International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 7 Issue 04, April-2018

Role of Moringa Oleifera and Tamarind Seed in Water Treatment

Prof. T D Raju, Asst Prof. Ahana K Reji, Naji Raheem, Sruthi Sasikumar,
Veena Vikraman, Shimil C P, Sneha K M
ILM College of Engineering and Technology, Methala, Perumbavoor

Abstract*— Water pollution is any chemical, physical or biological change in the quality of water that has a harmful effect on any living thing that drinks or uses or lives it. When humans drink polluted water it often has serious effects on their health. Water purification is the process of removing undesirable chemicals, biological contaminants, suspended solids and gases from water. Purifying water may reduce the concentration of a range of dissolved and particulate matter. Commonly the chemical coagulants such as salts of iron and aluminium are used. In this widely used coagulant is aluminium sulphate. Shortly known as Alum, when added to raw water reacts with the bicarbonate alkalinities present in water and forms a gelatinous precipitate. This floc attracts other fine particles and suspended material in raw water, and settles down at the bottom of the container. But this process is costly and also over dosage causes harmful effects on human being. Inorder to overcome these limitations, natural coagulants such as moringa oleifera and tamarind seed powder are used. In this present study, an attempt has been made to evaluate the comparative effectiveness of chemical coagulant Alum with Natural Coagulant such as Moringa Oleifera and tamarind seed powder. The maximum turbidity reduction of alum, moringa oleifera, tamarind and combined use of moringa oleifera tamarind seed were found as 97.5%, 98.12%, 98.12% and 98.75% with optimum dosage of 300, 250, 300 and 250mg/l. The pH, alkalinity, acidity and total chlorides was determined in treated sample of coagulants and maximum reduction effiieny was found in the combined use of moringa oleifera and tamarind seed powder. The Utilisation of locally available natural coagulant was found to be suitable, easier, cost effective and environment friendly for water treatment.

Index Terms*— Waste Water, Chemical Coagulants, Natural Coagulants

I. INTRODUCTION

A. General

Water is the driving force of all nature. Water is vital to life and development in all parts of the world.The availability of a water supply adequate in terms of both quantity and quality is essential to human existence.Civilization developed around water bodies that could support agriculture and transportation as well as provide drinking water. Recognition of the importance of water quality developed more slowly. Early humans could judge water quality through physical senses of sight ,taste and smell. Not until the biological, chemical and medical sciences developed were methods available to measure water quality and determine its effects on human health and well-being.

Water pollution is the presence of some inorganic, organic, biological, radiological or physical foreign substance in the water that tends to degrade its quality. Normally, water is never pure in a chemical senses. It contains impurities of various kinds dissolved as well as suspended. The polluted water is turbid, unpleasant, bad smelling, unfit for drinking, bath and washing and incompatible in supporting life. Water pollution is also caused by the presence of undesirable and hazardous
materials and pathogens beyond certain limits. Much of the pollution is due to anthropogenic activities like discharge of sewage, effluence and wastes from domestic and industrial establishments, particulate matter and metals and their compounds due to mining and metallurgy and fertilizer and pesticide runoffs from agricultural activities.

Waste water need to be treated. Commonly the chemical coagulants such as salts of iron and aluminium are used. In this widely used coagulant is aluminium sulphate shortly known as Alum, when added to raw water reacts with the bicarbonate alkalinities present in water and forms a gelatinous precipitate. This floc attracts other fine particles and suspended material in raw water, and settles down at the bottom of the container. But this process is costly and also over dosage causes harmful effects on human being. Inorder to overcome these limitations, natural coagulants such as moringa oleifera and tamarind seed powder are used. The use of Moringa and tamarind seeds have an added advantage over the chemical treatment of water because it is biological and has been reported as edible, ecofriendly, economical and locally available.

B. Scope

Modern waste water treatment process is aiming at incorporating cost effective, economic, natural and simple. In conventional water treatment, coagulation is achieved using chemical coagulants such as aluminum sulphate, ferric chloride, poly aluminum chloride, etc. While the effectiveness of these coagulants is well-recognized, nonetheless, their application in water treatment is becoming unsuitable owing to ineffectiveness in low temperature water, relatively high procurement costs, detrimental effects on human health, production of large sludge volumes and the fact that they significantly affect pH of treated water. Hence it is necessary to make an in depth study in the coagulating activity of these seeds substance of moringa oleifera and tamarind and to evaluate the optimum dosage for maximum turbidity removal and pH, Acidity, Alkalinity and chloride content reduction.

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 7 Issue 04, April-2018

C. Objectives

- To characterise the collected water sample.
- To use Moringa oleifera and Tamarind seed as a natural coagulant, an alternative to chemical coagulants.
- To treat collected samples by Natural and Chemical coagulant.
- To investigate the required dosage of moringa oleifera and tamarind seed powder in same proportion needed in order to reduce turbidity of wastewater.
- To study the coagulation efficiency of Natural and Chemical coagulants in the collected sample of water.
- To make comparative study with conventional chemical coagulants.

D. Materials

1. Moringa Oleifera

Fig.1 Moringa oleifera seed and powder

Moringa oleifera seed powder as natural coagulant. Tree dried Moringa oleifera seeds are harvested when they were fully matured, wings and coat from seeds are removed fine powder was prepared and sieved.

2. Tamarind Seed Powder

Fig.2: Tamarind seed and Powder

Tamarind seed kernel powder, discarded as agricultural waste, is an effective agent to make turbid municipal and industrial wastewater clear. The present practice is to use aluminium salt to treat such water. It has been found that alum increases toxic metals and ions in treated water and could cause diseases like the Alzheimer's. Kernel powder, compared to alum, is not-toxic and biodegradable.

3. Alum

Fig. 3 Alum

Aluminium Sulphate, shortly known as Alum, when added to raw water reacts with the bicarbonate alkalinities present in water and forms a gelatinous precipitate. This floc attracts other fine particles and suspended material in raw water and settles down at the bottom of the container.

E. Methodology

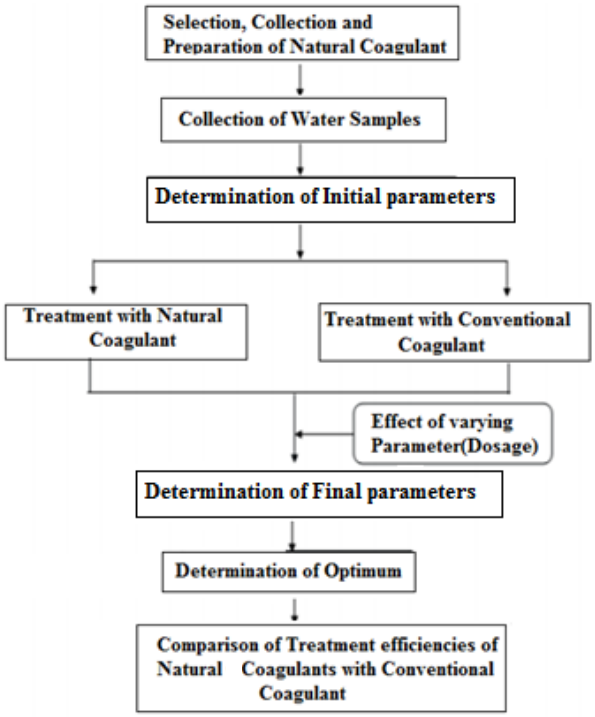

Fig.4 Flow Chart of Methodology

II. EXPERIMENTAL SETUP

A. Sample Analysis before Treatment

The raw waste water sample were analyzed by various physical parameters such as turbidity, pH, acidity, alkalinity and chemical parameters such as chloride content etc…

Fig.5: Water Sample before Treatment

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 7 Issue 04, April-2018

B. Experimental Procedure

Fig.6: Treatment Plant

In this experiment natural coagulants such as moringa oliefera seed powder and tamarind seed powder separately, mixture of both seeds in equal proportions and conventional coagulant as alum were used to treat the samples and the process parameters such as pH, turbidity, acidity, alkalinity and chloride content were determined. A conventional treatment plant was used to carry out the batch coagulation process for the treatment of water samples. It accommodates an overhead tank, flocculation tank, sedimentation tank and collecting tank. 15 liter of sample was taken to which varying amount of 100mg/l, 150mg/l, 200mg/l, 250mg/l, 300mg/l and 350mg/l coagulant dosage was added to the flocculation tank followed by variation in pH and settling time were done. Then the apparatus was switched on and the speed of paddles were rotated and thus rapid mixing of about 1 - 2 minutes was done. After rapid mixing, the speeds of paddles were reduced to about 100rpm followed by mixing for 60 minutes. After mixing, the apparatus was switched off and the samples were allowed to settle for 10 - 60 minutes. The treated samples were then analyzed for alkalinity and turbidity level with respect to the effect of varying parameters and the removal efficiencies were obtained.

III RESULTS AND DISCUSSION

A. Optimum Dosage of Coagulant

In this study, coagulation efficiency of moringa oleifera, tamarind seed and alum was determined. It was observed that turbidity of waste water decreases with increase of coagulant dosage.The optimum dosage was determined by using jar test. Jar test is simple experiment which will help in determining the optimum coagulant dose required.

Fig.7: Jar test

Optimum dosage of Moringa Oleifera

Table 1: Optimum dosage of Moringa Oleifera

Sl.no	Coagulant Dosage	Turbidity in NTU
2	150	11
3	200	6
4	250	4
5	300	13
6	350	15
1	100	17

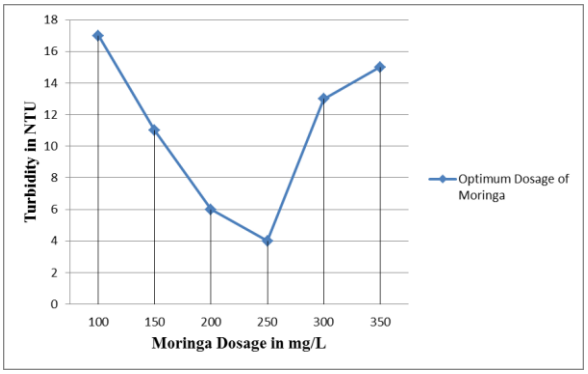

Fig 8: Graph of Optimum dosage of Moringa olifera

Optimum Dosage of Tamarind seed

Table 2: Optimum Dosage of Tamarind seed

Sl.no	Coagulant Dosage	Turbidity in NTU
1	100	19
2	150	12
3	200	9
4	250	9
5	300	6
6	350	14

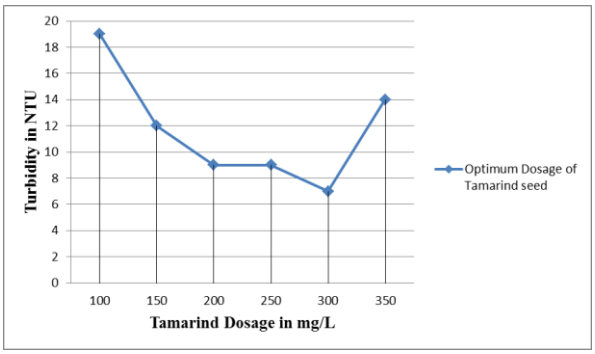

Fig.9: Graph of Optimum dosage of Tamarind seed

Optimum Dosage of Moringa Oleifera and Tamarind seed

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 7 Issue 04, April-2018

Table 3: Optimum Dosage of Moringa Oleifera and Tamarind seed

Sl.no	Coagulant Dosage	Turbidity in NTU
1	100	11
2	150	9
3	200	6
4	250	3
5	300	5
6	350	8

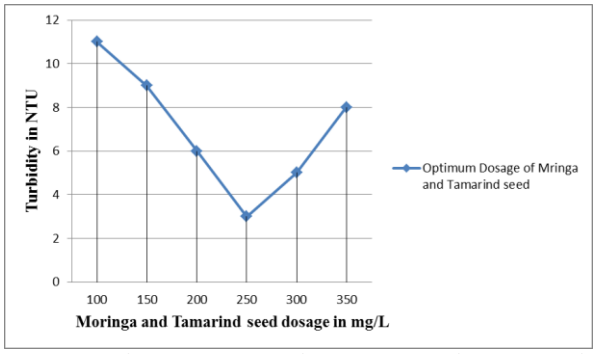

Fig.10: Graph of Optimum dosage of Combined Use of Moringa oleifera and Tamarind seed

Optimum Dosage of Alum

Table 4: Optimum Dosage of Alum

Sl.no	Coagulant Dosage	Turbidity in NTU
1	100	21
2	150	16
3	200	13
4	250	8
5	300	5
6	350	14

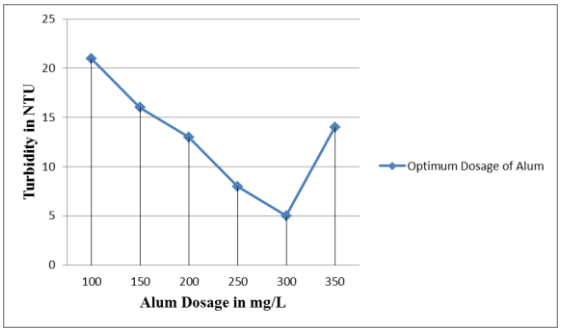

Fig11: Graph of Optimum dosage of Alum

B. Initial Parameters of Wastewater

Table 5: Initial Parameters of Wastewater

Sl.No	Parameters	Initial value
1	Odour	Objectionable
2	Color	Brownish
3	pH	8.8
4	Turbidity	320 NTU
5	Total Chlorides	215 mg/l
6	Alkalinity	245.50 mg/L
7	Acidity	15 mg/L

C. Final parameters of treated water

pH

Table 6: Test results of pH after Treatment

Sl.No	Coagulant	Dosage(mg/L)	pH
1	Alum	100	7.7
		150	7.6
		200	7.5
		250	7.3
		300	7.3
		350	7.2
2	Moringa Oleifera	100	7.6
		150	7.6
		200	7.5
		250	7.3
		300	7.2
		350	7.2
3	Tamarind seed powder	100	7.6
		150	7.5
		200	7.4
		250	7.3
		300	7.2
		350	7.2
4	Combined use of Moringa Oleifera and Tamarind seed powder	100	7.3
		150	7.3
		200	7.2
		250	7.2
		300	7.1
		350	7.1

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 7 Issue 04, April-2018

Turbidity

Table 7: Test results of Turbidity after Treatment

Sl. No	Coagulant	Dosage(mg/L)	Turbidity (NTU)
1	Alum	100	15
		150	13
		200	12
		250	12
		300	8
		350	14
2	Moringa Oleifera	100	12
		150	11
		200	10
		250	6
		300	8
		350	15
3	Tamarind seed powder	100	12
		150	10
		200	9
		250	8
		300	6
		350	11
4	Combined use of Moringa Oleifera and Tamarind seed powder	100	10
		150	9
		200	8
		250	4
		300	8
		350	13

Alkalinity

Table 8: Test results of Alkalinity after Treatment

Sl. No	Coagulant	Dosage (mg/L)	Alkalinity (mg/L)
1	Alum	100	118.00
		150	116.20
		200	115.35
		250	113.50
		300	113.15
		350	112.80
2	Moringa Oleifera	100	100.65
		150	98.50
		200	95.80
		250	91.20
		300	89.55
		350	88.75
3	Tamarind seed powder	100	110.40
		150	108.80
		200	102.65
		250	99.50
		300	98.35
		350	97.05
4	Combined use of Moringa Oleifera and Tamarind sreed powder	100	90.45
		150	88.70
		200	85.55
		250	82.40
		300	81.75
		350	80.15

Total Chlorides

Table 9: Test results of Total Chlorides after Treatment

Sl.No	Coagulant	Dosage (mg/L)	Total Chlorides (mg/L)
1	Alum	100	170
		150	168
		200	166
		250	165
		300	163
		350	162
2	Moringa Oleifera	100	135
		150	134
		200	132
		250	130
		300	128
		350	125
3	Tamarind seed powder	100	138
		150	136
		200	134
		250	132
		300	130
		350	127
4	Combined use of Moringa Oleifera and Tamarind seed powder	100	116
		150	115
		200	112
		250	110
		300	109
		350	107

Acidity

Table 10: Analysis of Acidity after Treatment

Sl.No	Coagulant	Dosage(mg/L)	Acidity (mg/L)
1	Alum	100	8
		150	7
		200	6
		250	6
		300	5
		350	4
2	Moringa Oleifera	100	7
		150	7
		200	5
		250	4
		300	4
		350	3
3	Tamarind seed powder	100	7
		150	6
		200	6
		250	5
		300	4
		350	4
4	Combined use of Moringa Oleifera and Tamarind seed powder	100	6
		150	5
		200	4
		250	4
		300	3
		350	3

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 7 Issue 04, April-2018

IV COMPARATIVE STUDY

From the results obtained, it was observed that the combined use of Moringa oleifera and tamarind seed powder were determined as the most effective natural coagulant among the use of natural coagulants independently and also when compared to the use of alum solution.The combined use of Moringa and tamarind was found to produce an equal and better results. It can be observed that Moringa oleifera and tamarind shows high turbidity removal efficiency when compared to the conventional coagulant as alum, in which both alum and natural coagulant were observed to play an equal role in the water treatment process. The comparative efficiencies of alum and Moringa oleifera, tamarind seed and combined use of moringa oleifera and tamarind seed powder were represented in the following tables and figures.

Fig.12: Water Samples After Treatment with Coagulants

pH Reduction Efficiencies of Coagulants

Table 11:pH Reduction Efficiencies of Coagulants

Sl. no	Coagulant	Dosage (mg/L)	Initial pH	Final pH	Reduction Efficiency %
1	Alum	100	8.8	7.7	12.5
		150	8.8	7.6	13.6
		200	8.8	7.5	14.7
		250	8.8	7.3	17.04
		300	8.8	7.3	17.04
		350	8.8	7.2	18.18
2	Moringa Oleifera	100	8.8	7.6	13.6
		150	8.8	7.6	13.6
		200	8.8	7.5	14.7
		250	8.8	7.3	17.0
		300	8.8	7.2	18.18
		350	8.8	7.2	18.18
3	Tamarind seed powder	100	8.8	7.6	13.6
		150	8.8	7.5	14.7
		200	8.8	7.4	15.9
		250	8.8	7.3	17.0
		300	8.8	7.2	18.18
		350	8.8	7.2	18.18
4	Combi-ned use of coagu-lant	100	8.8	7.3	17.0
		150	8.8	7.3	17.0
		200	8.8	7.2	18.18
		250	8.8	7.2	18.18
		300	8.8	7.1	19.31
		350	8.8	7.1	19.31

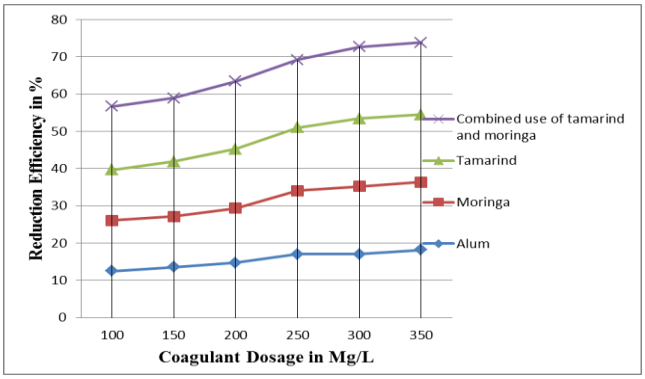

Fig 13: Graph of pH Reduction Efficiency Vs Coagulant dosages

Turbidity removal efficiencies of coagulants

Table 12: Turbidity removal efficiencies of coagulants

Sl. No	Coagulant	Dosage (mg/L)	Initial Turbidity	Final Turbidity	Removal Efficiency %
1	Alum	100	320	15	95.3
		150	320	13	95.93
		200	320	12	96.25
		250	320	12	96.25
		300	320	8	97.5
		350	320	14	95.62
2	Moringa Oleifera	100	320	12	96.25
		150	320	11	96.56
		200	320	10	96.87
		250	320	6	98.12
		300	320	8	97.5
		350	320	15	95.3
3	Tamarind seed powder	100	320	12	96.25
		150	320	10	96.87
		200	320	9	97.18
		250	320	8	97.5
		300	320	6	98.12
		350	320	11	96.56
4	Combine d use of Natural Coagulant	100	320	10	96.87
		150	320	9	97.81
		200	320	8	97.5
		250	320	4	98.75
		300	320	8	97.5
		350	320	13	95.53

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 7 Issue 04, April-2018

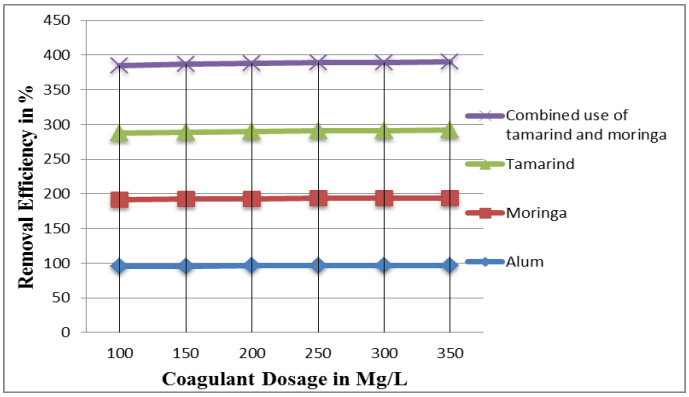

Fig 14: Graph of Turbidity Removal Efficiency Vs Coagulant dosages

Alkalinity reduction efficiencies of coagulants

Table 13: Alkalinity reduction efficiencies of coagulants

Sl. No	Coagulant	Dosage (mg/L)	Initial Alkalinity (mg/l)	Final Alkalinity (mg/l)	Reduction Efficiency %
1	Alum	100	245.50	118.00	51.93
		150	245.50	116.20	52.66
		200	245.50	115.35	53.01
		250	245.50	113.50	53.76
		300	245.50	113.15	53.91
		350	245.50	112.80	54.05
2	Moringa Oleifera	100	245.50	100.65	59.0
		150	245.50	98.50	59.87
		200	245.50	95.80	60.97
		250	245.50	91.20	62.87
		300	245.50	89.55	63.52
		350	245.50	88.75	63.84
3	Tamarind seed powder	100	245.50	110.40	55.03
		150	245.50	108.80	55.68
		200	245.50	102.65	58.30
		250	245.50	99.50	59.47
		300	245.50	98.35	59.93
		350	245.50	97.05	60.46
4	Combined use of Natural Coagulant	100	245.50	90.45	63.15
		150	245.50	88.70	63.86
		200	245.50	85.55	65.15
		250	245.50	82.40	66.59
		300	245.50	81.75	66.7
		350	245.50	80.15	67.35

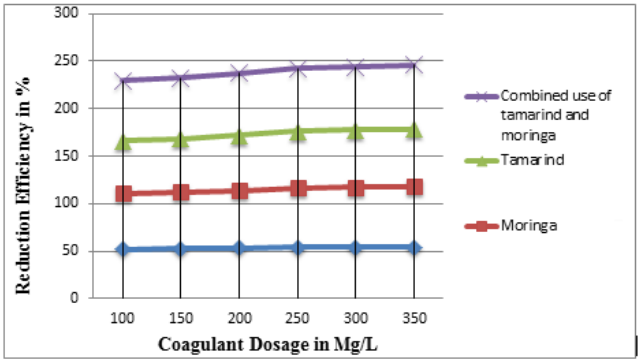

Fig.15: Graph of Alkalinity Reduction Efficiency vs Coagulant dosages

Chloride reduction efficiencies of coagulants

Table 14: Chloride reduction efficiencies of coagulants

Sl. No	Coagulant	Dosage (mg/L)	Initial Chloride (mg/l)	Final Chloride (mg/l)	Reduction Efficiency %
1	Alum	100	215	170	20.93
		150	215	168	21.86
		200	215	166	22.79
		250	215	165	23.25
		300	215	163	24.18
		350	215	162	24.65
2	Moringa Oleifera	100	215	135	37.20
		150	215	134	37.67
		200	215	132	38.60
		250	215	130	39.53
		300	215	128	40.46
		350	215	125	41.86
3	Tamarind seed powder	100	215	138	35.81
		150	215	136	36.74
		200	215	134	37.67
		250	215	132	38.60
		300	215	130	39.53
		350	215	127	40.53
4	Combined use of Natural Coagulant	100	215	116	46.04
		150	215	115	46.51
		200	215	112	47.90
		250	215	110	48.83
		300	215	109	49.30
		350	215	107	50.23

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 7 Issue 04, April-2018

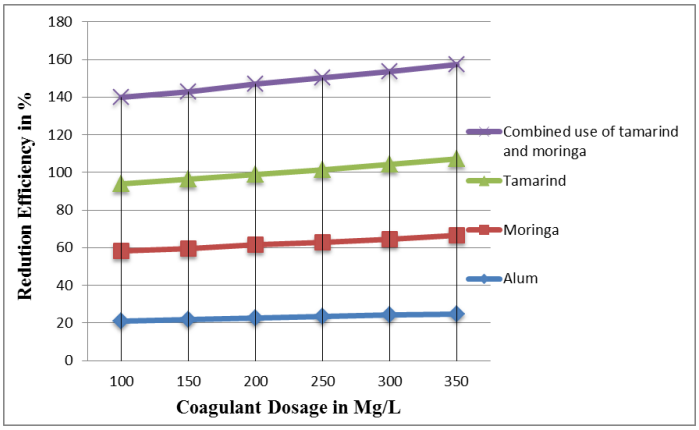

Fig 16: Graph of Chloride Reduction Efficiency vs Coagulant dosages

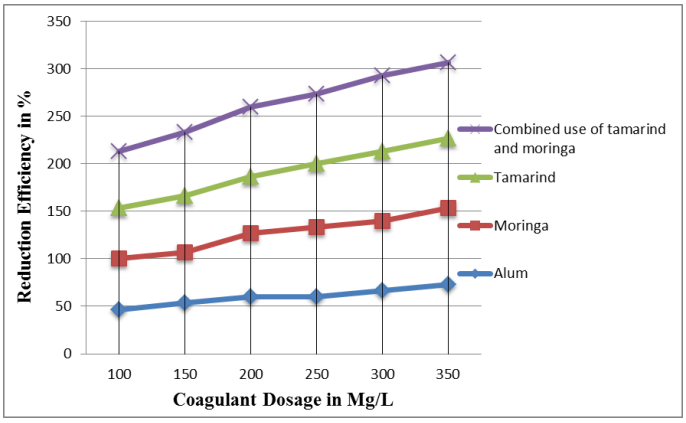

Fig 17: Graph of Acidity Reduction Efficiency Vs Coagulant dosage

Acidity reduction efficiencies of coagulants

Table 15: Acidity reduction efficiencies of coagulants

Sl. no	Coagulant	Dosage (mg/L)	Initial Acidity (mg/l)	Final Acidity (mg/l)	Reduction Efficiency %
1	Alum	100	15	8	46.66
		150	15	7	53.33
		200	15	6	60.0
		250	15	6	60.0
		300	15	5	66.66
		350	15	4	73.33
2	Moringa Oleifera	100	15	7	53.33
		150	15	7	53.33
		200	15	5	66.66
		250	15	4	73.33
		300	15	4	73.33
		350	15	3	80.0
3	Tamarind seed powder	100	15	7	53.33
		150	15	6	60.0
		200	15	6	60.0
		250	15	5	66.66
		300	15	4	73.33
		350	15	4	73.33
4	Combined use of Natural Coagulant	100	15	6	60.0
		150	15	5	66.66
		200	15	4	73.33
		250	15	4	73.33
		300	15	3	80.0
		350	15	3	80.0

V CONCLUSION

Water is the most vital parameter among the natural resources. Turbidity Imparts enormous problem in wastewater treatment. In this present study, an attempt has been made to evaluate the comparative effectiveness of chemical coagulant Alum with Natural Coagulant such as Moringa Oleifera and tamarind seed powder. The maximum turbidity reduction of alum, moringa oleifera, tamarind and combined use of moringa oleifera tamarind seed were found as 97.5%, 98.12%, 98.12% and 98.75% with optimum dosage of 300, 250, 300 and 250mg/l. The pH, alkalinity, acidity and total chlorides was determined in treated sample of coagulants and maximum reduction effiieny was found in the combined use of moringa oleifera and tamarind seed powder.

The Utilisation of locally available natural coagulant was found to be suitable, easier, cost effective and environment friendly for water treatment.

REFERENCE

[1] Ronke Ruth Ayangunna1, "Coagulation-Flocculation Treatment of Industrial Wastewater Using Tamarind Seed Powder, International Journal of chemtechResearch, Vol.9, 2016

[2] Prof. Chidanand Patil1, Ms. ManikaHugar, "Treatment of dairy wastewater by natural coagulants", International Research Journal of Engineering and Technology (IRJET), volume-2, july-2015.

[3] Lukmanaliyu1, Mukhtar L.W2, S.I Abba , "Evaluation of Coagulation Efficiency Of Natural Coagulants (MoringaOliefera, Okra) And Alum, For Yamuna Water Treatment",International conference of science, technology and management. 27th September 2015.

[4] MeenakshiM,et al, "Performance Assessment of Moringa oleifera in clarification of surface water", International Journal of chemtechResearch, Vol.2, 2015

[5] Dr.Amaziah Walter Otunyo and Arthur N. Wokocha, "MoringaOlrifera seed powder as a water coagulant for purification of fresh, rain and borehole water", International Research Journal of Engineering and Technology (IRJET), volume-4, july-2016.

[6] AbiramiM,et al , "A comparative study on the treatment of turbid water using Moringa oleifera and Alum as coagulant", International Research Journal of Engineering and Technology (IRJET), volume-4, july-2017.

International Journal of Engineering Research & Technology (IJERT)
ISSN: 2278-0181
Vol. 7 Issue 04, April-2018

[7] PatilRohan R, etal, “Use Moringa oleifera seed as natural coagulant for well and bore well water treatment”, International Research Journal of Engineering and Technology (IRJET), volume-4, july-2017.

[8] Mohammed Sulaiman,“Moringa oleifera seed as alternative natural coagulant forPotential application in water treatment: A review”, Journal of Advanced Review on Scientific Research 30, Issue 1 (2017) 1-11

[9] Basavanagouda A Patil, “Working Model Of Water Treatment Plant Using MoringaOliefera”,International Journal of Engineering Research-Online,Vol.5., Issue.3, 2017 May-June

[10] C.P. pise, Dr. S.A. Halkude. "A New technique for purification of water using natural coagulant", International journal of engineering and technology, Vol.6, Dec 2014- Jan 2015

[11] Iloamuzor FE, Ude CN, Ezekannagha CB, Nwabueze HO. "Performance Evolution O MoringaOliefera Seed Powder In Surface Water Treatment And Its Coagulation Kinetics", Journal of multi-disciplinary Research and development. Vol.4, Jan 2017.

[12] Suresnarayasamy, halimimohdsaud, Water Sedimentation using Moringa oleifera Seed Powder to Remove Water Turbidity in Malaysia, Journal of Agricultural Chemistry and Environment,2014.vol.3,