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Colour Removal from Textile Effluent by coagulation and flocculation using Natural Material: Review

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ABSTRACT

In recent years, many approaches have been discussed to tackle man-made environmental hazards. Clean technology, eco-mark and green chemistry are some of the most highlighted practices in preventing and or reducing the adverse effect on our surroundings. Textile Engineering has a direct connection with environmental aspects to be detailed manner and abundantly considered. The main reason is that the textile industry plays an important role in the economy of the country like India and it accounts for around one third of total export. Out of various activities in textile industry, chemical processing contributes about 70% of pollution. A number of conventional techniques are in use to remove these pollutants but the advanced techniques have proven more eco-friendly, rapid, cost, and time effective in nature. Materials from biological origin have been investigated for their potential use for wastewater treatment. The main objective of this review is to provide recent information about the most important feature of the abundant plant and to show the advantages gained of colour removal capacity 65%-87% from the textile effluent.

Keywords*- Effluent, Coagulation and flocculation process, Colour removal, Natural Biomaterial, Textile Industries.*

1. INTRODUCTION

India is the world's second major manufacturer of textiles and garments after china. The textile industry in India is one of the oldest manufacturing sectors in the country. It is one of the major industries in the world that provide employment with no required special skills and play a major role in the economy of many countries. The textile industry utilizes various chemicals and large amount of water during the production process. Colour is the major parameter present in the effluent from various textile industries. Textile effluent are highly toxic to living beings and have hazardous effect on their health. Textile wastewater is a source of pollution, which could have effects on the ecology and environmental Thus removal of colour using natural flocculent is a major step towards the protection of natural resources. Coagulation flocculation is the most widely used method is applicable for the removal of the colour even at low concentrations. Effluents from textile industry are a major cause of water pollution. In general, textile wastewater contains high concentrations of organic compounds, heavy metals, high temperature, high COD, high pH and strong color. In that process following parameters like ph, coagulant dose, flocculent dose, mixing time of coagulant, mixing speed of coagulant, mixing time of flocculent, mixing speed of flocculent, setting time, concentration of waste water were investigated.[10]

2. BACKGROUND INFORMATION

Wet Processing operation during textile chemical processing, i.e. desizing, scouring, bleaching, dyening, printing and finishing, are the major causes of water pollution. A major contribution to colour in textile wastewater is usually the dyening and the washing operation after dyening during which as much as 50% of the dye might be released into the effluent. During dyening, most of the dye is exusted on the fibre,but the unfixed dye goes into wastewater causing deep colour. The wastewater extremely variable in composition due to large number dyes and other chemicals used in processing. The problem is further made complex by the thousands of dyestuff commercially available. The use of different dyes depends upon the characteristics of the fibre, the specific colour to be applied and the desired finish required on the fibre. [1]

Many methods are used to treat wastewaters from various origins. Each method is selected depending on the characteristics of the wastewater and the treatment objectives. Depending on its origin, wastewater contains a complex mixture of organic and inorganic pollutants. Discharged in the environment without treatment, wastewater leads to the breakdown of the ecosystem and creating potential health risks. A complete sequence of wastewater treatment may consist of the combination of a number of physical (membrane technologies, adsorption, ion exchange, etc.), chemical (coagulation, chemical oxidation, electrochemical treatments, etc.) and biological (biofilter, sequential batch reactor, etc.) processes. In spite of their availability to remove various pollutants from wastewaters, these methods represent some disadvantages. For example, although the advantages offered by the coagulation-flocculation process (lower sensitivity to toxic loadings and to higher amounts of organics, the easy operation, the energy saving, etc.), the used chemicals (such as aluminum salts, acrylamides, etc.) remain in treated water and may induce health problems (neurotoxicity and carcinogenic properties, genotoxicy, etc.), which were reported on various organisms[2]

Textile and dyeing mills use many kinds of artificial composite dyes and discharge large amount of highly coloured wastewater. Textile waste water pollutants are generally causticsoda, urea, detergents, starch, wax, ammonia pigments and dyes. These wastes must be treated prior to discharge in order to comply with the environmental protection laws for the receiving waters. Biological treatment processes are frequently used to treat textile effluents. Coagulation is an essential process in the treatment of industrial waste water. Examples of chemical based coagulants that are available commercially include lime, alum, ferric chloride and polyaluminium chloride. While the effectiveness of these chemicals as coagulants are well noted, there are,none the less, disadvantages linked with usage of these coagulants such as comparatively high costs, harmful effects on human health as well as the fact that they appreciably affect pH of treated waters. As such, it is desirable to substitute these chemical coagulants with cost-effective natural coagulants to offset the aforesaid disadvantages. Cactus (opuntia)and water hyacinth (Eichhornia crassipes)exhibited high turbidity removal efficiency.[3]

Determination of physicaland chemical parameters in the treatment process of waste water by flocculation and coagulation processes using natural coagulants and assessing their feasibility for water treatment by comparing the performance with each other and with a synthetic coagulant. Initial studies were done on the synthetic waste water to determine the optimal pH and dosage, the activity of natural coagulant, followed by the real effluent from tannery waste. [4]

Textile industries are considered as highly polluting industries due to improper treatment of wastewater. In wastewater treatment, coagulation has been practiced since earliest times. Generally coagulant is a chemical which is added to the water to remove the colloidal impurities and other bio-contaminants. Aluminium and iron coagulants are commonly used in most industries. Hence nowadays, there has been a great attention in the improvement and implementation of natural coagulants in wastewater treatment. Natural coagulants are organic based coagulant that can be used in coagulation stage of wastewater treatment to reduce turbidity, colour and organic matters. Natural coagulants are harmless and more economical. These natural coagulants can be formed or extracted from plants, microorganisms and also plants.[5]

Especially surface water contains both dissolved, suspended and colloidal particles. Coagulation has been practiced since earliest times to remove colloidal impurities and turbidity. Nowadays, there has been great attention in the improvement and implementation of natural coagulants in wastewater treatment for their least cost. In the present study, wastewater collected from different locations of municipal primary drain in Rajshahi City were tested for various physical and chemical parameters to characterize. An attempt has been taken to check how natural coagulants such as Acacia nilotica, Moringa oleifera, banana stem, banana peels and Ficus carcia can remove the TDS, TSS and turbidity from wastewater through coagulation process at its optimum condition so that this treated water becomes suitable to safely discharge into river or directly use for irrigation.[6]

A coagulation–flocculation process was used to treat water-based printing ink wastewater with aluminum sulphate {Al2(SO4)3} as coagulant and with Praestol as flocculant. To minimize turbidity and sludge volume index (SVI), the experiments were carried out using jar tests and response surface methodology (RSM) was applied to optimize this process. A central composite design, which is the standard design of RSM, was used to evaluate the effects and interactions of three factors, that is, coagulant dosage, flocculent dosage and pH on the treatment efficiency. [7] This study focused on the quality of textile dyeing effluent by analyze the physico-chemical parameters such as colour, pH, total hardness, biological oxygen demand (BOD), chemical oxygen demand (COD), total dissolved solids (TDS), total suspended solids (TSS), turbidity, chlorides, sulphides, silica, calcium, iron, oil and grease of the effluent.[8]

The waste water produced during this process contains large amount of dyes and chemicals containing trace metals such as Cr, As, Cu and Zn which are capable of harming the environment and human health. In the textile wastewater contain a high degree of pollutants with high TDS and suspended solids. The wastewater is highly colored and viscous due to dyestuff and suspended solids respectively. Chloride is major anion found in the wastewater but concentration of bicarbonate, sulphate and nitrate are also high (>100 mg/L). Sodium salts of these anions are most commonly used in the process. The wastewaters also have high BOD and COD indication its polluting nature. In this study we have used natural coagulants such as moringa , lablab, Tamarind for the treatment of wastewater produced by the textile industries[9]

Other natural adsorbent banana and orange peel was used for removal of colour from waste effluent of textile industry. The materials were obtained and treated for the removal of colour at different doses. These materials also evaluated for the removal of colour at different pH and time. The materials are capable of

removing colour from waste water, their colour removal capacity for banana peel is 87% and orange peel is 68 % respectively at normal pH and temperature conditions [10]

3. CONVENTIONAL METHOD

Conventional methods for removing Colour are either becoming inadequate to meet current stringent regulatory effluent limits or are increasing in cost. As a result, alternative, cost effective technologies are in high demand. Conventional techniques for removing Colour include Coagulation and flocculation Process using natural biomaterial.Removal of colour from textile is a major problem faced by environmental scientist and engineers

Most current practices for wastewater decolourization treatment fall into following four Main classes:

Physical or physico-chemical technique. I.e. precipitation, Coagulation/flocculation, Ion exchange, adsorption, and membrane separation. These remove or separate the colour physically and result in need for solid waste disposal,

Chemical techniques, i.e. Ozonolysis, chemical oxidation / reduction, etc. These technologies remove the colour from the effluent by breaking down the dye into simpler fragments and destroy the chromopore responsible for colour,

Biological techniques, i.e. aerobic and anaerobic digestion, whereby decolourization take place either by adsorption of dyes on activated sludge or by biological degradation of dye molecules, and

Electrochemicaltechniques, i.e.electro dialysis / ion oxidation. It combines the oxidation of the dye and the other polluting contaminants by means of electrolytic process with the physic-Chemical precipitation of the sludge.[1]

The adsorption process is a very important separation method based on the use of a suitable absorbent characterized by porous structure allowing high surface area and showing fast adsorption kinetics. This method is noted to be competitive to other techniques applied for water treatment. This is due to various factors such as the cost efficiency, eco-friendly and insensitivity of the used materiel to toxic substances, high efficiency level, design simplicity, easy operation, etc. Activated carbon is widely used as an adsorbent for the removal of pollutants from wastewaters. However, due to some limitations related to the activated carbon cost, the additional costs for regeneration after exhausting, and the loss of adsorption efficiency after regeneration, many research activities have been conducted in order to explore alternative cheaper adsorbents. Therefore, various materials, including natural materials, wastes and byproducts generated by industries were investigated.[2]

Coagulation is an important wastewater treatment process used to reduce water turbidity and normally precedes the more complexsecondary and tertiary water treatment process. In this study, the effectiveness of a natural coagulant derived from a cactus species for turbidity removal from dye industry effluent. Other parameters such as pH as well as colour were also studied. Cactus opuntia used in the study was collected from a nursery. The cactus was washed with tap water and subsequently sliced into small pieces to facilitate drying. The sliced cactus was then dried under direct sunlight and then kept in oven for 6 hours at 800C.The dried cactus was ground into fine powders using pestle and mortar. Water hyacinth used in the study was collected from a nearby pond. The roots of hyacinth was washed thoroughly and then dried under direct sunlight .The dried roots was ground into fine powders using pestle and mortar. [3]

The objective of the study to determine the activity of natural coagulants on the treatment of real effluents comparable with synthetic wastewater. This study aims to extend the previous work and find a viable way to use the naturally occurring coagulants such as Aloe Vera, Moringa Oleifera seeds and Cactus.

The Moringa Oleifera seeds were sourced locally from a vendor. They were air-dried at 45°C for 48 hours. The chaff surrounding the seed kernel was removed and the kernels were ground finely using a blender into powder. This was the coagulant prepared from Moringa Oleifera.

The cactus pads were washed thoroughly and the outer covering along with the thorns was removed to extract the mucilage. The mucilage obtained was then air dried in an oven at 65°C for 24 hours. The dried mucilage was then ground into the powdered form and coagulant was thus prepared.

The Aloe Vera leaves were washed thoroughly followed by draining of aloin by keeping the leaves in the horizontal position and the gel was scooped out from within. This gel was used for the coagulation purpose. The aluminum sulphate (alum) which was used for comparison was also sourced locally.[4]

Textile industries discharge large volume of waste water which is characterized by high BOD, COD, turbidity, suspended solids, dissolved solids, sulphide, chloride, chromium, animal hairs, epidermic fats and other bio-contaminants. Usually these untreated effluents are treated by the current commercial synthetic coagulant such as ferrous sulphate, aluminium sulphate (alum), poly aluminium chloride which is harmful for livelihood. Natural coagulants are organic based coagulant that can be used in coagulation stage of waste water treatment to reduce turbidity, colour and organic matters. Based on the experimental results, it was concluded that natural coagulants which have been obtained from Moringa oleifera, Azadiratchta indica have shown improved performance of coagulation comparing to commercial alum.[5]

The plant based natural coagulants such as Acacia nilotica, Moringa oleifera, banana stem, banana peels and Ficus carcia were used ascoagulant to avoid the drawbacks of chemical coagulation .These natural coagulants were collected from tropical trees which contain water soluble, positively charged proteins that act as an effective coagulant for water and wastewater treatment.[6]

The wastewater used in this study was taken from a card board packing industry located in Sfax, (southern of Tunisia). This effluent present a dark gray color mainly caused by the solid ink residue. The industry implanted a wastewater treatment station in 1985. Wastewater treatment plant consisted of a feed tank where industrial effluents are collected and pumped to the coagulation /flocculation tank. The treated effluent was finally collected in decantation tank. Samples were collected within about two months from February to March, 2011. Samples were collected and preserved according to the Standard Methods for the Examination of Water and Wastewater (APHA, 1992). Physicochemical analyses, for example, pH, total suspended solid (TSS), volatile solid (VS), total solid (TS), turbidity, biological oxygen demand (BOD), and COD of effluent, were carried out immediately after samples arrived in the laboratory according to the standard methods (APHA, 1992). The pH (precision 0.01) and temperature (precision 0.01) of the UNIPACK effluents were measured using a multifunction pH-meter Testo model (ECOMETP25Korea South). Color of the effluent was noted by visual observation. The remaining effluent characteristics parameter, that is, TSS, VS, TS, turbidity, BOD, and COD were analyzed by volumetrically /titrimetrically as per standard methods (APHA, 1992; Manivasakam, 1996; Trivedi and Goel, 1984) (Table 1), respectively [7]

The suitability of Orange peel and Banana peel as a low cost natural adsorbent with respect to various parameters such as colour adsorbent capacity of material with initial concentration at different doses, time, and pH.

Waste orange peel and banana peel were obtained from the local fruit stall. These peels then dried in oven at 900 C for 24 hrs and ground to a fine powder and sieved through 600 micron and 300 micron sieves. The 600 micron particle size powder and 300 micron size powdered material of orange and Banana peel were selected for the batch adsorption and pH study. Both the materials were dipped in a 1N HCl for 5 hrs then washed with distilled water, dried and used for the study.

The colour concentration was determined using COD plus colorimeter (model: La-motte, code-1922/1922EX-2).The colorimeter measures the colour in ptcobalt scale and range is upto 1000 units. The pH is measured by using pH meter.[10]

4. NATURAL BIOMATERIAL

Elemental analysis was carried out to provide elemental compositions of the cactus .In this study, it was determined that cactus opuntia contained 2.3% nitrogen, 29.4% carbon,1.7% hydrogen. The coagulant was slightly acidic in presence of water. It was observed that increased cactus dosages correlated with decreased pH.[3]

Moringa oleifera is the thirteenth species of the genus Moringacae. Moringa was highly valued in the ancient world. Moringa Oleifera seeds are used as a primary coagulant in drinking water clarification & waste water treatment due to the presence of a water- soluble cationic coagulant protein which are able to reduce turbidity of treated water. Seeds are powdered and added to the water straight or after preparing crude extract. The seed kernel contains significant quantities of series of low molecular weight and soluble protein which carry positive charge to solution. The protein is considered to act similarly to synthetic and positively charged polymer coagulant. Common Names of Moringa oleifera: Benzolive, Drumstick tree, Kelor, Marango, Mlonge, SaijhaandSajnaMulangay.

The Azadirachta indica (Neem tree) is available in tropical South East Asia. It is fast growing, can survive in drought and poor soil and keeps its leaves all year around. It is a tall tree, up to 30 meters high, with leafy spreading branches. Neem trees can be grown in areas which have 400 mm and 1500mm of rain each year. It performs best at an attitude of less than 1500 meters. Neem trees will survive very hot temperatures, up to 44°C and as low as 4°C Common Name of Azadirachta indica: Nim, Intaran, Margousier, Betain, Agas, Nimba.[5]

Natural coagulant is a natural based coagulant (carbofydrates and proteins) that can be used in coagulation process of wastewater treatment for reducing turbidity (Saharudin and Nithyanandam, 2014). These natural coagulants can be formed or extracted from animal, microorganisms and also plant. Natural coagulants usage is profitable in wastewater treatment since the treatment cost is low, the steady pH levels in the treated water and because they are highly biodegradable. The application of natural coagulants is based on their traditional use in tropical, rural. Therefore, this study was carried out to analyze the effect of Acacia nilotica, Moringa oleifera, banana stem, banana peels and Ficus carcia as a primary coagulant in clarifying municipal wastewater in coagulation process at its optimum speed.[6]

Naturally occurring coagulants are biodegradable and are presumed safe for human health. Thus, in water treatment, the use of natural coagulants could be an option with many advantages over chemical agents, particularly the biodegradability, low toxicity, low residual sludge production and safe to human. Cactus and Hyacinth bean, Tamarindus indica , Acacia (Babul),were used as locally available natural coagulants in this study to reduce

turbidity of synthetic water. Natural coagulants worked better with high, turbid, water compare to medium, or low, turbid, water. Highest turbidity reduction efficiency (95.89%) was found with Cactus and Hyacinth bean. About 89 to 96% [11] Total coliform reductions were also found with natural coagulant treatment of turbid water. Using locally available natural coagulants, suitable, easier, and environment friendly options for water treatment were observed. [9]

5. COAGULATION AND FLOCCULATION PROCESS:-

Over the years, Coagulation has been the only economically feasible method for colour removal. The primary treatment in a conventional wastewater treatment scheme consists of coagulation and flocculation, which removes the colloidal particles of colour, turbidity and bacteria.

Coagulants such as Fe(III) or Al(III) salts when added in a sufficiently high concentration ,rapid precipitation in form of hydroxide takes place. The colloidal particles become enmeshed in the precipitate and settle along with it, coagulant aids can be used to produced more compact floc and lead to improve setting. Coagulant dosing required depends on concentration of colloidal impurities present in the water. Iron was found to be superior to alluminium for colour removal. Several studies have been reported on the use of different coagulant for textile wastewater.[1]

Coagulation and flocculation are usually followed by sedimentation, filtration, and disinfection, in the primary stage, succeeded by chlorination. This method is used worldwide for water treatment before it is finally distributed to the consumers [13]. Various types of coagulants are used in typical water treatment processes for making the water fit for use by the consumers.These can be classified into inorganic coagulants, synthetic polymers, and biological coagulants.[4]

Natural coagulants originating from vegetables and seeds were in use for the purpose of water treatment before the wide scale use of chemical salts, but they have not been able to displace the use of chemical salts as the scientific grasp of their effectiveness and mechanism of action was lacking. The usage of biological coagulants has not picked up so far because of the lack of clarity in the method to use them commercially. They have given way to inorganic salts progressively under modernization and survived only in some parts of some developing countries [14]. However, there has been a renewed interest in understanding the activity of natural coagulants for water treatment in most countries [4]

As previously reported, the inorganic salt aluminium sulphate (alum) is one of the most widely used coagulants in conventional water and wastewater treatments. The performance of alum no longer needs to be proved and is appreciated for its low cost, ease of use and availability. However, it produces abundant sludge that is difficult to dehydrate, its efficiency is entirely dependent on the pH and when formed in cold water alum flocs are not very mechanically resistant. In addition, the use of alum is a source of concern and the debate about

its possible toxicity is still open. Since high aluminium concentrations in water may have human health implications, environmentally friendly coagulants will present an interesting alternative for the purification of wastewaters [20].

The use of inorganic polymeric coagulants has been also questioned. Increasing use is also being made of synthetic coagulants of organic polymeric origin. Commercial synthetic polymers have been utilized in Coagulation / flocculation processes for water purification for at least four decades [15]

Table 1

Typical investigations and remarks carried out by various researchers on Colour removal from textile effluent

Author(s	Investigation	Interpretation/remarks
M Joshi, R Bansal &Purwar [1]	This paper presents a critical review of the current literature available on various textile wastewater decolourisation technique being applied and researched colour from textile wastewater	In principal, decolourization are achievable using one or combination of the following methods :adsorption, filtration ,precipitation, coagulation,flocculation,chemical,photo and biodegradation
F. Ben Rebah1,2*, S.M. Siddeeg3,4 [2]	The present paper reviews wastewater treatment technologies that may involve cactus. This biomaterial can be involved as coagulant/flocculant, as biosorbent and as packed material for biofilter.	For many accessibility criteria, cactus based materials are very attractive for wastewater treatment. Cactus plants are renewable, abundant, environmentally friendly, adaptable and biodegradable. The capability of various cactus preparations for pollutant removal was also observed.
1DR.T.Kannadasan, 2M.Thirumarimurugan,3K.S.Sowmya, 4Sukanya karuppannan,5M.Vijayashanthi[3]	The effectiveness of a natural coagulant derived from a cactus species for turbidity removal from dye industry effluent. Other parameters such as pH as well as colour were also studied.	It was shown that powdered and dried cactus opuntia was very effective in removing turbidity as well as colour from effluent water than water hyacinth
L Muruganandam,M P Saravana Kumar, Amarjit Jena,SudivGulla and BhageshGodhwani[4]	The raw tannery effluent was bluish-black in colour, mildly basic in nature, with high COD 4000mg/l and turbidity in the range 700NTU, was diluted and dosed with organic coagulants, AloeVera, Moringa Oleifera and Cactus (O.ficus-indica)..	The study observed that coagulant Moringa Oleifera of 15 mg/L dose at 6 pH gave the best reduction efficiencies for major physicochemical parameters followed by Aloe Vera and Cactus under identical conditions.

R.S.Mane*, V.N.Bhusari** [10]	Feasibility of Orange peel and Banana peel as a low cost natural adsorbent with respect to various parameters such as colour adsorbent capacity of material with initial concentration at different doses, time, and pH. The study shows that the material has good potential for the removal of colour from textile effluent.	The improvement of Banana and Orange peel with acid treatment significantly improve colour adsorption capacity as compared to raw Banana and Orange peel. It was found that colour removal efficiency was achieved maximum at very low dose of 0.06 g for Banana peel and 0.05 g of Orange peel within short time of 55 minutes.
S.Ramesh,A. Amirthashanthi, M. Kalaivani,P. Easwaran,K. ngusenthil [5]	Natural coagulants are organic based coagulant that can be used in coagulation stage of waste water treatment to reduce turbidity, colour and organic matters.	The COD and BOD reduction for textile effluent were 68.67 % and 73.33 %. It is also observed that among the two natural coagulants the maximum reduction was observed in Moringa oleifera
MD. N. Bari1 ,A. Bushra*2 & MD. M. Hasan2[6]	Natural coagulants such as Acacia nilotica, Moringa oleifera, banana stem, banana peels and Ficus carcia can remove the TDS, TSS and turbidity from wastewater through coagulation process at its optimum condition so that this treated water becomes suitable to safely discharge into river or directly use for irrigation.	Based on the experimental results, it is found that the maximum removal of TSS, TDS and turbidity are obtained 75% by banana stem, 69% by Ficus carcia and 99% by Ficus carcia and banana stem respectively..
Gomathi Elango1, Rathika G2*and Santhini Elango3 [8]	Quality of textile dyeing effluent by analyze the physico-chemical parameters such as colour, pH, total hardness, biological oxygen demand (BOD), chemical oxygen demand (COD), total dissolved solids (TDS), total suspended solids (TSS), turbidity, chlorides, sulphides, silica, calcium, iron, oil and grease of the effluent.	The present study clearly enlightens the physico-chemical parameters of the textile effluent, which is highly useful to analyze the nature and types of pollutant concentration present in the effluent and this study gives an idea to treat the effluent by suitable treatment method.
Nandkishor Kumawat1, Nikhil Koul 2, Jayesh Indrekar 3, Shubham Payghan4 [9]	Wastewater of textile industry was found to contain a high degree of pollutants with high TDS and suspended solids. The wastewater is highly colored and viscous due to dyestuff and suspended solids respectively.	It can be concluded that, the use of natural coagulants like Cactus and Hyacinth bean, Tamarindus indica Acacia (Babul) are receiving attention for their effectiveness in water treatment

6.SUMMARY AND CONCLUDING REMARK

The quality of life depends on available water in the greater interest of the people. Water depletion of good quality water and environmental pollution has given tremendous importance to the water management. Joints

efforts are needed by water technologists and textile industry experts to reduce water consumption in the industry.

The present study deals with the determination of physical and chemical parameters in the treatment process of waste water by flocculation and coagulation processes using natural coagulants.

In this study suggest that low cost biomaterial may provide a promising economical and cleaner alternative to replace or supplement current treatment processes such as using chemical in coagulation and flocculation process for the removal of very high concentrations of colour in textile industrial wastewater effluents, as they are more polluted in environment such as land and river. However, the decolourization efficiency by the natural material such as abundant plant depends largely on the type of effluent, pH, temperature and flocculant concentration.

From the literature, it is noted that the new methods of industrial waste water treatment are due to Biomaterial and they are prone to be efficient inreducing the Colour and other parameter. Quantification of metal–biomass interactions is fundamental to the evaluation of potential implementation strategies, hence sorption isotherms, ion-exchange constants, as well as models used to characterize biosorption are found to be very important towards treatment of textile industrial waste.

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