

# Eco Friendly Dye Extraction From Cyanophyta for Textiles

E. Ramkumar, V.S. Bala Murali, S.M. Dharshan, S. Ajay Vishnu, T. Guna

**Abstract:** In countries like India there is always a scarcity for fresh water along with it polluting the available fresh water sources is a major threat. The major fresh water bodies are affected by eutrophication. It is the phenomenon in which algae forms a layer above the water surface and does not allow the sun light to enter into the water body. Due to this reason organisms which is present in the water body gets affected and the ecosystem gets damaged. The algae which are taken from the water bodies is dropped as waste in garbage or let to dry out on roads. "One man's waste is other man's treasure" so instead of wasting the collected algae, the algae can be used to prepare a dye which can be used to dye clothes for different uses. The collected algae are used as a raw material in an algal dyeing machine where the processes carried out are cleaning, drying the algae, grind it, boil them with water and other essentials, filter the residue and finally filtrate will be used to print on cloth.

**Keywords:** Algae, Algal dye, Eutrophication, Pollution, Printing on cloth.



Fig. 1. Algae

## I. INTRODUCTION

In country such as India the fresh water bodies are more, where in these fresh waters the growth of algae is plenty. Growth of algae up to certain limit is beneficial while in case of over growth it causes more damage to aquatic animals and eco system. The condition of excessive growth of algae in aquatic areas is termed as eutrophication. Algae form in fresh waters are collected and removed from water bodies by government and certain NGO's. These removed algae are thrown as waste either in garbage or left out in road sides as waste. The idea is to convert the wasted algae into textile dyes and used in fabrics. The removal of algae from water body which will provide sunlight to aquatic organism. These algae which is collected from the water bodies and convert into algal dye by the process which is detailed in upcoming segments, overall algal dye can be prepared by two ways traditional process and modern automated process.

## II. MOTIVATION AND OBJECTIVE

The project's aims are to,

- Extract algal dye from algae which is taken from eutrophication affected water bodies.
- By removal of algae from it, water bodies are prevented from contamination and eutrophication.
- Water body's eco system in conserved and environment depending on it remains undisturbed.
- A valuable substituent for current chemical dye processes.
- As an alternative for chemical dye, it will eliminate/minimize the effect of chemical dyes towards.
- Overall, it will be good entrepreneurial model with a significant global impact.

## III. LITERATURE CRITERIA

- Harper, David M Book on Eutrophication of Freshwater - gives a clear cut understanding on how eutrophication is formed on a water body and its negative effects towards environment.
- Smith, Val H. et al. article on Eutrophication of fresh water and marine ecosystem - gives the various outcomes of eutrophication and how they affect the ecosystem of water body and its surrounding.
- Conley, D.J. et al. Science Magazine on controlling Eutrophication: nitrogen and phosphorous - provides various algae removal methods from water body and steps to control their further growth.
- Awual, Md Rabiul Journal on Efficient phosphate removal from water for controlling eutrophication using novel composite adsorbent - gives Preventive ways to control eutrophication on water body

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- Wang, Liang, et al. article on Cultivation of green algae *Chlorella* sp. in different wastewaters from municipal wastewater treatment plant - gives an innovative idea for cultivating algae artificially for future needs
- Chequer, FM Drumond et al. article on Textile dyes: dyeing process and environmental impact - gives clear understanding on current dyeing process carried out by cloth dyeing industries and its negative impact on environment and also they come out with a new proposal of dyeing process which is eco-friendly.
- Akarslan, F. et al. article on Effects of textile materials harmful to human health – gives a detailed study on chemicals used in textile industries and their respective advantages and disadvantages in human health and environment.
- Tounsadi, H. et al. journal on Impact of chemical substances used in textile industry on the employee's health: Epidemiological study – Gives a health assessment on the textile industries employee health hazards caused due to the chemicals used. The assessment shows an alarming impact of chemicals on employee's health.
- Duecoffre, V. et al. article on Emulsifiers with high chemical resistance: a key to high performance waterborne coatings and Krog, N.J. et al. article on Food emulsifiers and their chemical and physical properties – gives a clear understanding on emulsifiers and selection of eco-friendly emulsifiers for organic dye preparation.
- Goel, R.K., et al. article on Flow equalization and neutralization, R. George Hartig. et al. article on Neutralization of phosphoric acid waste waters, Tadros. et al. article on Formulations for neutralization of chemical and biological toxants and Tucker, Mark D. et al. article on Concentrated Formulations and methods for neutralizing chemical and biological toxants – Provided a deep analysis of various chemical toxics and agents that are harmful for environment and their respective neutralizing agent specification which we had considered for the selection of neutralizing chemicals for dye preparation.

### IV. METHODOLOGY/PROCESS OVERVIEW

Algae taken from water bodies undergo various process before it is used as dye the processes flow are explained in a detailed manner as follows,

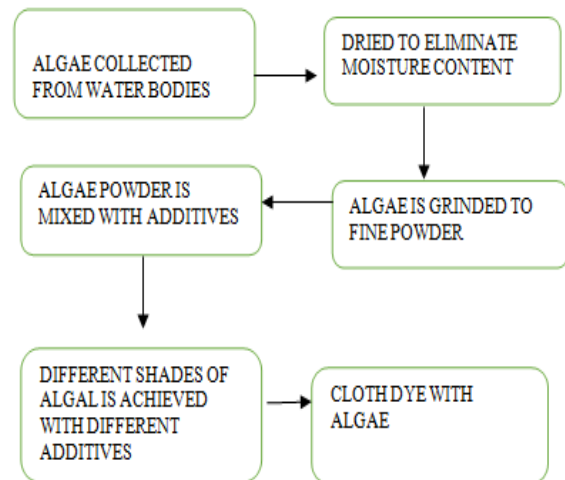
#### (i) Algal Dye Preparation in Traditional Way:

The algae taken from water bodies will be a mixture of algae, dust and soil particles, these dust and soil particles will be removed in initial stage and algae will be cleaned using potable water, after that the cleaned algae is dried out in minimal temperature thereby retaining the algae's real color, after that the dried algae is grinded well to fine powder, finally the power is added with chemical salts & neutralizing chemicals finally boiled with emulsifying liquids and filtered thereby the filtrate will be the dye extracted from the overall process

#### (ii) Algal Dye Preparation in Modern Way:

The algae taken from water body is fed into the sprinkler machine which will help in cleaning the algae by removing soil particles and dust particles, after the cleaning the algae is moved with a inclined conveyor belt which is used to filter the water from algae by using gravity separation, the algae

then moved to the vacuum tray (dryer) where the algae will be completely dried, these dried algae is then powdered using a grinding machine into fine particles, then finally the algae powder is mixed with certain salts, fragrance chemicals and emulsifiers together they are made to boil at higher temperature in a boiler at last the algae dye is printed in fabrics to obtain algae printed fabrics.



### V. IMPLEMENTATION

#### ➤ Algal dye preparation process: -

##### (i) Sprinkler:

Algae are placed on the basin, a sprinkler is mounted on the top of the setup to spray a high pressure water with air mixture to clean the unwanted waste in the collected algae from water bodies. The particles maybe sand, stone, other plant parts, chemicals etc... These should be cleaned properly before converting the algae to powdered form. The cleaning process is monitored by a camera.

##### (ii) Inclined conveyer belt:

The algae from the sprinkler is moved by means of a conveyer belt which filter 50 percent of water by gravity separation method assisted through a mechanical vibrator while a moist sensor connected to the conveyer belt monitors the moist content of algae and sends feed to the controller which inturn controls the operation of the conveyer and vibrator.

##### (iii) Tray dryer:

The algae with least moist content is then transferred into a vaccum tray where in which the minimum moisture content is dried using a heating coil and dryer setup to which an integrated temperature sensor is provided to monitor the temperature of dryer, which signals to contoller and the controller will modify the temp of air blown based on requirement.

##### (iv) Grinder:

The dried algae is then taken and finely grinded into micro-sopic structure by means of a industrial grinder. The powder is then made to undergo a sieving process where macro particles and dust particles are removed to achieve quality dye.

(v) **Boiler:**

Then the powdered algae along with chemical additives are mixed together inside a boiler with distilled water to considerable amount and heated at high temperature in order to achieve thick denser dye like material. The heating is assisted with a mixer to help in uniform heating. Moreover, the idea of the proposed concept is derived from current trends of automobile industries drift towards.

(vi) **Filter:**

The solution is then taken and filtered through a filtering apparatus which has several stages of filter which differs in pore size. Sediments of the boiled solution along with crystal and solid impurities is removed in this method thereby final achieved filtered solution is the proposed algal dye.

(vii) **Cloth printing:**

The algal dye is then used to dye the textile fabrics by several means like printing, dipping and coating.

• **General process:**

Post grinding the powder is then boiled with salts for sterilization, with feel good/aromatic oils for good smell and pungent removal, with chemical binders, emulsifiers and thinners to attain dye texture. The type of additives differs based on shades and specifications of algal dye also in adverse cases can lead to plagiarize. Thus, specification of additives is not be provided.

**Note:** The additives used in above cases are eco-friendly chemicals and human friendly ones.

• **Technically how it is prepared:**

The powdered algae are then taken and mixed with additives such as binder, thinner, emulsifier, fragrance and neutralizing salts in a boiler along with distilled water and boiled to high temperature to achieve a thick denser fluid which is then filtered thoroughly and the filtered solution is the required algal dye having eco-friendly and human friendly dye characteristics. **Note:** Before using the prepared dye in clothes samples should be mandatorily tested for PH value and chemicals as adverse condition may lead to human infection.

## VI. CONCLUSION

The algal dye is extracted from the machine is added to the fabrics and the final output are observed were as the application is used in various process and overall, the fabric is designed for the two reasons such as natural dye for clothes and another one is stop polluting the water bodies.

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