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Textile Waste Water Treatment by Using Natural Coagulant (Neem-Azadirachta India)

S. Mohan[1*], K.Vidhya[2], C.T. Sivakumar[2], M.Sugnathi[1], V. Shanmugavadivu[1], M.Devi[1]

[1] *Assistant Professor, Department of Civil engineering, Mahendra Engineering College,(Autonomous), Namakkal-637 503, Tamil Nadu, India.*

[2] *Professor, Department of Civil engineering, Mahendra Engineering College, (Autonomous), Namakkal-637 503, Tamil Nadu, India,*

**Corresponding author E-Mail ID: mohaa072@gmail.com*

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ABSTRACT

Textile industry processes are among the most environmentally unfriendly industrial process, because they produce colored wastewaters that are heavily polluted the environment. Therefore, wastewater from textile industry has to be treated before being discharged into the environment. In this present study, an attempt has been made to evaluate the effectiveness of locally available natural coagulant Neem leaves powder for reduction of characteristics in the wastewater in order to improve its quality. A common herb like Neem leaves powder is utilized to illuminate and sterilize the water. The coagulant chemicals play the vital role in wastewater treatment. At the same time spending more amounts for these chemical coagulants increase the total treatment cost and become more burdens to the industry. In view of the replacement or reduction of chemical coagulants which are used in wastewater clarification, coagulants which are effective, productive and also free from physio-chemical characteristics are considered. Using natural coagulants is more eco-friendly and sustainable when compared to the chemical coagulants which is biodegradable.

Keywords: Textile wastewater, Azadirachta Indica, Jar test apparatus, BOD and COD

1. INTRODUCTION

Next to air, water is the most important natural resource necessary for the survival of life on earth. Industries such as textiles, paper, engineering &electronics determine the wide range of water chemistry. With the increased demand for textile products, the textile industry and its waste waters have been increasing proportionally, making it one of the main sources of severe pollution problems worldwide. More than 80,000 tons of dyes used mainly in food industries, cosmetics, paper mills and especially in textile industries which absorb alone more than 70% of the produced total quantity. There are more than 8,000 chemical products associated with the dying process and over 100,000 commercially available dyes exist with over 7×10^5 metric tons of dyestuff produced annually. In particular, the discharge of dye- containing effluents into the fresh water environment is undesirable because of their color, released directly and the breakdown products are toxic. Much of the water pollution is caused due to diversity in the composition of chemical reagents used in textile industries. The reagents range from inorganic compounds to polymers and organic products.

Wastewater generated by different production steps of a textile mill have high pH, temperature, detergents, oil, suspended solids, dissolved solids, dispersants, leveling agents, toxic metals, non-biodegradable matter, color and alkalinity. Textile effluents are rich in recalcitrant organics, color, toxicants, surfactants and chlorinated compounds. These industries also use synthetic dyes including VAT dyes, AZO dyes and mordents. Mordents are used for fixing of colours and contain heavy metals like iron, copper, chromium, cadmium etc. which are toxic in nature. Many synthetic dyes are toxic mutagens and carcinogenic. The textile wastewaters are characterized by extreme fluctuations in many parameters such as biological oxygen demand (BOD), chemical oxygen demand (COD), pH, color and salinity. Due to the lack of appropriate wastewater treatment systems in these rural or underdeveloped societies, the best instant option is to use simple and relatively cost effective point-of-use (POU) technologies such as coagulation. Coagulation is an important process in the treatment of wastewater. Its application includes removal of turbidity from wastewater.

Neem leaves is not giving poisonous effect. It is easily available, eco-friendly and cheaper method of water treatment. In rural areas this type of treatment is better and it is cost effective. After the treatment the sludge settled at the bottom of tank, can be used as bio-fertilizers is another advantage of this method in rural areas. This treatment process basically requires land, energy which increases overall cost of treatment process. So naturally available coagulants were used to reduce the treatment cost. Present work aims to evaluate the use of Neem leaves powder as coagulants as well as for removal of turbidity and reports an environmental benefits and it can be used for purification of waste water from domestic sources in rural area.

A. Natural coagulation

- The sedimentation process can be quickened by adding coagulant to water.
- Coagulation with extracts from natural and renewable vegetation has been widely practiced since recorded time. There is a variety of natural coagulants used around the world, depending on the availability.
- Extracts from Azadirachta indicia can be used, the tress of which is native to tropical south East Asia.

B. Necessityof Coagulation

By plain sedimentation, colloidal solids and very finely divided suspended matter cannot be removed, because of their extremely lower setting velocities. Silt particles of 0.06mm size requires 10 hours to settle in 3m deep plain sedimentation tank and 0.02mm particle will require about four days for settling, which is impracticable because water cannot be detained for such long time in addition to suspended solids, water also contains colloidal particles, which will be in continuous motion. In order to remove such fine particles from water, certain chemicals called coagulants are used.

C. Merits of Coagulation

The merits of coagulation in waste water treatment are as follows

- Sedimentation aided with coagulation produces better effluent with lesser Biochemical Oxygen Demand (BOD) and suspended solids, as compared to plain sedimentation
- Coagulated settling tank requires less space required less space than required by an ordinary plain sedimentation

- Coagulation process may also remove the phosphorous and nitrates from water or wastewater, which may help in eutrophication of river, into which the effluent is being discharged.

D. Neem- Natural Coagulant

Azadirachta indicia are a species of flowering plant in the meliaceae family and are best known as a Neem and Indian Liac. It grows worldwide in tropical, subtropical and mild temperate regions. It possesses medicinal uses especially for diabetic treatment.

Fig 1. Azadirachta indicia

E. Uses and benefits of Neem

- Neem leaves enhance biological function by strengthening the immune system, boosting respiratory functions, improves digestive health, and supports the liver by getting rid of the unwanted toxin in the blood.
- Extracts from the neem leaves are also used for eye problem, viral diseases, cardiac care
- Neem leaves used as natural pesticides, mosquito repellent, funal diseases, skin care,diabetic food and animal feed
- The wood of neem tree is strong and resistant to termite. It is also good for fire wood and for making charcoal.

SCOPE OF THE PROJECT

- The process being biological in nature does not generate any non-treatable wastes and the process is easy to operate and it requires little or no maintenance.
- This project evaluates Neem leaves powder can be used as water purifiers and it would be possible to develop an eco-friendly method of water purification.
- The usage of natural coagulants derived from plant-based sources represents a vital development in ‘grassroots’ sustainable environmental technology since it focuses on the improvement of quality of life for under developed communities.

MATERIALS AND METHODS

A. Preparation of Coagulants

Neem leaves were collected and washed with distilled water and dried naturally at room temperature for 4 days. The dried neem leaves were crushed and powdered and passing through

75micron sieve. Finally these powder used as a natural coagulant in wastewater treatment. Neem leaves were collected from household in Salem city.

Fig 2. Neem leaves powder

B. Jar Test Apparatus

Jar test apparatus all coagulation experiments were carried out by using a convention jar test apparatus.jar test is the most widely used experimental methods for coagulation-flocculation. A conventional jar test apparatus was used in the experiments to coagulate sample turbid water using natural coagulant. It was carried out as a batch test, accommodating a series of six beakers together with six sample steel paddles. Before operating the jar test, the sample was mixed homogenously. Then, the sample ought to be measured for turbidity, for representing an initial concentration. Coagulants of varying concentrations were added in the beaker.

- Before going to jar test the water sample of 250ml is filled in the four jars. The natural coagulants of different proportion are added to the sample.
- A jar test stimulates the coagulation process. In our project we have to coagulate the sample by slow mixing process. The duration of mixing is 20 minutes.
- After the flocculation process the sample is tends to various tests.

C. Estimation of optimum coagulant dosage

Take 250ml of sample in four beakers and keep in jar test apparatus. Switch on the motor and adjust the speed of the paddles. Allow flash mix rapidly for 1 minute. Reduce the speed of the paddles and continue it for 10 minutes. Switch off the motor and allow the solution to settle for 20 minutes. Measure the amount of sludge produced at the bottom. Draw the graph between amounts of dosage added to the sludge produced. From that notes the ideal dosage of coagulant.

D. Water Quality Parameter

The chemical parameters like PH, TSS, TDS, Chloride, Sulphate ,Nitrate and Chromium etc are main constituents defining the quality of Textile waste water. Therefore, presence of this parameter in Textile waste water beyond the permissible limits in the absence of alternate source has been considered as Textile waste water quality hotspots.

RESULT AND DISCUSSION

Neem leaves powder plays a major role for the better influence in removal of physiochemical parameters such as P^H, Total solids, TDS, TSS, EC, turbidity, T. Alkalinity, Bi-Carbonate Alkalinity, Total Hardness, Ca.Hardness, Mg.Hardness, Calcium, Magnesium, Carbonate Hardness, Non carbonate Hardness, Chloride, Sulphate, MLVSS, Iron, Silica COD, BOD, Copper and Chromium.

Table 1: Result of textile waste water before& after treatment

Sl.No	Parameters	Before treatment values	After treatment values
1.	p^H	9.2	7.7
2.	Total solids mg/l	5819	4628
3.	TDS mg/l	5770	4516
4.	TSS mg/l	49	42
5.	EC mhos/cm	8261.3	7010
6.	Turbidity NTU	24	20
7.	T.Alkalinity mg/l	90	80
8.	Bi-carbonate Alkalinity mg/l	30	20
9.	T.Hardness mg/l	80	70
10.	Ca.Hardness mg/l	45	40
11.	Mg.Hardness mg/l	35	30
12.	Calcium mg/l	18	10
13.	Magnesium mg/l	8.4	6
14.	Carbonate Hardness mg/l	80	50
15.	Non Carbonate Hardness mg/l	Nil	Nil
16.	Chloride mg/l	4301.23	3176.32
17.	Sulphate mg/l	1620	1609
18.	MLVSS mg/l	31	18
19.	Iron mg/l	0.8	0.5
20.	Silica mg/l	2.92	2.81
21.	COD mg/l	1173	601
22.	BOD mg/l	282.6	206
23.	Copper mg/l	<0.01	<0.01
24.	Chromium mg/l	1.2	<0.01

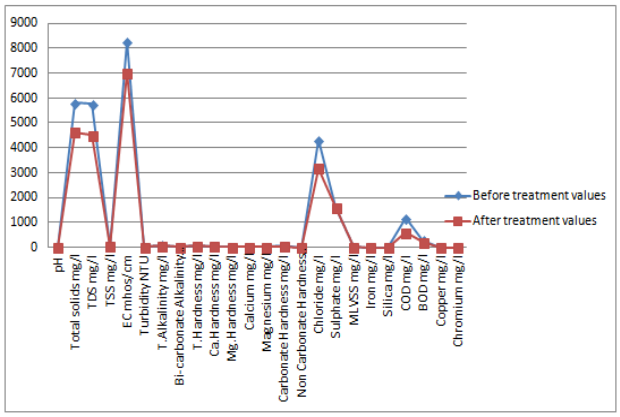

Fig 3. Graph showingof textile waste water before & after treatment

CONCLUSIONS

1. Low cost adsorbents obtained from leaves of plant material such as Neem leaves is highly encouraged for the decolourization of aqueous solution of dyed effluents of industries are used because they are not only cost effective but sometimes more efficient than the commercially available activated charcoal.
2. Natural coagulants are more Eco –friendly and sustainable when compared to the chemical coagulant which is Biodegradable.

3. It clearly shows the Neem leaves serves as a potential alternative absorbent to remove heavy/toxic metal irons from the waste water, this is due to the fact that the surface structures of Neem leaf remains stable during long time agitation treatment and also can be obtained without excessive cost.
4. It also can be adopted and used widely in industries, and in addition to this, living organisms and surrounding environment will also benefit from the decrease are elimination of the potential toxicity created heavy metals.
5. The study revealed that decrease the pH in Textile waste water by Neem leaf shown coagulants and is more effective. After treatment the range of pH was 7 - 8 and within the limit.
6. During the analysis it was observed that, after treatment with Neem leaf powder COD was 2980.00. Experimental results indicated that the wastewater could be effectively treated by using a coagulation/flocculation process, where the BOD3/COD ratio of the effluent was improved to 0.19.
7. The amount of food (or organic carbon) that bacteria can oxidize measured by the BOD test were reduced when added neem leaf powder.

REFERENCES

1. Bhattacharyya.K.G and Sharma.A., 2005. Kinetics and thermodynamics of methylene blue adsorption on Neem (Azadirachtaindica) leaf powder, Dyes and Pigments, 65, pp.51 – 59.
2. Breckling .J Ed., The Analysis of Directional Time Series: Applications to Wind Speed and Direction, ser. Lecture Notes in Statistics. Berlin, Germany: Springer, 1989, vol. 61.
3. Coagulation/flocculation process and sludge conditioning in beverage industrial wastewater treatment. Department of Pure and Applied Chemistry, LadokeAkintola University of Technology, Ogbomoso, Nigeria
4. Davy Nkhata, Zambia, "The use of Moringaoleifera can offer an alternative option to these coagulant" People and system for water, sanitation and health. [online] Papers of the27th WEDC Conference Lusaka,Zambia.(236-238).
5. Ghanshyam G. Pandhare, Nikhileshtrivedi, S.D, and Dawande.S.D., 2013.Adsorption of color from a stock solution using neem leaves powder as a low-cost adsorbent, International Journal of Engineering Sciences & Emerging Technologies, 5(2), pp.97-103.
6. Jamaluddin, A. M. and Nizamuddin, M. 2012."Physicochemical Assessment of Textile Effluents in Chittagong Region of Bangladesh and Their Possible Effects on Environment", International Journal of Research in Chemistry and Environment ;2(3): 220-230.
7. Jed W. Fahey, Sc.D. "Moringaoleifera: A Review of the Medical Evidence for Its Nutritional, Therapeutic, and Prophylactic Properties. Part 1" [online] Trees for Life Journal a forum on beneficial trees and plants www.TFLJournal.org.
8. MarutiPrasad.S.V&B.SrinivasaRao-"Influence of Plant-Based Coagulants in Waste Water Treatment" IJLTEMAS ISSN 2278 –2540 Volume V, Issue III, (2016)
9. Mohan.S, Sivakumar.C.T, Tamilchelvan.P, Vidhya.K, Muralimohan.N"Reclamation of Nanjarayan lake by using Bioclean STP treatment Tirupur corporation in Tamilnadu, India", International Journal of Scientific & Engineering Research,(IJSER) ISSN 2229-5518 Vol.7 No.11 , pp.no.128-134,Nov- 2016.

10. Mohan.S, Vidhya.K, Sivakumar.C.T, Shanmugavadivu.V, Devi.M, Mathinagalaxmi.C, " A study on Solid Waste Management using Biomethanation Technology, Pallipalayam Municipality in Namakkal District, TamilNadu, India", Indian Journal of Scientific Research, Vol.17(1), pp. 137-141, 2017.
11. Mohan.S, Vidhya.K, Sivakumar.C.T, Shanmugavadivu.V, Kumaresh.M, published a paper in National journal of Multidisciplinary Research and Development, "Production of biogas by using anaerobic sludge digestion of sago waste", ISSN: 2455-9040, Volume 3 issue 1, January 2018, Pg.No-1147-1154.
12. Muralimohan.N&Palanisamy.T "Treatment of Textile Effluent by Natural Coagulants in Erode District"Asian Journal of Chemistry; Vol. 26, No. 3 ,911-914. (2014)
13. Muralimohan.N, Palanisamy.T&Vimaladevi.M.N "Experimental study on removal efficiency of blended Coagulants in Textile wastewater treatment" International Journal of Research in Engineering & Technology (IMPACT: IJRET) ISSN(E): 2321-8843; ISSN(P): 2347-4599Vol. 2, Issue 2,15-20 (2014)
14. Namasivayam, C., D. Sangeetha and R. Gunasekaran, 2007.Removal of anions, heavy metals, organics and dyes from water by adsorption onto a new activated carbon from Jatropha husk, an agro-industrial solid waste. Process Safety and Environmental Protection, 85(2): 181-184.
15. Neem foundation, http://www.neemfoundation.org (1997).
16. NIIR, board, "The complete technology book on textile processing with effluent treatment" (2003b)
17. Palanisamy,K.,Nomanbhay, S.M. 2005. Removal of heavy metal from industrial wastewater using chitosan coated oil palm shell charcoal. Electronic journal of Biotechnology:8.
18. Sivakumar.C.T, Tamilchelvan.P, Mohan.S, "Impact of solid waste landfill on ground water quality in Erumapalyam, Salem District, Tamil Nadu", International Journal of Applied Engineering Research, Vol.10, No.9, pp.9198-9203, 2015.
19. Sivakumar.C.T. Indian Journal of public health Research & Development (An International Journal) "Fabrication of sewage cleaning system"ISSN-0976-2045(Print).ISSN-0976-5506(Electronic) Volume 9, Number2, February 2018.Pg.No-459.
20. Vijayakumar.S, (2013)Studies on Textile Industry Waste Water Using Saw Dust as a Low Cost Adsorbent, Universal Journal of Environmental Research and Technology, Volume 3, Issue 6: 695-698.
21. Wegmuller.M, J. P. von der Weid, P. Oberson, and N. Gisin, "High resolution fiber distributed measurements with coherent OFDR," in Proc. ECOC'00, 2000, paper 11.3.4, p. 109
22. Zarate, R., Jaber-Vazdekis, N.E., Cequier-Sanchez, E., Gutierrez-Nicolas, F., and Ravelo, A.G. (2008). Biotechnology for the Production of Plant Natural Products, Atta-ur-Rahman (Ed.) Studies in Natural Products Chemistry 34: 309-392.
23. Zhang.S, C. Zhu, J. K. O. Sin, and P. K. T. Mok, "A novel ultrathin elevated channel low-temperature poly-Si TFT," XXX Electron Device Lett., vol. 20, pp. 569–571, Nov. 1999.

Conflict of Interest

None of the authors have any conflicts of interest to declare.