FEASIBILITY STUDIES ON SETTLING CHARACTERISTICS OF PLANT BASED COAGULANTS

Dr.N.Muralimohan*

Ms.R.Arulmozhi**

Ms.E.Durgadevi**

Mr.A.Manobarathi**

Mr.P.Magendiran**

Abstract:

the study is carried out in a specially designed two settling columns to study effect different parameters on type-ii suspensions namely different diameter of settling column, different height, and with different coagulants used for effective sedimentation. Here the optimum dosage of coagulants such as Nerium Oleander, Mangifera Indica are determined by conducting jar test. The study was carried out in a two settling column of diameter 15cm, 17.5cm and with different height of column as 180cm, 150cm to investigate the settling characteristics of sample.

Key words- coagulation, flocculation, settling column test, Nerium Oleander, Mangifera Indica.

* **Professor, K.S.R. College of Engineering, Namakkal, Tamilnadu**

** **UG students, K.S.R. College of Engineering, Namakkal, Tamilnadu**

I.INTRODUCTION

Majority of natural water source contained in it are dissolved and suspended particles (Tzoupanos and Zouboulis 2008) [1] [7]. However, such suspended particulates (materials) are usually as a results of erosion from lands, dissolutions of minerals as well as decay of agricultural vegetation's and from numerous sources of both domestics and industrial waste discharge[1]. Similarly, such existing materials may constitute suspended particles, both dissolved organics and inorganics constituents (matter), and including considerable biological organisms (bacterial, algae, and or viruses) [1]. Therefore, these minerals should be removed completely, because it's a sources to water quality deterioration (reduces water clarity) such as turbidity/color, ultimately a sources for pathogenic organisms and or toxic (harmful) compounds (Safe drinking water, 2007; Tzoupanos and Zouboulis 2008)[1] [4] [7].

There are wide varieties of processes available for the treatment of raw water. The exact choice of process will depend upon the availability and economics of water supply[2].Here the coagulation and flocculation processes are used for separating the dissolved and suspended particles, which are relatively simpler in their relative nature as well as cost effective with appropriated dosage for the required water composition. Coagulation and flocculation is generally employed at pre-treatment (rapid sand-filtrations) or at post-treatment stage (at the completion of sedimentation), regardless of the water treatment nature [1]. Majority of suspended solids in water possesses negative (-ve) charges which repel each other (Gregory, 2006) [3], causing repulsion that prevents the finer particles from agglomerating, apparently allowing them to exist freely in suspension [1] [3]. Coagulation and flocculation occurs successively with the aim to subdue the forces providing stability for the suspended particles, which apparently allows particles collision as well the growth of flocs, which subsequently allows settling, and are removed by sedimentation process or filtration process. (Safe drinking water, 2007; Gregory, 2006; Tzoupanos and Zouboulis 2008) [1] [4] [3] [7].

The purpose of this work is to study the settling column analysis of Type –II suspensions for the effect of different diameter of settling column, the effect of different height, and the effect of different coagulants used for effective sedimentation [2]. Recently there has been more interest, especially in developing countries, in possible application of natural coagulants [2]. This type of settling is the settling of particles that flocculate as they settle. Flocculation, which produces larger particles, causes the settling velocity of the particles to change as they settle [2].

Using this theory P Krishnan (1976) [2] [8] suggested simple method where there is no need for the development of Iso percentage lines. The Suspended solids data collected at various column depths for each sampling period can be directly used to obtain the average solid removal in the column. Although this method gives comparable answers to those of the traditional method, it has not seen extensive use in water and wastewater treatment. Because finding suspended solids concentration at every sample depth at constant time interval is difficult, tedious and time consuming. So to overcome drawbacks of this method the authors would like to suggest a slight modification in the settling column test procedure. In the modified method only the turbidity of sample is considered at every sample depth at constant time interval. Percentage turbidity removal data collected at various column depths for each sampling period can be directly used to obtain the average turbidity removal in the column. The results obtained using this method is very close to the graphical traditional method [2] [9].

II.MATERIALS AND METHODS

The aim of this study is not only to optimize the use of Nerium oleander and Mangifera indica as a natural coagulant in the treatment of wastewater.The advantage of using these seeds of N.Olerander and M.Indica is to allow the substitution of imported flocculants by a local product which is easily accessible. Therefore it would save substantial foreign exchange for developing countries [2]. The coagulants used on 268NTU initial turbidity sample for the effective sedimentation and settlement characteristics of the turbid water [9].

A.Preparation of seed extracts:

10 gm of seed powder is mixed with 100 ml distilled water for 2 minutes. Then mixture is mixed in the rapid mix unit for 20 minutes at 120 rpm. Then, solution is filtered through Muslin Cloth. Resulting stock solution is of 10000mg/l (1%) concentration. Fresh stock solutions are prepared every day for the one day's experimental run [2]. The optimum doses of these coagulants were found out by using jar-test method. For 268NTU initial turbidity optimum dose for N.Olender 15ml/l and for M.Indica is 20ml/l.

B.Method

Fill the settling column with prepared turbid water solution of initial turbidity of 268NTU. With the help stirrer mix the turbid water sample properly for five minutes.

Then the samples are drawn from each sample port from top to bottom & turbidity of each sample is measured with help of digital (Nephelometer) turbidity meter. And the average is taken this is the initial turbidity of sample.

Optimum doses of coagulants (N.Oleander of 1% concentration) required for settling column (diameter 15 cm, volume 38 liter and for diameter 17.5cm, volume 35litres) is added into the settling column. Then with the help stirrer mix the turbid water sample properly.

Then the sample is allowed for settle, after 30, 60, 90, 120, 150, 180, 210, & 240 minutes intervals, the samples are drawn from each sample port from top to bottom & turbidity of each sample is measured with help of digital (Nephelometer) turbidity meter. And results are tabulated in table. Then the percentage removal of these turbidities readings are calculated from their initial turbidity readings. Then the graph of sampling port depth versus time of percentage removal of turbidity readings are plotted. From these graph the overall removal efficiency was calculatedatconstanttimeinterval.

III.RESULTS AND ANALYSIS

Using optimum dose of coagulant the settling column analysis is carried out. The turbidity readings obtained at various sampling depth at constant time interval for Nerium oleander coagulant Dia. 15 cm and 268 NTU is shown in the table – 1.

Table – 1 observed turbidity readings for Nerium Oleander for dia 15cm, 180cm height.

Time(min)	Turbidity In NTU							
Depth(m)	30	60	90	120	150	180	210	240
0.3	257	244	233	227	214	192	186	164
0.6	249	228	216	204	196	173	156	138
0.9	235	217	189	172	164	155	136	120

1.2	224	192	159	146	138	129	122	119
1.5	215	168	157	139	127	118	113	109

Table – 2 percentage removal of turbidity for Nerium Oleander for dia 15cm, 180cm height

Time(min)	Turbidity In NTU							
Depth(m)	30	60	90	120	150	180	210	240
0.3	4.1	8.9	13.1	15.3	20.14	28.35	30.59	38.80
0.6	7.1	14.9	19.4	23.89	26.86	35.44	41.79	48.50
0.9	12.3	19.0	29.5	35.83	38.80	42.16	49.25	55.22
1.2	16.4	28.4	40.6	45.53	48.50	48.13	54.47	55.59
1.5	19.7	37.3	41.4	48.14	52.61	55.97	57.83	59.32
Avg	11.9	21.7	28.8	33.7	37.3	42.01	46.7	51.4

Table – 3 observed turbidity readings for Nerium Oleander for dia 17.5cm, 150cm height

Time(min)	Turbidity In NTU							
Depth(m)	30	60	90	120	150	180	210	240
0.3	243	232	218	197	175	164	151	125
0.6	247	238	226	212	191	167	143	122
0.9	245	220	194	185	174	165	142	133
1.2	234	227	219	183	178	162	157	124

Table – 4 percentage removal of turbidity for Nerium Oleander for dia 17.5cm, 150cm height

Time(min)	Turbidity In NTU							
Depth(m)	30	60	90	120	150	180	210	240
0.3	9.32	13.43	19.77	26.49	34.70	38.80	43.65	53.35
0.6	7.83	11.19	15.67	20.89	28.73	37.68	46.64	54.47
0.9	8.58	17.91	27.61	30.97	35.07	38.43	47.01	50.37
1.2	12.68	15.29	18.28	31.71	33.58	39.55	41.41	53.73
Avg	9.6	14.4	20.3	27.5	33.0	38.6	44.6	52.9

Table - 5: observed turbidity readings for Mangifera Indica for dia 15cm, 180cm height

Time(min)	Turbidity In NTU							
Depth(m)	30	60	90	120	150	180	210	240
0.3	252	239	177	147	110	93	86	64
0.6	200	162	137	123	114	100	97	79
0.9	249	194	156	143	124	115	108	85
1.2	226	172	150	138	118	109	93	81
1.5	212	196	184	145	130	122	107	97

Table - 6: percentage removal turbidity for Mangifera Indica for dia 15cm, 180cm height

Time(min)	Turbidity In NTU							
Depth(m)	30	60	90	120	150	180	210	240
0.3	5.97	10.82	33.95	45.14	58.95	65.29	67.91	76.11
0.6	25.37	39.55	48.88	54.10	57.46	62.68	63.80	70.52
0.9	7.08	27.61	41.79	46.64	53.73	57.08	59.70	68.28
1.2	15.67	35.82	44.02	48.50	55.97	59.32	65.29	69.77
1.5	20.89	26.86	31.34	45.89	51.49	54.47	60.07	63.80
Avg	14.9	28.13	39.9	48.0	55.5	61.7	63.3	69.6

Table - 7: observed turbidity readings for Mangifera Indica for dia 17.5cm, 150cm height

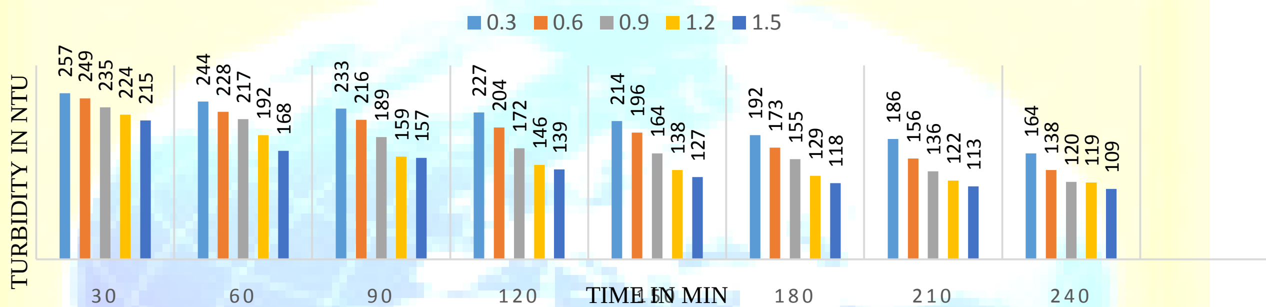
Time(min)	Turbidity In NTU							
Depth(m)	30	60	90	120	150	180	210	240
0.3	143	129	123	117	112	103	97	74
0.6	193	172	168	129	119	106	89	67
0.9	224	184	140	143	132	123	119	105
1.2	148	142	131	131	120	118	102	89

Table - 8: percentage removal turbidity for Mangifera Indica for dia 17.5cm, 150cm height

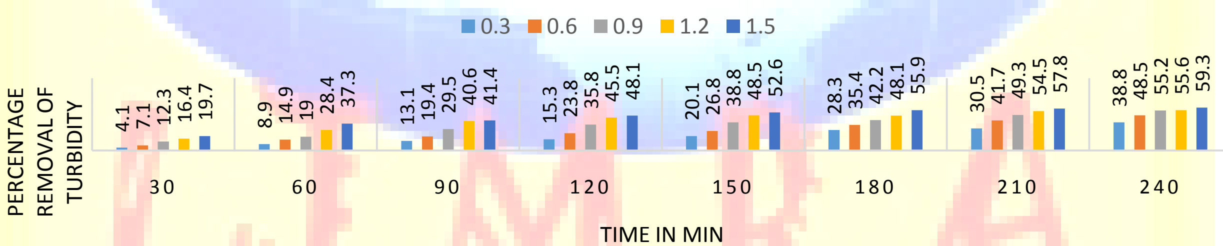
Time(min)	Turbidity In NTU

Depth(m)	30	60	90	120	150	180	210	240
0.3	46.6	51.8	54.1	56.3	58.2	61.5	63.8	72.3
0.6	27.9	35.8	37.3	51.8	55.5	60.4	66.7	75
0.9	16.4	31.3	47.8	46.6	50.7	54.1	55.5	60.8
1.2	44.7	47.0	51.1	51.1	55.2	55.9	59.6	66.7
Avg	33.9	41.5	47.5	51.4	54.9	57.9	61.4	68.7

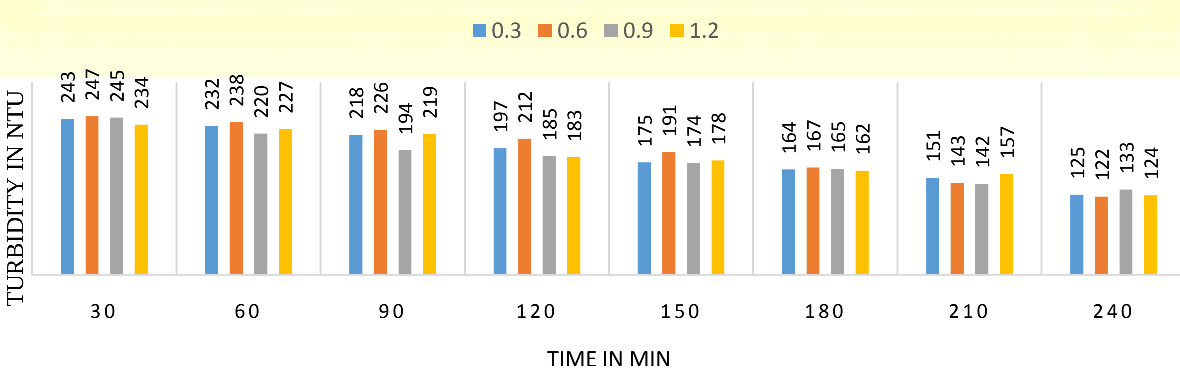
Graph 1: Turbidity readings for Nerium Oleander for dia 15cm, 180cm height



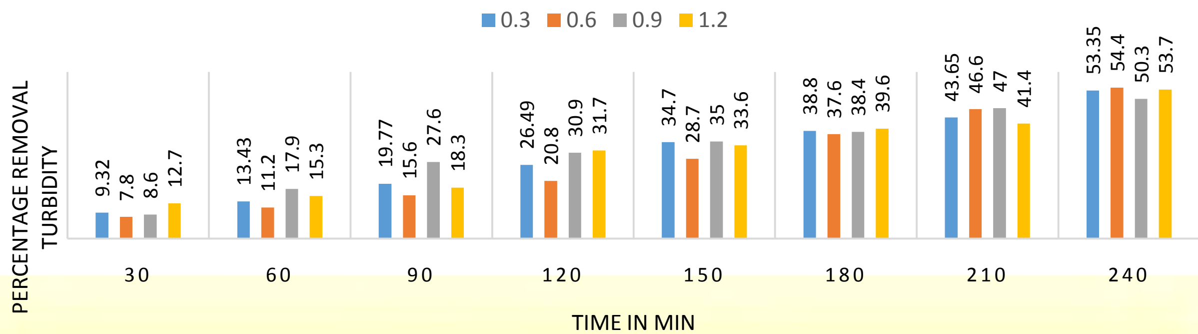
Graph – 2 percentage removal of turbidity for Nerium Oleander for dia 15cm, 180cm height



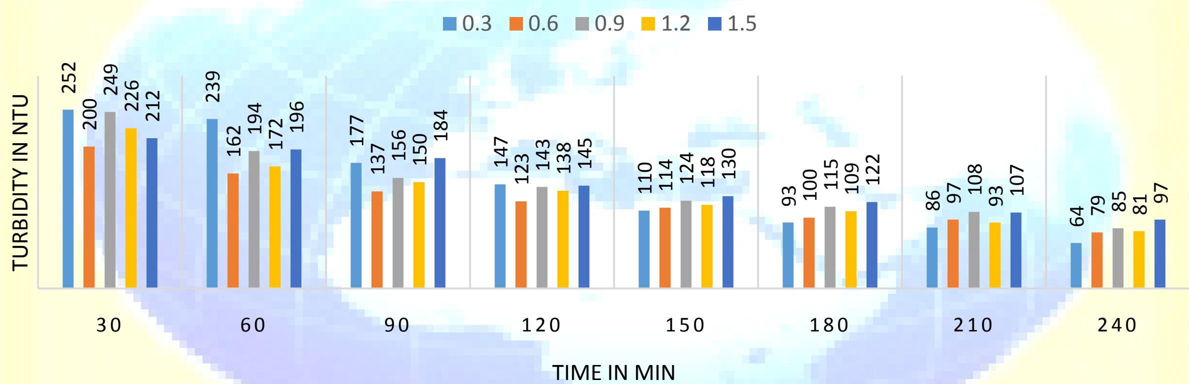
Graph – 3 observed turbidity readings for Nerium Oleander for dia 17.5cm, 150cm height



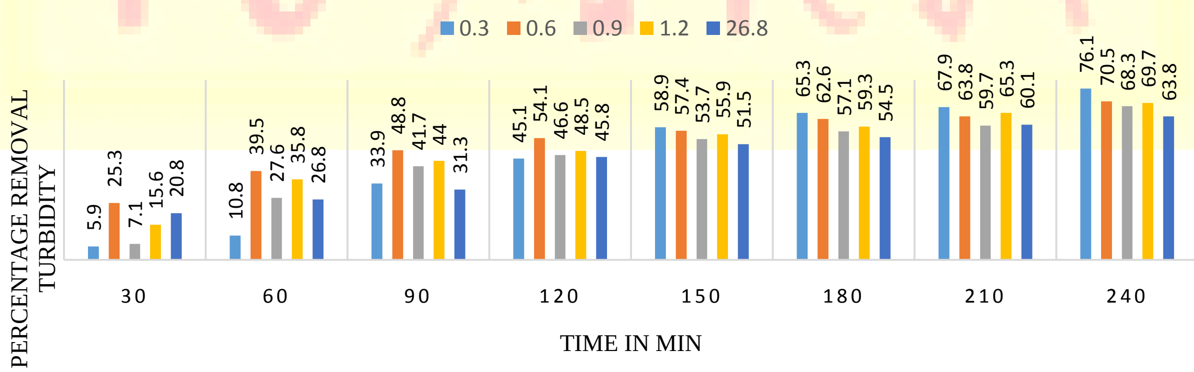
Graph– 4 percentage removal of turbidity for Nerium Oleander for dia 17.5cm, 150cm height



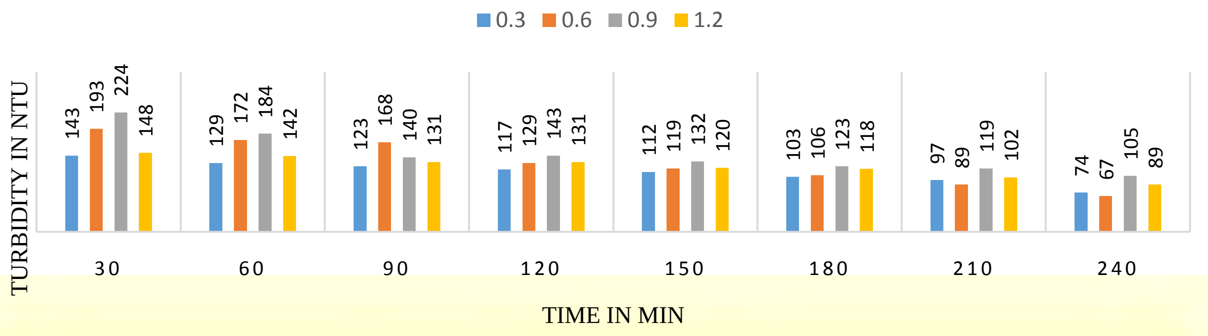
Graph - 5: observed turbidity readings for Mangifera Indica for dia 15cm, 180cm height



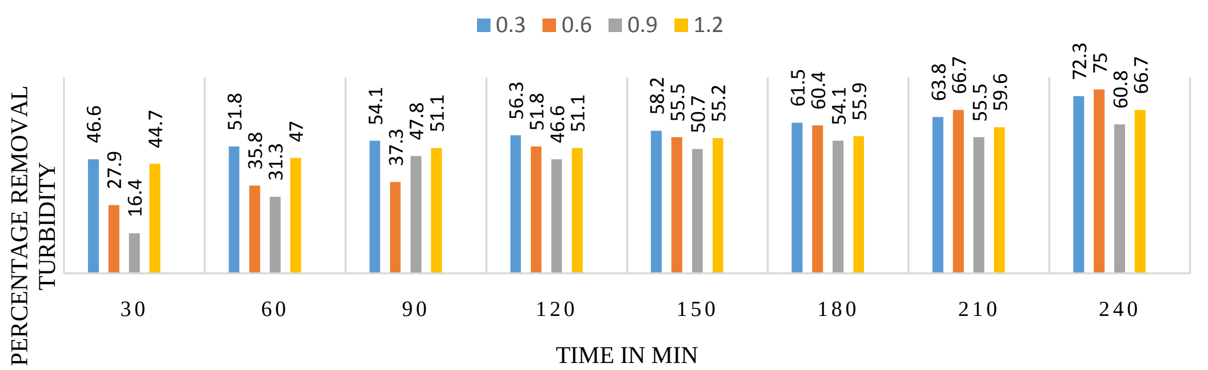
Graph - 6: percentage removal turbidity for Mangifera Indica for dia 15cm, 180cm height



Graph - 7: observed turbidity readings for Mangifera Indica for dia 17.5cm, 150cm height



Graph - 8: percentage removal turbidity for Mangifera Indica for dia 17.5cm, 150cm height



VI.DISCUSSION

In this Study the overall removal efficiency is calculated using the Modified average Method. The modified. P. Krishnan was Developed this Average Method first time , But he was applied this Method on suspended solid concentration readings measured from the sampling depth of column as we know finding the suspended solid concentration is very lengthy and complicated method and consumes lot of time and will not get the accurate results. Also this method was applied to other available data of various researcher, it gives variation in the Results of overall removal efficiency. The suspended solid concentration is very lengthy and complicated method and consumes lot of time and will not get the accurate results. Also this method was applied to other available data of various researcher, it gives variation in the Results of overall removal efficiency. Only the Methodology is changed this Method is applied to the measured turbidity readings obtained from the sampling depth of the settling column. This Modified average

Method gives very quick and much accurate results of overall removal as compared to Krishnan Method [9].

V.REFERENCE

1. m.a.saleh[1]*, a.u.eziefule[2], h.abubakar[3], o.o.cynthiya[4]., "analysis of type – ii settlement in water (flocculent particles), international journal of engineering and modern technology, 2015.
2. Dr.s.a.halkude, c.p.pise., "study of type ii suspension with moringa oleifera&alum coagulants using settling column analysis", international journal of scientific & engineering research, april- 2015.
3. Gregory J. (2006). *Particle in Water: Properties and processes*, CRC Press
4. Safe drinking water is essential (2007) Conventional Coagulation-Flocculation.
5. Sedimentation [Online] Available at: www.drinkingwater.org/html/en/Treatment/Coagulation-Flocculation-technologies.html [Accessed 30th September 2015]
6. Tripathy T. and De B. R., (2006). Flocculation: A new way to treat the waste water. Journal of Physical Science 10, 93-127.
7. Tzoupanos N. D. and Zouboulis A. I., (2008). Coagulation Flocculation in Water Wastewater Treatment; The Application of new generation of chemical reagents. 6th IASME/WSEAS International Conference on heat Transfer, Thermal Engineering and Environment Rhodes, Greece. [Online] Available at: www.wseas.us/elibrary/conferences/2008/rhodes/hte/hte47.pdf [Accessed 30th September 2015].
8. Alphonse E. Zanoni and Marshal W. Blomquist June, "Column settling test for flocculent suspension". Journal of Environmental Engg., ASCE, Vol.101(3), 309 318, 1975.
9. C P Pise, S A Halkude, "A Modified Method for Settling Column Data Analysis", International Journal of Engineering & Science Technology, Volume 3 (4) 3177-3183, 2011.
10. Viessman W. Jr. and Hammer. M. J. (1998), Water supply and pollution control, Addison-Wesley, Menlo Park, Calif., 370-371.