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DECOLOURISATION OF TEXTILE INDUSTRIAL EFFLUENT USING ORANGE AND PINEAPPLE PEELS AS ADSORBENTS

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Abstract - *In the Textile industry it is estimated that over 10,000 different dyes and pigments are used industrially and over 7×10[5] tons of synthetic dyes are annually produced worldwide. The textile industry is one of the most pollutants releasing industries of the world. Surveys shows that nearby 5 percent of all landfill space is consumed by textile wastes. Besides, 20 percent of all fresh water pollution is made by textile dyeing. Textile effluent is a cause of significant amount of environmental degradation and human illnesses. Methylene blue is a cationic dye employed by textile industry for a variety of purposes. It is a Heterocyclic aromatic chemical compound with a molecular formula $C_{16}H_{18}ClN_3S$.The methylene blue is a synthetic basic dye which is a odourless, dark green powder. The textile waste water effluents contain high BOD and COD values. It may affect the environment so it is necessary to treat and discolour the effluent before its discharge. The orange and Pineapple peel powders were used as eco-friendly and low cost adsorbents. The orange and pineapple peels are very inexpensive materials which can be used as adsorbents to remove the colour from waste water. In this study it includes physicochemical adsorption process. To remove the colour from textile effluents. This study is to investigate the colour removal efficiency using the low cost adsorbents.*

Key Words: Physicochemical adsorption method, Orange and pineapple peel adsorbents.

1. INTRODUCTION

The Pollution is the introduction of contaminants into the natural environment that cause adverse changes. Especially the pollutants released by the textile industry are continuously doing unimaginable harm to the environment. It pollutes land and makes them useless and barren in the long run. Textile manufacturing units release hazardous waste into the nearby land and water bodies which leads to several hazards. Dyes are chemicals which on binding with material will give colour to the material. Dyes are ionic, aromatic organic compounds with structures including aryl rings which have delocalized electron systems. The colour of a dye is provided by the presence of a chromophore group. A chromophore is a radical configuration consisting of conjugated double bond containing delocalized electrons. The chromogen, which is the aromatic structure normally Containing benzene, naphthalene or anthracene rings, is part of a chromogen-chromophore structure along with an auxochrome. The presence of ionising groups known as auxochromes results in a much stronger alteration of the maximum adsorption of the compound and provides a bonding affinity. Coloured dye and also as a consequence of its use in the textile and other industries. The textile industry uses millions of gallons of water every day. The problem does not rest only in the high usage of water it also involves the discharge of untreated effluent into water bodies. Treatment of industrial waste water may be necessary to lower the concentration of toxic pollution in waste water to the level of permissible limits. One of the most commonly present dye in the textile effluent is methylene blue and to remove this orange and pineapple peel were used as adsorbents. Because these are the low cost natural adsorbent which does not cause any issue to the human being and environment. Then the other variety of physical, chemical and biological treatment methods have been reported along with their colour removal efficiencies. And also adsorption technique for waste water treatment have become more popular in recent years owing to their efficiency in the removal of pollutants. The other techniques like chemical oxidation and use of activated carbon for decolourisation can be an expensive method. Whereas the use of orange and pineapple peels as adsorbents is a simple and efficient method. Also they are the easily available low cost adsorbents which have excellent adsorption capabilities.

1.1 Objectives

- The objective of the study is to investigate the colour removal efficiency of orange and pineapple peels for removing methylene blue dye.
- To conduct batch adsorption test for the removal of color.

1.2 Adsorption process

The process by which a solid holds molecule of a gas or liquid or solute as a thin film. The process creates a film of the adsorbate on the surface of the adsorbent. The substance

which gets adsorbed is called as adsorbate and the substance which adsorbs is called the adsorbent. The factors controlling the adsorption includes the surface area of the adsorbent, temperature, PH, nature of adsorbent, adsorbent dosage, etc.

1.3 Properties of adsorbents

- The pH of orange peel powder is found to be 6.36 and that of pineapple is found to be 4.25. The pH is altered by using 0.1M of NaOH and 0.1M of HCl.
- The particle size of orange peel powder and pineapple peel powder are 0.150 micron meter and it is determined by sieve analysis.
- The SEM test was taken to determine the characteristics of orange and pineapple peels and it is shown in fig 1 and 2 respectively.
- From the SEM test it is found that the orange and pineapple peels are amorphous and hence they can be used as adsorbents.

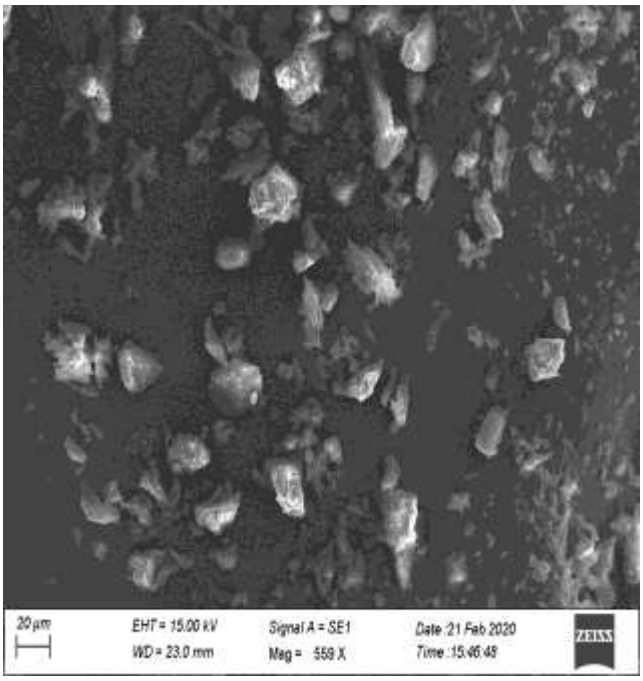

Fig. 1 SEM test on orange peel powder

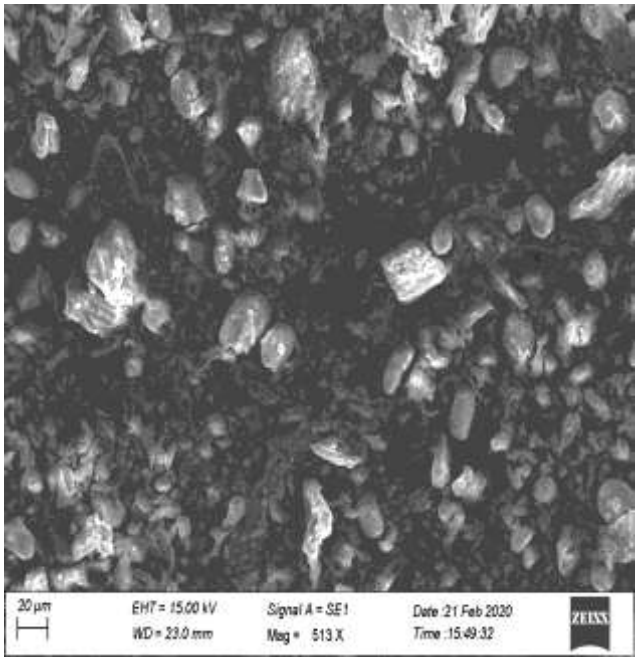

Fig. 2 SEM test on pineapple peel powder

2. Preparation of adsorbents

The orange and pineapple peels are easily available in fresh fruit juice stalls and soft drinks industries all over the world. The collected peels were first cleaned with distilled water to remove the impurities. Then they are kept in oven at 105^0 C until it becomes dry and crisp. Finally, they were ground into fine powder and packed in air tight containers.

Fig. 3 Orange and pineapple peel powder.

3. Adsorption test

The Methylene blue stock solution was prepared for 250 ppm (parts per million) and it was prepared by dissolving 0.1 gram of dye powder in 100 ml of distilled water. The batch adsorption test was experimented by varying PH, rpm, contact time and adsorbent dosage to determine the colour removal efficiency. By using UV-Visible Spectrometer at a wavelength between 400nm to 700nm the absorbance value is measured. From the absorbance value the corresponding final concentration of methylene blue is interpolated with the initial methylene concentration value in order to find out colour removal efficiency of the adsorbent. The graph is plotted between the varying contact time, adsorbent dosage, speed of rotation and pH with the percentage of colour removal efficiency as shown in chart 3, 4, 5 and 6 respectively. The percentage of colour removal efficiency is determined by the following formula,

$$\% \text{ Removal} = \frac{C_0 - C_e}{C_0} \times 100$$

Where, C_o – initial concentration of methylene blue.

C_e – final concentration of methylene blue

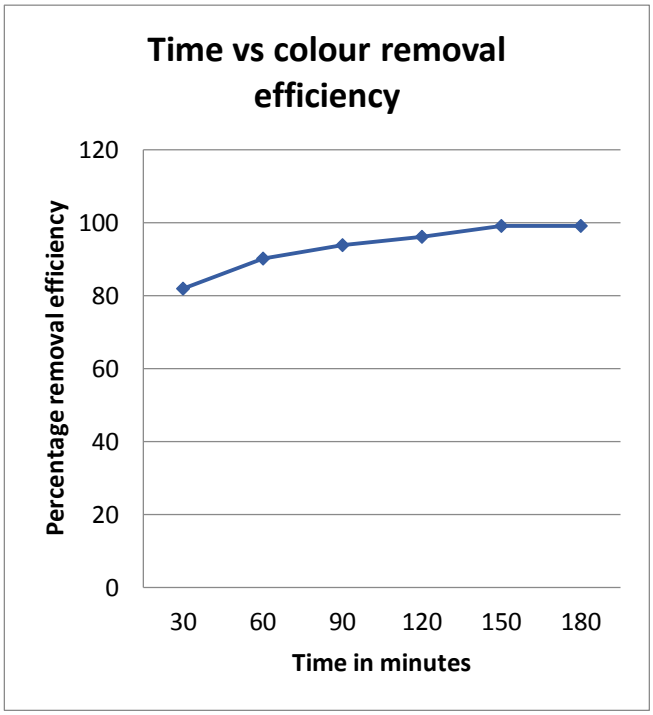

Chart. 3 Contact time vs color removal efficiency

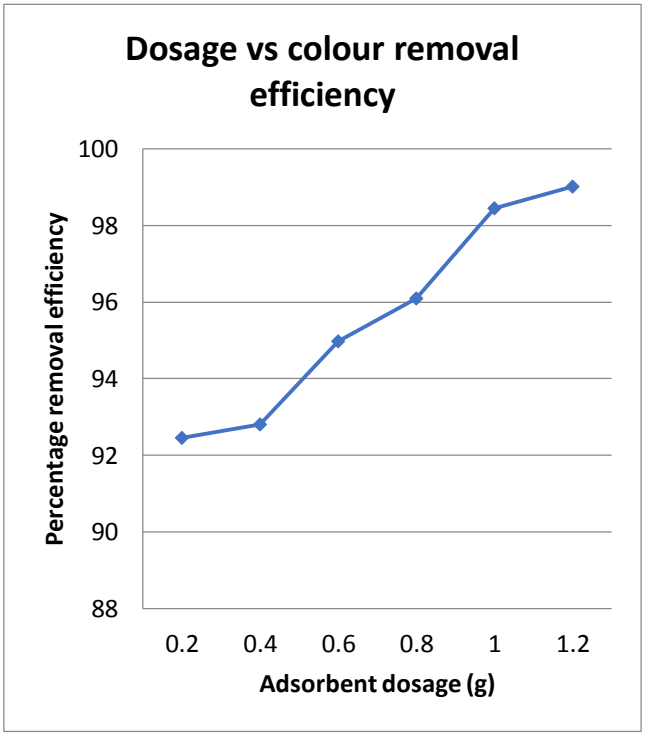

Chart. 4 Adsorbent dosage vs color removal efficiency

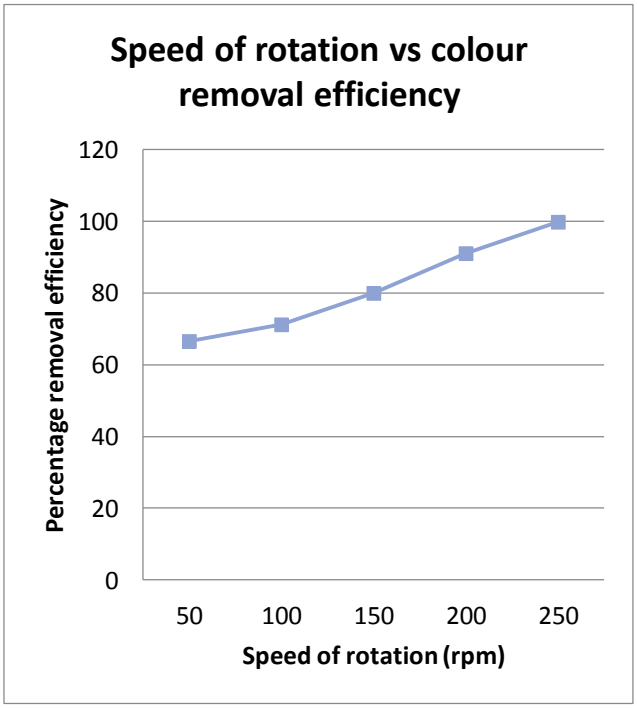

Chart. 5 Speed of rotation vs colour removal efficiency

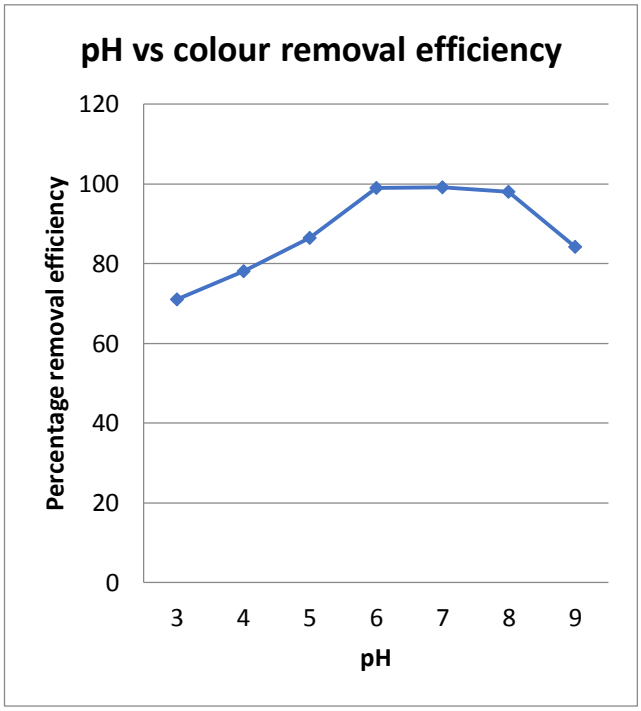

Chart. 6 pH vs color removal efficiency

4. RESULTS AND DISCUSSION

It was experimented with initial values in order to find out methylene blue concentration at 250 ppm. The maximum removal efficiency was observed at pH of 7. The adsorption studies reveal that the optimum time for adsorption of orange peel and pineapple peel powder is found to be 180 minutes. The optimum adsorbent dosage is found to be 1.2 grams and speed of rotation at 250rpm using a flocculator gives better colour removal efficiency.

5. CONCLUSION

To have a good wastewater treatment system need a good wastewater management. Poor management will result into a disappointing energy saving performance and will automatically increase the cost higher than usual. For this the average ranges of physical, chemical and biological characteristics of wastewater quality are experimented and found out and the corresponding wastewater treatment is done to remove the contaminants. The adsorption process is a very effective process for the decolourization of textile wastewater, as we can reach 97% decolourization in few minutes. Adjusting some controlling factors will give high result of decolourization.

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