water. The BOD value is most commonly expressed in milligrams of oxygen consumed per litre of

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sample during 5 days of incubation at 20 °C and is often used as a robust surrogate of the degree of organic pollution of water.

1.8 CHEMICAL OXYGEN DEMAND:

In environmental chemistry, the chemical oxygen demand (COD) test is commonly used to indirectly measure the amount of organic compounds in water. It is expressed

in milligrams per liter (mg/L) also referred to as ppm (parts per million), which indicates the mass of oxygen consumed per liter of solution. Wastewater treatment plants are complex nonlinear systems, subject to large disturbances, where different physical (such as settling) and biological phenomena are taking place. Many models have been proposed in the literature for wastewater treatment process but their evaluation and comparison are difficult.

1.9 ATOMIC ABSORPTION SPECTROSCOPY:

Atomic absorption spectroscopy (AAS) is a spectro analytical procedure for the quantitative determination of chemical elements employing the absorption of optical radiation (light) by free atoms in the gaseous state. In analytical chemistry the technique is used for determining the concentration of a particular element in a sample to be analyzed. AAS can be used to determine over 70 different elements in solution or directly in solid samples employed in pharmacology, biophysics and toxicology research. Atomic absorption spectroscopy (AAS) is a widely used technique for determining a large number of metals. In the most common implementation of AAS, an aqueous sample containing the metal analyte is aspirated into an air-acetylene flame, causing evaporation of the solvent and vaporization of the free metal atoms. This process is called atomization.

1.10 UV TREATMENT:

Ultraviolet germicidal irradiation (UVGI) is a disinfection method that uses ultraviolet (UV) light at sufficiently short wavelength to kill microorganisms. It is used in a variety of applications, such as food, air and water purification. UVGI utilises short-wavelength ultraviolet radiation (UV-C) that is harmful to microorganisms. It is effective in destroying the nucleic acids in these organisms so that their DNA is disrupted by the UV radiation, leaving them unable to perform vital cellular functions.The wavelength of UV that causes this effect is rare on Earth as the atmosphere blocksit.

1.11 COLONY COUNTING:

A colony counter is an instrument used to count colonies of bacteria or other microorganisms growing on an agar plate. Early counters were merely lighted surfaces on which the plate was placed, with the colonies marked off with a felt-tipped pen on the outer surface of the plate while the operator kept the count manually

1.12 OBJECTIVE

Chemical treatingof variousIndustrial effluent samples i.e.

1. Distilleries sample 2. Dye industry effluent

The waste water using the treatment is recycled and used for laundry and construction purposes.

- Removal of toxic metal compounds.
- Removal of chemicals like iron, cadmium etc.,
- Micro biological treatment studies using U.V Treatment.

EXPERIMENTAL INVESTIGATION

2.1 GENERAL

The samples were tested and analyzed by the following methods.

Total suspended solids
Total dissolved solids
Total volatile solids
Chemical oxygen demand

2.2 TOTAL SOLIDS

‘Total solids’ is the term applied to the material left in the vessel after evaporation of a sample of water waste water and its subsequent drying in an oven at a definite temperature. Total solids include total suspended solids” the Portion of total solids retained by a filter and “total dissolved solids” the portion that passes through the filter

2.3 TESTS ON TOTAL SOLIDS

1. Total suspended solids
2. Total dissolved solids
3. Total volatile solids

2.3.1 TOTAL SUSPENDED SOLIDS

PROCEDURE

- Note down the empty weight of the dish (W1).
- Pour a measured portion (50 to 100 mL) of the well-mixed sample into the dish and evaporate the contents by placing the dish on a steam bath.
- Transfer the dish to an oven maintained at either 103–105°C or 179–181°C and dry it for 1 hour.
- Weigh the dish as soon as it has completely cooled (W2).
- Weight of residue = (W2 – W1) mg. W2 and W1 should be expressed in mg.

2.3.2 TOTAL DISSOLVED SOLIDS

PROCEDURE

Filter a measured portion of the mixed sample (50 or 100 mL) through a filter paper and collect the filtrate in a previously prepared and weighed evaporating dish.

Repeat the steps 3 to 6 outlined in total solids procedure.

Weight of dissolved solids = (W5 – W4) mg.

W4 = Weight of empty evaporating dish in mg.

W5 = Weight of empty evaporating dish in mg + Residue left after evaporating the filtrate in mg.

2.3.3 TOTAL VOLATILE SOLIDS

PROCEDURE

Keep the same dish used for determining total residue in a muffle furnace for 1 hour at 550°C.

Allow the dish to partially cool in air until most of the heat has dissipated, then transfer to a desiccators for final cooling in a dry atmosphere.

Weigh the dish as soon as it has cooled (W3).

Weight of total fixed residue = (W3 – W1) mg.

W3 and W1 should be expressed in mg.

Table 2.4.1 Untreated distillery effluent

S.N0	solids	Volume of sample (ml)	Initial weight of the dish (mg)	Final weight of the dish (mg)	Total solids (mg/l)
1	Total suspended solids	10	48.88	50.09	121
2	Total dissolved solids	10	49.68	50.62	94
3	Total volatile solids	10	49.22	49.48	26

Table 2.4.2 treated distillery effluent

s.no	solids	Volume of sample (ml)	Initial weight of the dish (mg)	Final weight of the dish (mg)	Total solids (mg/l)
1	Total suspended solids	10	48.88	49.72	84
2	Total dissolved solids	10	49.68	49.90	22
3	Total volatile solids	10	49.22	49.32	10

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Table 2.4.3 untreated dye effluent

s.no	solids	Volume of sample (ml)	Initial weight of the dish (mg)	Final weight of the dish (mg)	Total solids (mg/l)
1	Total suspended solids	10	52.42	53.57	115
2	Total dissolved solids	10	49.05	50.07	102
3	Total volatile solids	10	48.87	49.93	106

Table 2.4.4 treated dye effluent

s.no	solids	Volume of sample (ml)	Initial weight of the dish (mg)	Final weight of the dish (mg)	Total solids (mg/l)
1	Total suspended solids	10	52.42	53.02	60
2	Total dissolved solids	10	49.05	49.92	87
3	Total volatile solids	10	48.87	49.25	38

2.5 CHEMICAL OXYGEN DEMAND

PROCEDURE

- Before conduct the cod experiment first 2ml waste water sample to taken in 5 Samples bottles ,After that potassium di chromate ($k_{2r}cr_2o_7$) is added in 10ml and silver mixed H_2so_4 (sulphuric acid) Are added 30ml of the sample solutions.
- Magnesium sulphate are added (pinch level)0.05gm in samples
- The solution are heated in heating mantle with in 75ºC heat during. The period of 1hrs.
- After complete the heating process to maintain the cooling condition during on ½ hrs.

2.6 ATOMIC ABSORPTION SPECTROSCOPY

Preparation of unknown

- The instructor will provide a solid unknown.
- Digest your sample by dissolving approximately 0.10 g (weigh accurately) in a mixture of 25 ml of concentrated nitric acid and 10 ml of concentrated sulfuric acid in a beaker.
- Do this operation in a fume hood.
- You may have to heat the sample (put a watch glass over the beaker) in order to get all material to dissolve.

Preparation of Standard Curves:

- The instructor will describe the components and appropriate settings of the instrument and provide a list of which metals will be studied in the current laboratory session.
- The data table below provides relevant information for several metals that can be measured quantitatively with AAS and atomization by an air-acetylene flame.

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RESULT AND DISCUSSION

Results of total solids

s. no	items	Untreated distillery effluent	Treated distillery effluent	Untreated dye effluent	Treated dye effluent
1	Total suspended solids(mg/l)	121	84	115	60
2	Total dissolved solids (mg/l)	94	22	102	87
3	Total volatile solids(mg/l)	26	10	106	38
4	Amount of COD (mg/l)	1450	125	1546	176
5	Amount of BOD(mg/l)	2400	430	2570	518
6	Amount of chromium(mg/l)	0.346	0.218	3.42	2.23
7	Amount of cadmium(mg/l)	0.12	0.084	0.16	0.093
8	Amount of lead(mg/l)	0.287	0.098	0.296	0.099

RESULT OF MICROBIOLOGICAL STUDIES

Number of colonies in untreated distillery effluent = 625

Number of colonies in treated distillery effluent = 298

Total number of colonies in Untreated effluent > Total number of colonies in Treated effluent

4. CONCLUSION

The project comprised of several environmental friendly water purification processes in multistage setup performed, gave an efficiency of. Biodegradable natural materials proved to be good adsorbents of heavy metals like cadmium which was initially for distillery effluent 0.12 mg/l and treated effluent was found to be 0.084 mg/l and dye effluent initially for0.16mg/l and treated dye effluent fount to be 0.093mg/l. chromium which was initially for distillery effluent 0.346 mg/l and treated effluent was found to be 0.218 mg/l and the dye effluent initially found to be 3.42mg/l and treated dye effluent found to be 2.23mg/l. Lead which was initially for distillery effluent 0.287 mg/l and treated effluent was found to be 0.098 mg/l and dye effluent initially 0.296mg/l and treated dye effluent fount to be 0.099mg/l. Considerably the levels of toxic heavy metals were in decreasing concentrations in post treatment analysis. The total solid study gave better results after filtration and adsorption processes. Finally the project outcome is beneficial to the environment because of the use of biodegradable material instead of chemical derivatives. Further studies are required to derive efficient performance in large scale.

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