

TREATMENT OF INDUSTRIAL WASTE WATER BY ADSORPTION (BORASSUS FLABELLIFER)

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Abstract

Use of various dyes in order to colour the products is a common practice in textile industry. The presence of these dyes in water even at low concentration is highly visible and undesirable. Adsorption experiments were carried out for the removal of dye using palm tree male flower activated carbon (PTMFAC) as the adsorbent by various parameters. Dye removal from industrial wastewater is an important environmental concern. The most widely used adsorbent is commercially available activated carbon. Despite the frequent use of adsorption in wastewater treatment systems, commercially available activated carbon remains an expensive. In recent years, the safe and economical methods are required for the treatment of textile effluents, which involved researchers to focus towards the preparation of low cost adsorbents from cheapest sources. This study was carried out for the utilization of Borassus Flabellifer (PTMFAC) as adsorbent for the removal of dyes from wastewater and to establish it as a standard wastewater treatment process for textile dyeing industry. This batch adsorption experiment was carried out for finding the effects of adsorbent's dosage, concentration, PH and contact time on the removal of dyes from the wastewater.

key words:- Borassus Flabellifer (PTMFAC)

Introduction

1.1. General:- The main aim of the present work is to study the adsorption of four different dyes namely Crystal Violet, Methylene Blue, Rose Anthocyanin, Malachite Green, Methyl Orange using the adsorbent activated carbon PTMF prepared from Borassus flabellifer.

1.2. Objective:- The specific objectives are as follows,

1. To prepare activated carbon from Borassus flabellifer using different physical and chemical activation methods.
2. To determine effectiveness of removing Crystal Violet, Methylene Blue, Rose Anthocyanin, Malachite Green, Methyl Orange dye using Activated Carbon and to study effects of various experimental parameters on adsorption.

1.3 Advantages of this project:-

1. The selected activated carbon is used for the removal of removing Crystal Violet, Methylene Blue, Rose Anthocyanin, Malachite Green, Methyl Orange from its aqueous in batch mode adsorption.
2. Application of these adsorbents for the treatment of the various dyeing industrial effluents was also demonstrated to identify the cheap and efficient low cost method for industries.

3. The operating cost of the wastewater treatment using these adsorbents was compared with the commercial activated carbon.
4. To make the harmful effect on water and make it fit for survival of aquatics.
5. To make the water eco-friendly.
6. To make use of natural waste as by product for removing colour from the textile effluent.

1.4. Sources of textile waste

One of the main sources with severe pollution problems world wide is the textile industry and its dye containing wastewaters. There are three basic needs that a man possesses food, clothing and shelter. The global textile and clothing industry is found to be huge, as it fulfils the second basic requirements of man. This is because people are getting increasingly conscious of the way they dress. It has become a means to create an impression and represent their personality. Everybody wants to strike an impression with different and fashionable clothes.

There is no doubt to the fact the textile industry release harmful pollutants into the atmosphere in large quantities. It is agreed all over the world that textile industry is one of the most pollutants emitting industries of the world. Almost 2000 different types of chemical are used in this industry. It consumes as well as contaminates fresh water. There is a need to take action in this direction, urgently. Without adequate treatment these dyes can remain in the environment for a long period of time.

The textile dyeing industry consumes large quantities of water and produces large volumes of wastewater from different steps in the dyeing and finishing processes. Wastewater from printing and dyeing units is often rich in colour, containing residues of reactive dyes and chemicals. Now a days urban people are facing many problems and water pollution is one of them. Pollution of water and due to hazardous toxic wastes has become a global concern. The industrial, municipal and agricultural wastes, which are legally or illegally discharged into the environment, are responsible for environmental pollution with the increased awareness about the need for a clean environment, industrialists, environmentalists and policy makers are the treatment of wastewater. Dyes are an important class of pollutants, and can even be identified by the human eye. Bright coloured water soluble dyes are problematic. Disposal of dyes in precious water resources must be avoided, however, and for that various treatment technologies are in use. Among various methods, adsorption occupies a prominent place in dye removal. The growing demand for efficient and low-cost treatment methods and the importance of adsorption has given rise to low-cost alternative adsorbents. Discharge of these dyes into the water streams will affects the people who may use these effluents for living purpose such as washing, bathing, and drinking. Some of these dyes can cause allergy, dermatitis, skin irritation, cancer and mutations in humans. Hence adsorption process has been preferred for the treatment of wastewater due to its cheapness, simple design, easy operation, less energy Intensive, no effect by toxic substances and high quality of treated effluents particularly for well-designed adsorption process.

1.5. Textile dyeing wastewater risk

Discharged wastewater by some industries under uncontrolled and unsuitable condition is causing significant environmental problems. The importance of the pollution control and treatment is undoubtedly the key factor in the human future.

If a textile mill discharges the wastewater into the local environment without any treatment, it has a serious impact on natural water bodies and land in the surrounding area.

The effluent causes depletion of dissolved oxygen, which has an adverse effect on the aquatic ecological system. Water pollution by industrial effluent has been one of the vital issues of the environmental concern. The effluents from almost all industries of the country are directly discharged into canals and rivers.

But the sad fact is that the human greed to look applying and wear glamorous clothes has ended up causing harm to the environment. The textile industry is one of the most pollutants releasing industries of the world. Surveys show that nearly five percentage of all landfill space is consumed by textile waste.

Besides, 20 percentage of all fresh water pollution is made by textile treatment and dyeing. Pollutants released by the global textile industry are continuously doing unimaginable harm to the environment. The disposal of industrial effluents into the natural streams causes three types of pollution as,

- ✓ Air pollution
- ✓ Land pollution
- ✓ Water pollution

1.5.1 Air pollution

Air pollution caused by the textile industry is also a major cause of concern. Boilers, thermo pack, and diesel generators produce pollutants that are released into the air. The pollutants generated include suspended particulate matter (spm), sulphur-di-oxide gas, oxide of nitrogen gas, etc., the nearby areas with human population get affected adversely owing to the release of toxic gas into the atmosphere. It has become utterly necessary to reduce the pollutants by the textile industry. Contamination of the air, water, and land by textile industries and its raw material manufacturing units has become a serious threat to the environment. It has endangered the life of human being and various other species on earth. Global warming is direct result of the pollutants released by such industries. It also causes harmful diseases and health issues in people getting exposed to the pollutants in the long run.

1.6.2 Land pollution

Pollutants released by the global textile industry are continuously doing unimaginable harm to the environment. It pollutes land and makes them useless and barren in the long run. Surveys show that cotton consumes the highest amount of harmful pesticides and fertilizers. Majority of them fall on land while they are sprinkled on the crop. Similarly, textile manufacturing units release hazardous waste into the nearby land. It pollutes land. It pollutes land makes them useless and barren in the long run. **1.6.3 Water pollution:-** The liquid effluents released by the textile industry are the most disturbing area of concern. This is because the toxic material released through liquid waste is vast in quantity. It consists of chemicals such as formaldehyde (hcho), chlorine, and heavy metals. Besides, it is disposed into water bodies that reach faraway areas and is consumed by a larger number of people for drinking or for daily activities. They need to be treated to reduce their toxic

content before being released into water bodies. Due to continuous disposal of wastewater into water bodies, the surface water quality throughout the country is getting gradually deteriorated because of the mixing of various chemical pollutants of the effluents with water. If the water pollution thus continues, the surface water quality will decline to such a level at which it will not be usable for any purpose. Under this situation, it has become urgent to think of an alternate way of reducing the industrial impact on the environment and maintaining the water quality. Besides, it is disposed into water bodies that reach faraway areas and is consumed by a larger number of people for drinking or for daily activities. They need to be treated to reduce their toxic content before being released into water bodies.

Materials

2.1. Dye:- Dyes are basically natural or synthetic, organic components that cannot connect themselves to surface or fabrics to provide bright and lasting colour. A dye is a coloured substance that has an affinity to the substrate to which it is being applied. Dyes appear to be coloured because they adsorb some wavelengths of light more than others. This study includes the adsorption of different colours such as

- ✓ Crystal violet
- ✓ Malachite green
- ✓ Rose anthocyanin
- ✓ Methylene blue
- ✓ Methyl orange

2.2. Preparation of dye:- 1g of dye was weighted out accurately. It was transferred into 1000ml standard measuring beaker having distilled water. 1g of dye in 1 litre beaker is considered and equal to 1000ppm. This dye solution is taken as the mother solution for the experiment.

2.3. Borassus flabellifer:- Borassus Flabellifer is a robust tree and can reach a height of 30 meters (9.8 feet) long, with robust black teeth on the petiole margins. Like all Borassus Flabellifer is dioeciously with male and female flowers on separate plants. The male flowers are less than 1Cm long and form semi-circular clusters, which are hidden beneath scale like bracts within the catkin like inflorescences. In contrast, the female flowers are golf ball sized and solitary sitting upon the surface of the inflorescence axis. A tall dioeciously palm; trunk stout, unarmed. Leaves terminal, plicatelymultifid; petiole spinous, blade rigidly coriaceous, segments linear, margins spinulose. Flower borne in spa dices, female spades sparingly branched, bearing few scattered solitary flower. Male flower small mixed with scaly bracts, in two serious in small spikelet. Perianthglumaceous; sepals 3, narrowly cuneate, tip inflexed truncate; petals obovate-spathulate. Stamens 6. Pistil odes of bristle. Female flower larger, globose. Fruit a large sublobse drupe, with 1-3 obcordate fibrous pyrens; pericarp thinly fleshy. Seeds oblong. The borassusFlabellifer leaves are used for thaching, mats baskets, fan, hats, umbrellas and as writing material. All the literature of the old Tamil was written in preserved palm leaves also known as palm leaf manuscript. In Tamil yaedu or Olichuvadi. It was written with a sharpended iron piece called Eluthani. In Indonesia the leves were used in the anciebt culture as paper, known as lontar. Leaves of suitable size, shape, texture and maturity were chosen and then seasoned by boiling in saltwaatr with turmeric powder, as a preservative, polished with pumice, cut into the proper size and a hole made four pages. The writing was done

with a stylus and had a very cursive and inter connected style. The leaves were then tied up as sheaves. The stem of the leaves has thorny edges (called karukku in tamil). Fences can be preped from these stems by nailing them together.

2.4. Activated carbon

Activated carbon is a solid, porous, block carbonaceous material. it is distinguished from elemental carbon by the absence of both impurities and an oxidized surface. Any carbon source can be converted into activated carbon via a number of methods. Activated carbon has an extraordinarily large surface area and pore volume, making it suitable for a wide range of applications. it can be used as a decolorizing agent. The adsorption process is used to remove colour and other soluble organic pollutants from effluents. Most commonly used adsorbent for treatment is activated carbon. It is manufactured from carbonaceous material such as wood, coal, petroleum products etc. the pores need to be large enough for soluble organic compounds to diffuse in order to reach the abundant surface area.

The main criteria for the materials are

- ✓ low inorganic matter (ash content)
- ✓ high carbon content
- ✓ ease of activation
- ✓ availability and low cost
- ✓ low degradation

Parameters

3.1. Effect of contact time:- In order to study the kinetics/dynamics of adsorption of dye, the adsorption experiments were conducted by varying the contact time at fixed optimum initial concentration of dyes with a fixed dose of adsorbent and at the pH of the solution. The bottles were placed in a mechanical shaker. The bottles were with-drawn from the shaker at different time intervals viz, 15, 30, 45, 60, 75, 90 minutes and to find out the time from maximum efficiency.

3.2. Effect of solution pH:- The pH of solution is a very important in the adsorption process, particularly for dye adsorption. The magnitude of electrostatic charges which are important by the ionized dye molecules is controlled by the solution ph. As a result the rate of adsorption will vary with the pH of the medium used. The effect of pH on extent of dye decolourization was analysed over a range of pH 2,4,6,7,8,10. The varying pH was regulated using sodium hydroxide and hydrochloric acid.

3.3. Effect of adsorbent dosage:- Adsorbent dosage is also an important parameter in order to determine the adsorbent's capacity for a given amount of adsorbate at the operating conditions. In order to study the effect of adsorbent dosage on the adsorption process, it can be carried out by prepare adsorbent-adsorbate solution with different amount of adsorbents added to fixed initial dye concentration then shaken together until equilibrium time.

3.4. Effect of concentration:- The initial dye concentration is another important variable that can affect the adsorption process. The effect of initial concentration varies for different type of dye used in the experiment. At

an optimum initial concentration of adsorbent the maximum percentage removal was found. This is due to the interaction between dye in the surface and in the bulk of the solution.

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4. Conclusion:

- 1). The selected activated carbon is used for the removal of removing Crystal Violet, Methylene Blue, Rose Anthocyanin, Malachite Green, Methyl Orange from its aqueous in batch mode adsorption.
- 2). Application of these adsorbents for the treatment of the various dyeing industrial effluents was also demonstrated to identify the cheap and efficient low cost method for industries.
- 3). The operating cost of the wastewater treatment using these adsorbents was compared with the commercial activated carbon. the harmful effect on water and make it fit for survival of aquatics.
- 4). The water eco-friendly. use of natural waste as by product for removing colour from the textile effluent.

References

1. Dask bibek,"competitive adsorption of dyes (congo red, methylene blue, malachite green)on activated carbon", 2009.
2. Dalia Khalid mohamed, Mohamed amran, mohdsalleh, aznildris,zurinazainalabidin, " batch adsorption of basic dye using acid treated kenaffibre char: equilibrium, kinetic and thermodynamic studies", 2011.
3. Faradilla bintilokman, "dye removal from simulated waste water by using empty fruit bunch as an adsorbent agent", 2006.
4. H. Chen. J. Zhao, "adsorption study for removal of congo red anionic dye using organo-attapulgit", adsorption15:381-389,2009.
5. R. A. Shawabkeh, E. S. M. Abu- naesh. "adsorption of phenol and methylene blue by activated carbon from pecan shells"2007.