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INTRODUCTION

Water is one of the most valuable resources on planet earth. It is the lifeline for almost all living things on earth. Although the fact is widely recognized, pollution of water resources is a common occurrence. Water pollution is one of the major environmental problems that cause severe threat to living organisms. Increased population, industrialization and urbanization are responsible for environmental pollution. Industrialization of numerous sectors such as food, pharmaceutical, leather, textile, cosmetics, paper and printing, etc. utilize dye compounds to colour their end products (Garg *et al.,* 2004a). Water is the main component used in all these types of industries. Water used for different processes is not completely utilized and it is discharged as wastewater. Among these industries, the textile industry is the principal contributor of wastewater effluents due to the high utilization of water during dyeing, washing and finishing processes.

Textile industry is one of the biggest consumers of potable water as well as chemicals used during textile processing stages. Dyeing and finishing stages are the major producers of waste water with complex characteristics. At the global level, textile industry represents an important factor of economic growth for many countries. Indian textile industry is one of the oldest and largest industries in the world and employs many people directly or indirectly. The textile units are scattered all over India, out of 21076 units, Tamil Nadu alone has 5285 units (Bal, 1999).The textile industry has a $1 trillion worldwide business. There are more than 8000 chemical products associated with the dyeing process, while over 100000 commercially available dyes exist with over 7×10^5 metric tons of dyestuff produced annually. It is estimated that 10–15% of the dye is lost in the effluent during the dyeing process (Arora, 2014).

The waste water discharged from industries is either used for irrigation purposes or it runs off into natural sources of water (Ahlawat and Kumar, 2009). Thus waste water from textile industries creates a big pollution problem due to the dye content presence in it.

The inadequacy in dyeing process has resulted in 10-15% of unused dye stuff entering the waste water directly (Spadarry *et al.,* 1994).

These wastewaters consists high contents of other products besides dye compounds such as dispersants, acids, bases, salts, detergents and oxidants (de Souza *et al.,* 2008). Even a small amount of dye present in water (>1ppm) is highly visible and undesirable (Robinston *et al.,* 2001). Therefore, discharges from textile industries are usually high in colour content, biological oxygen demand (BOD), chemical oxygen demand (COD) and suspended solids (Garg *et al.,* 2004b). The direct discharge of textile wastewater into the water stream is certainly impermissible and every one of us is being exposed to contamination from the past and present industrial practices. In addition, these textile dyes reduce light penetration; affect the photosynthetic activity in aquatic life and it may also be toxic and carcinogenic to living organisms (Asouhidou *et al.,* 2009). Thus, it is necessary to develop an effective and efficient method to remove the colour from wastewater before being discharged into natural water stream.

Low cost adsorbents are becoming the focus of many researches. These adsorbents could be produced from many raw materials such as agricultural by-products/ wastes and industrial waste products (Vigneshpriya and Shanthi, 2016). The conventional (physical and chemical) treatment methods for dye effluents, such as oxidation (Ebrahiem e*t al.,* 2017), coagulation and flocculation (Golob *et al*., 2005; Oliveira *et al*., 2018), photocatalytic destruction (Souza *et* al., 2016), ion exchange (Alvarado *et al*., 2013) and nano membrane filtration (Rashidi *et al*., 2015). But these are complicated and costly, in particular as some methods require additional chemicals or may produce toxic by-products. At present research is focused on the biosorbent for the dye removal mainly by bacteria, fungi, micro and macro algae, agricultural by-products and other polysaccharide materials.

With the search of a new dimension of treatment methods; the biological techniques of dye decolorization are cheaper and easier to operate when compared to the conventional treatments like physical and chemical methods. Removal of dye from aqueous solution using biosorbents is also a nonconventional technology and it mainly takes place on the biomass surface and the binding sites at the surface is activated and thus increase the effective approach of enhancing the biosorption capacity (Mao *et al.,* 2008). The main advantages of adsorption treatment for the control of water pollution are less investment in terms of initial development cost, simple design, easy operations, no generation of toxic substances, and easy and safe recovery of the adsorbent (Mittal *et al.,* 2009). A large variety of adsorbent materials have been used to adsorb the dye molecules such as fruit peels, wood, banana pith, maize cobs, barley husk and bagasse pith, zeolites, activated clays, activated carbons, palm kernel fiber, red mud, bottom ash (Wu *et al.,* 2007).

Dyes used in the textile industries are classified into three classes, (a) anionic (direct, acid, and reactive dyes), (b) cationic (all basic dyes), and (c) non-ionic (dispersed dyes). Basic and reactive dyes are extensively used in the textile industry because of their favourable characteristics of bright color, being easily water soluble, cheaper to produce, and easier to apply to fabric (Karadag *et al.* 2007). Brilliant green (BG) dye (triphenyl methane) is a cationic dye used for decolourization study which was selected on the basis of its extensive use as a colouring agents (silk, wool) including soluble dyes and insoluble pigments, inks, paints and as indicators and reagents. It causes threats to human beings which include irritation in the respiratory tracts and gastrointestinal tracts that lead to damage in organs with symptoms of nausea, diarrhea and vomiting. It might form harmful products like nitrogen oxides and sulfur oxides during decomposition (Mittal *et al.,* 2008). Due to its toxicity to the environment, in this research, brown marine macroalgae which are popularly known as seaweed was used as the adsorbent to remove BG dye from aqueous solution. Seaweed was chosen as it is ubiquitous biological resource and is most predominant that contains alginate gel in their cell walls which offer a convenient basis for the production of biosorbent particles that are suitable for sorption processes and also the presence of abundant dye uptake functional groups (Vieira and Volesky, 2000). Keeping in view the significance of textile dyes and their environmental tribulations, the current study was undertaken to explore the biosorption potential of brown marine macroalgal biomass *Sargassum wightii* for the removal of brilliant green dye from aqueous solutions.

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OBJECTIVES OF THE PRESENT STUDY

Based on the current state of the textile dyes, effluents and their environmental tribulations, the present study aimed to utilize bioremediation approaches to benefit the environment using brown marine macroalga, *Sargassum wightii*. The present study was undertaken to explore the biosorption potential of macroalgal biomass for the removal of BG dye and effluents from aqueous solution and to study the applicability of their commercial use and their significance with the following objectives:

The objectives of the present investigation are

- To investigate the feasibility of *Sargassum wightii* for the removal of BG dye from aqueous solution.
- To determine the different environmental factors on decolourisation with varying dye concentrations, adsorbent dose and pH at different temperatures.
- To determine the variations in the functional groups using FT-IR spectroscopy, the surface characterization by SEM, the elimination of metals before and after biosorption using EDX.
- To determine the equilibrium uptake (q_{eq}) and adsorption yield of *S. wightii* as a function of initial pH, initial dye concentration and temperature for the removal of BG dye.
- To analyze the experimental adsorption data using Langmuir and Freundlich adsorption isotherms and determination of isotherm constants.
- To evaluate the kinetics of the adsorption process using pseudo first and second order rate equations.
- To state thermodynamics to explain the adsorption process.
- To analyse the physico-chemical parameters of dye before and after treatment by *S. wightii*.
- To check the feasibility of *S. wightii* for the removal of real textile effluents from aqueous solution.