Cleaner Approach Towards The Manufacturing Of Dyes

[1]Tarjan Pathak, [2]Mrs. Niharika Mehta
[1]Bachelor Of Engineer, [2]Assistant Professor
[1]Chemical Engineering Department
[1]Aditya Silver Oak Institute Of Technology, Ahmedabad, India

Abstract : Dyes are the chemical substance that imparts its color on other substance.The key objective behind undertaking this project is to produce fine quality of dye product by using plant materials such as Rose Petals,Marigold Flowers,Leaves of Asopalav Trees etc. as a raw material.This leads to the production of Eco-friendly,Hygenic form of dyes which can be used as an alternative form of synthetic dyes that are produced in various chemical industries with the use of various toxic chemicals containing Nitrite,Amino & Azo group that generates large amount of toxic & hazardous industrial waste as effluents.Inorder to extract dyes from the raw materials non-conventional extraction methods are to be carried out in the laboratory.

IndexTerms **- Extraction,EcoFriendly,Dyes,Marigold-Flowers,Rose petals**

I. INTRODUCTION

Gujarat is a leading state when it comes to synthetic dyes manufacturing.There about more than 500 small & large scale chemical plants that produce various types of synthetic dyes such as Acid Dyes,Reactive Dyes,Direct Dyes etc.The major application of these dyes comes in the Textile Industries where the dyes are imparted on the fabric materials to colorise them.Apart from this these dyes & its dertivatives are used for various commercial & house-hold purpose.With the increase in the production of textile materials in the industries,the need for dyes manufacturing is also increased correspondingly.But one of the major disadvantage is that the production of synthetic dyes leads to huge amount of generation of toxic waste as effluents. The principal air pollutants from dye manufacturing are volatile organic compounds (VOCs), nitrogen oxides (NOx), hydrogen chloride (HCl), and sulfur oxides (SOx). Liquid effluents resulting from equipment cleaning after batch operation can contain toxic organic residues. Cooling waters are normally recirculated. Wastewater generation rates are of the order of 1–700 liters per kg (l/kg) of product except for vat dyes. The wastewater generation rate for vat dyes can be of the order of 8,000 l/kg of product. Biochemical oxygen demand (BOD) and chemical oxygen demand (COD) levels of reactive and azo dyes can be of the order of 25 kg/kg of product and 80 kg/ kg of product, respectively. Values for other dyes are, for example, BOD, 6 kg/kg; COD, 25 kg/kg; suspending solids, 6 kg/kg; and oil and grease, 30 kg/kg of product. Major solid wastes of concern include filtration sludges, process and effluent treatment sludges, and container residues. Examples of wastes considered toxic include wastewater treatment sludges, spent acids, and process residues from the manufacture of chrome yellow and orange pigments, molybdate orange pigments, zinc yellow pigments, chrome and chrome oxide green pigments, iron blue pigments, and azo dyes.

HARMFUL EFFECTS OF SYNTHETIC DYES

Due to these reasons the necessity of selecting an alternative of synthetic dyes have arised in order to fulfill the aspect of cleaner production.Production of natural dyes from plant materials leads to production of much Eco-friendly & Hygenic Aternative of dyes Which generates negligible amount of waste effluents & if they are generated they can be easily removed by simple washing with water or some amount of diluted acid solution.

II. METHODS USED

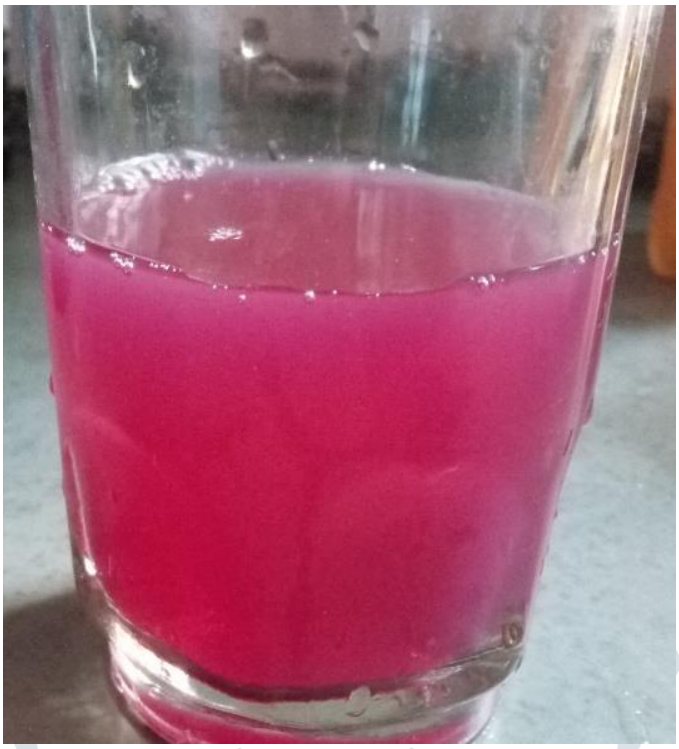
For the purpose of extraction few of the non-conventional extraction methods can be used which are over the ages proven to be the best for the purpose of dyes manufacturing.Those non-conventional methods very well known are:

- Acidic Extraction
- Basic Extraction
- Alcoholic Extraction
- Aqeaous Extraction

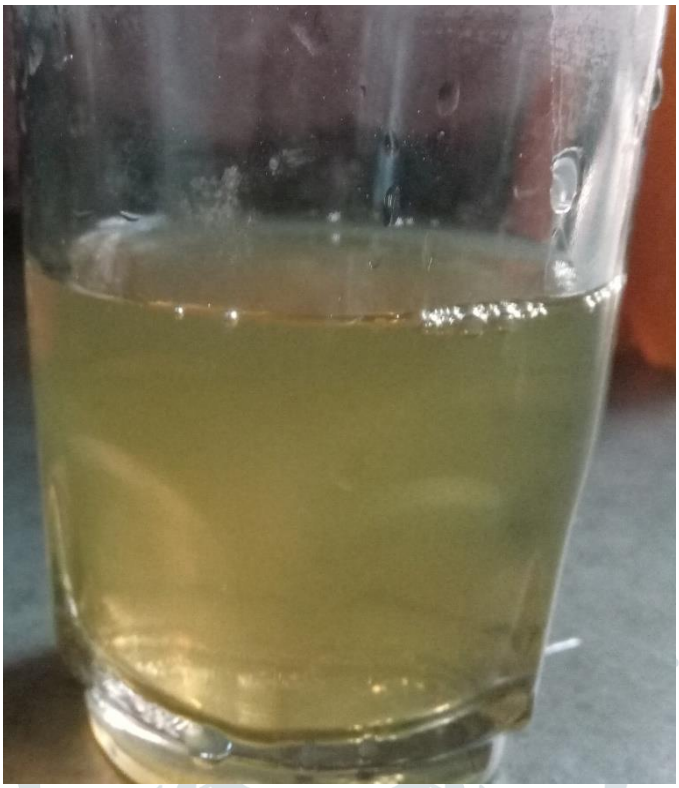
Few of the steps included in these methods are found to be similar which follows the fundamental rules of extraction process.They mainly differ by the types of extracting solvents used for the extraction purpose.

III. ACIDIC EXTRACTION

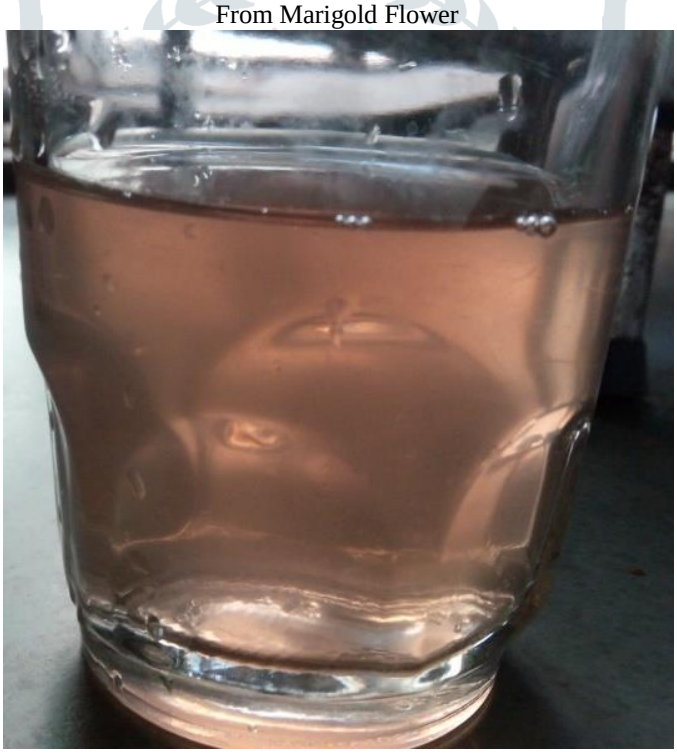
It is one type of liquid-liquid extraction.Acidic Extraction is used to separate compounds on the basis of their Acidic properties or their reactivity with acids.Under this method the raw materials are mixed with water & formes a compound.The acids are added as extracting solvent.If the compound formed by raw materials & water are basic one,it will react with the acid by picking up a proton. a proton might be added via reaction with a strong mineral acid such as HCl.The proton would be transferred to the part of the compound which is basic hence which makes forms an extract & the part which is neutral will be taken out as a raffinate.Related to this project an experimental work showing this extraction process was carried out in the laboratory.In this process raw materials such as Rose Petals,African Marigold & Asopalav Leaves are taken in amount of 25 gms and are mixed in a 250 ml 1% HCl solution(2.5 ml HCl in 250 ml water).The entire feedstock prepared is boiled at 100C for around 30 mins.After the boiling process is done the solution is brought back at ambient temperature.Then the solution is filtered out and can be used for Dyeing and other tests.



ACIDIC EXTRACTION(ROSE PETALS)



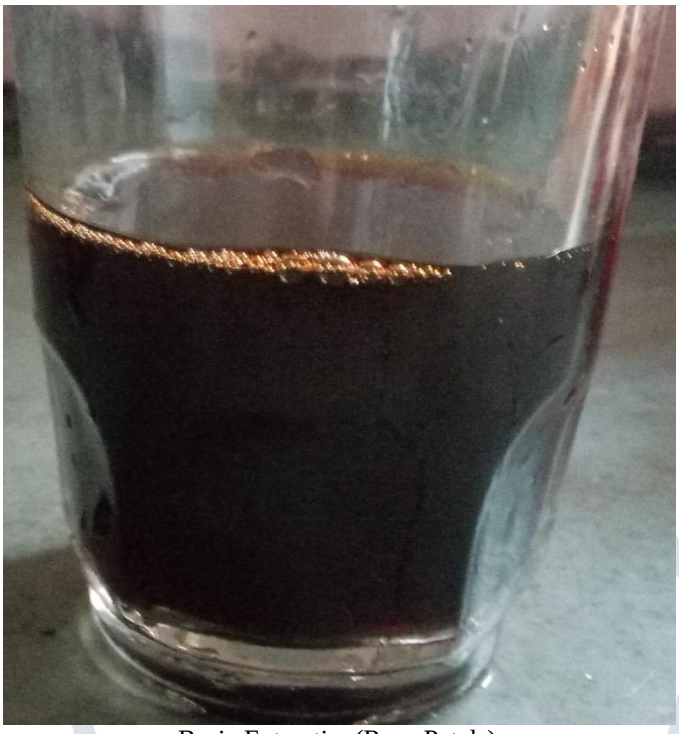
From Marigold Flower



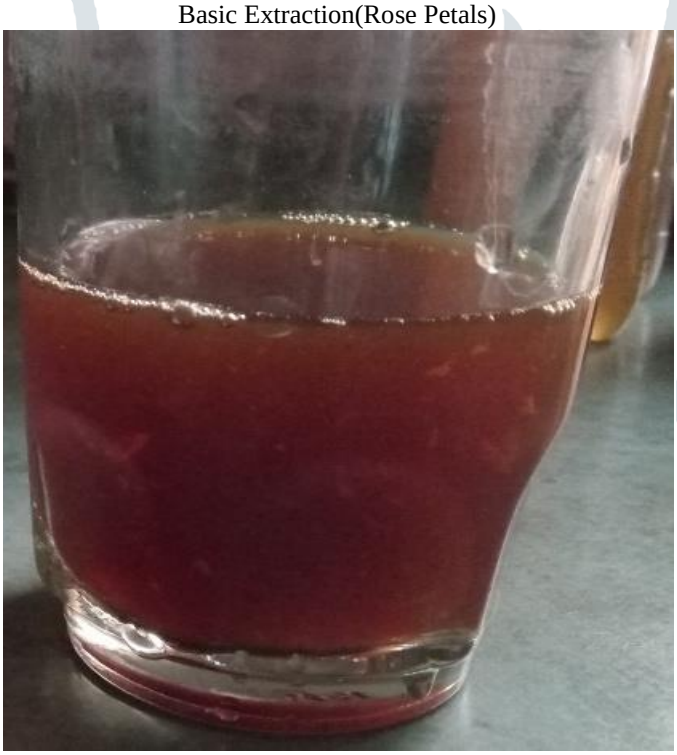
From Asopalav Leaves

IV. BASIC EXTRACTION

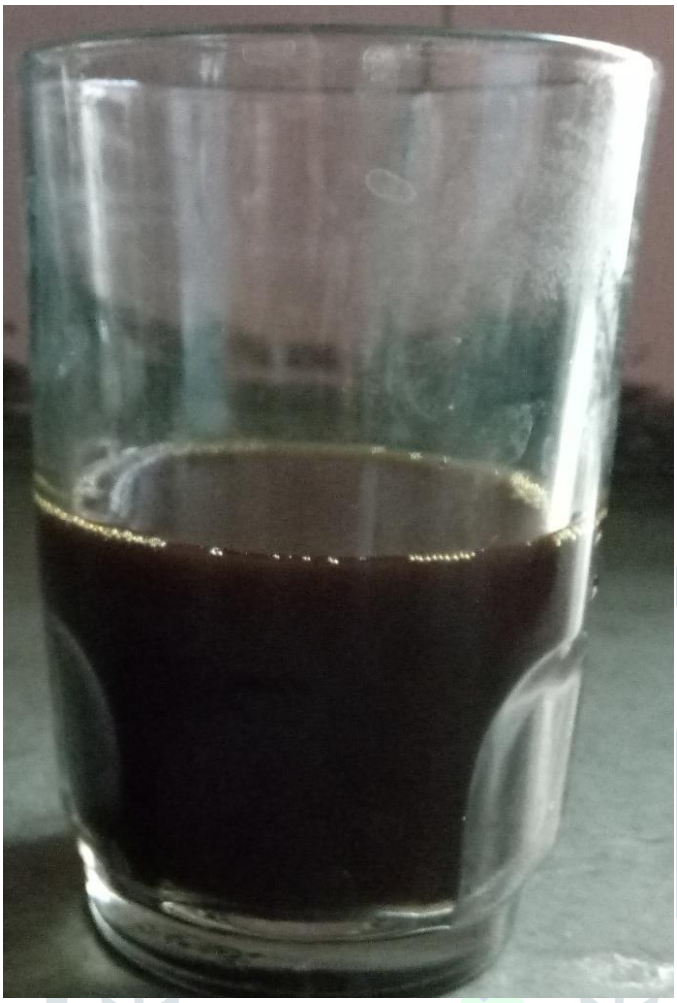
Just like the acidic extraction this method is also a type of liquid-liquid extraction.The core difference in the mechanism of this method is [that] here the proton is transferred *from* part of compound which is acidic forming an extract & the part which is neutral will be taken out as a raffinate.Commonly some mineral bases such as NaOH & Na_2CO_3 are used for this purpose. An experimental work showing this extraction process was carried out in the laboratory.In this process raw materials such as Rose Petals,African Marigold & Asopalav Leaves are taken in amount of 25 gms and are mixed in a 250 ml 1% NaOH solution(2.5 gm NaOH in 250 ml water).The entire feedstock prepared is boiled at 100C for around 30 mins.After the boiling process is done the solution is brought back at ambient temperature.Then the solution is filtered out and can be used for Dyeing and other tests.



Basic Extraction(Rose Petals)



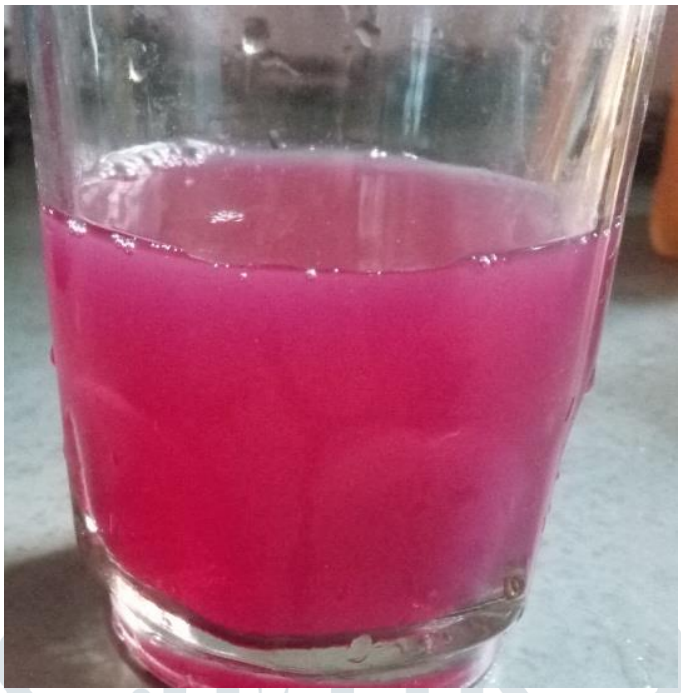
From Marigold Flowers



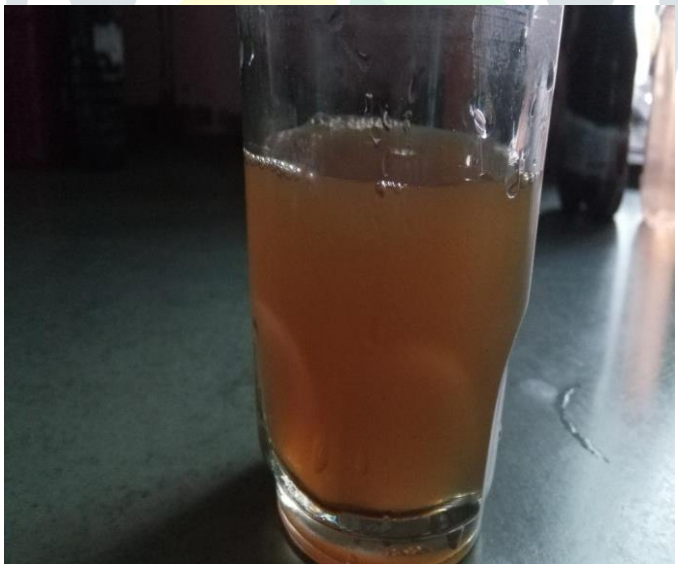
From Asopalav Leaves

V. Aqueous Extraction

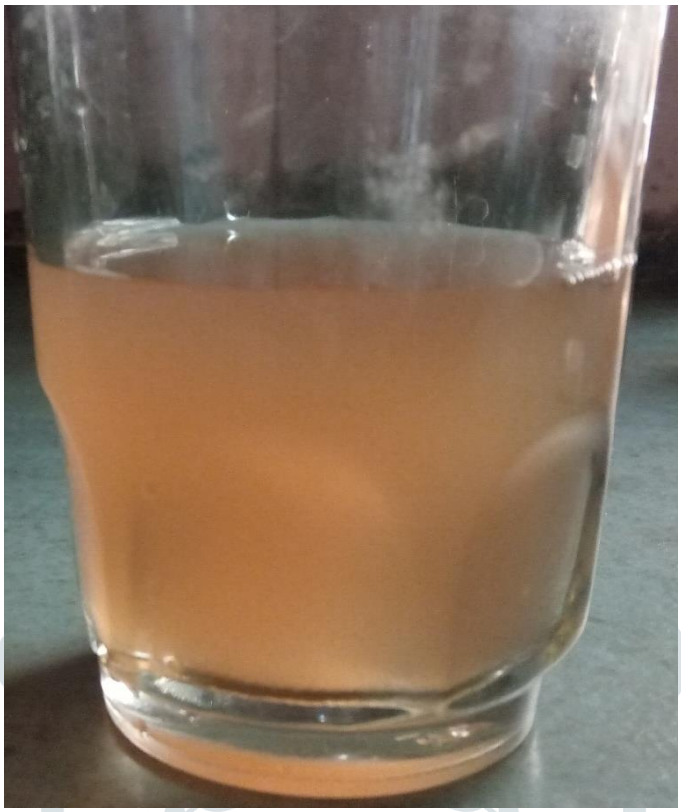
It is one of the most simplest & probably the cheapest conventional method of extraction.It can be achieved by simply using water as the extracting solvent.The aqueous extracts can be obtained by evaporating the watery solution and making it to the semisolid or solid consistency.In this process the raw materials(Rose petals,African Marigold & Asopalav Leaves) are merely boiled in 250 ml water for around 30 mins at 100C.The dyes solution obtained is filterred out for further uses.



Aqueous Extraction(From Rose Petals)



From Marigold Flowers



From Asopalav Leaves

VI. Conclusion

The main aspect of a Cleaner Production is not to treat the waste after the production is done but instead the main aspect of Cleaner Production is to reduce the genration of waste during the production of the chemical products.Practically it is impossible to generate 0% waste effluent after any production of chemical substance is done.But atleast we can reduce the amount of waste generation to the minimum amount so that no excessive harm is done on the environment & the Industries can obtain the Eco-friendly form of compounds.For this the cheap & Eco-friendly substances as an alternative of harmfull chemical substances can be used as raw materials in order to produce the the Day-Today Commercially useful Chemicals.As we have seen in this project the formation of Dyes from raw materials of Plants sources Leads to generation of very few amount of liquid effluents which are not as harmfull as comparison to the one generated from the Synthetic Dyes Manufacturing.The one drawback of the project is that the yield obtained from the raw materials is quiet low in comparison to the synthetic dyes & the project can be proved to be costly so further studies regarding the intensification in the production yield can be done on this project.But apart from that the product obtained is in its purest form & has good application on various fabrics & the product has a good Dyeing Strength & has good value of Absorbence & fastness.Thus with the help of this project a fine quality of dyes product is obtained fulfilling the aspects of Cleaner Production.

VII. Aknowledgement

I hereby would like to acknowledge each & every personnel in the pannel for reading my work and appreciating it.I would like to thank all the faculties of my department without whose guidance this work would not have been possible.Then I would like to thank my friends for supporting me through this whole journey.And lastly but not least i would like to thank my family without whose blessings and unconditional support i would have got upto this platform.Thank You.

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