International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 07 Issue: 04 | Apr 2020 www.irjet.net p-ISSN: 2395-0072

WASTEWATER TREATMENT BY COAGULATION USING MORINGA OLEIFERA AND INDICA AZADIRACHTA

Dr.S.Sujatha[1], M.Aishwarya[2], B.Harinikeerthana[3], K.Jayashri[4] and S.Madhumedha[5]

[1-5]K. RAMAKRISHNAN COLLEGE OF TECHNOLOGY, TAMILNADU

ABSTRACT: Nowadays many cities like Chennai are highly polluted and are in demand of water for their daily needs. Especially textile industries produce more pollution. So we have decided to treat the Textile and Mat Industry wastewater using natural coagulants which are Moringa Oleifera (moringa seeds) and Indica Azadirachta (neem leaves) in the replacement of chemical coagulants. By treating the wastewater using coagulation we have reduced the physical and chemical characteristics which includes pH , Total solids , Total Dissolved Solids , Total Suspended Solids , Turbidity , Chloride content and Total Hardness. The colour of the wastewater solution has also been removed. To remove the odour in the filtrate, it is heated. Hereby the odour has been removed in the wastewater. Using this, the wastage of water and water demand will be controlled, which is the major problem all over the world. This treated water can be used for construction, agricultural and industrial process. The usage of natural coagulants is eco-friendly and pollution free. It is observed that the maximum reduction of the characteristics is obtained after the addition of Moringa Oleifera.

Keywords: **Moringa Oleifera, Indica Azadirachta, Coagulation, Textile and Mat Industry Wastewater.**

1. INTRODUCTION

Water is a resource that is essential for life which is required by every living organisms. It is becoming very limited in its pure form due to contamination. The textile industries are one of the major polluting industries and they are the largest manufacturing sectors today. The textile wastewater is being discharged without proper treatment which pollutes the environment. The treatment using coagulation is one of the common process earlier. Generally coagulants are the substances which are comprised of positively charged molecules and when added to water it neutralizes the charge. In most of the industries organic and inorganic coagulants are used which includes PolyAMINEs, PolyDADMACs, Aluminium chloride, Aluminium sulphate, Polyaluminium chloride (PAC), Ferrous sulphate, Ferric chloride, etc are used as coagulants. However these coagulants are having many disadvantages like high cost, corrosive and hazardous. Natural coagulants are organic based substances that are plant products which are harmless, pollution free and economical. These are used in the water treatment process for the reduction of pH, Total Solids, Total Dissolved Solids, Total Suspended Solids, Turbidity, Chloride content and Total Hardness.

2. MATERIALS AND METHODS

MORINGA OLEIFERA:

Moringa Oleifera seeds are obtained from the drumstick tree or the Moringa plant (given in fig 1). The moringa seeds are positively charged proteins that act as a coagulant in the wastewater treatment and it is not have any significant drawbacks. Its cultivation has been increased in many developing countries. The seeds were sun dried for 24 hours, grounded and sieved through 200-µm stainless steel which is shown in fig 2. This was mixed by using electro-coagulation and was done by centrifuging for 5 min at 100 rpm and then for 10 min at 50 rpm.


Fig 1: Moringa seeds **Fig 2**: Moringa powder

NEEM LEAVES:

The neem leaves powder is used to make the water free from bacteria or other living micro-organisms. It is fast growing, can survive in drought, poor soil and also at very hot temperatures. Neem leaves are collected from neem tree and are kept under the sun for 24 hours. The sun dried leaves are then grounded to fine powder and are sieved through 200-µm stainless steel. The powder is then mixed by using electro-coagulation and was done by centrifuging for 5 min at 100 rpm and then for 10 min at 50 rpm.

Fig 3: Neem powder

WASTEWATER SOLUTION:

The wastewater samples used are Textile Effluent and Mat Effluent. The wastewater is being collected from Textile Industry located at Erode and Mat Industry located at Tirupur. The sample is being collected and then transported to the laboratory for the next process of treating and then test for various physical and chemical characteristics.

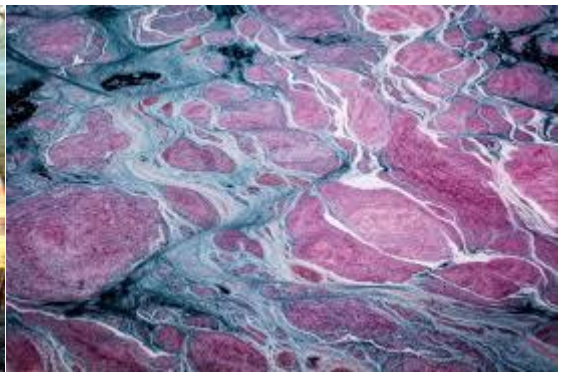


Fig 4: Dyeing solution **Fig 5**: Industrial Wastewater

Fig 6: Textile and Mat effluent

ANALYSIS OF SAMPLES:

The wastewater which was collected from the industry was transported to the laboratory. Then these samples were tested for the initial value of the physical and chemical characteristics. The samples were then tested for final value after treatment. The sample of 10 ml solution is mixed with 500 ml of distilled water and mixed with the moringa and neem powder of increasing weights by coagulation. The water is then kept undisturbed for 1 - 2 hours for the particles to get settled and filtered using filter paper during which the moringa powder with dye is removed. The filtered water is analyzed to study the physical and chemical characteristics using appropriate experiments such as pH, Total solids, Total Dissolved Solids, Total Suspended Solids, Turbidity, Chloride content, Biochemical Oxygen Demand and Total Hardness. Then for the removal of odour the filtered water is heated.

3. RESULT AND DISCUSSION

(a) Physical and Chemical Characteristics of textile effluent (sample – 1) before treatment is listed in Table 1. The fig below shows the filtration process of wastewater sample – 1.

Fig 7 Fig 8 Fig 9

Table 1: Characteristics of Textile Effluent (sample 1) before treatment.

PARAMETERS	SAMPLE – 1 (BEFORE TREATMENT)
pH	5.3
TOTAL DISSOLVED SOLIDS	100 mg/l
TOTAL HARDNESS	398.81 mg/l
CHLORIDE	194.98 mg/l
TOTAL SUSPENDED SOLIDS	79 mg/l
TOTAL SOLIDS	30 mg/l
TURBIDITY	88.5 NTU
BOD	820 mg/l

(b) Physical and Chemical Characteristics of mat effluent (sample – 2) before treatment is listed in Table 2. The fig below shows the filtration process of wastewater sample – 2.

Fig 10: Coagulation by using Jar test apparatus. **Fig 11**: Filtration of the sample.

Table 2:Characteristics of Mat Effluent (sample 2) before treatment.

PARAMETERS	SAMPLE – 2 (BEFORE TREATMENT)
pH	3.7
TOTAL DISSOLVED SOLIDS	148 mg/l
TOTAL HARDNESS	1350 mg/l
CHLORIDE	398.81 mg/l
TOTAL SUSPENDED SOLIDS	32 mg/l

TOTAL SOLIDS	180 mg/l
TURBIDITY	119.7 NTU
BOD	750 mg/l

(c) Physical and Chemical Characteristics of the textile effluent (sample-1) after treatment for 10 ml is listed in Table – 3 below which is mixed with moringa powder and neem powder.

Table 3:Characteristics of textile effluent (sample-1) after treatment with MO powder and neem powder.

PARAMETERS	**SAMPLE – 1 (AFTER TREATMENT)**			
DOSAGE	**1g(M)+1g(N) =2g**	**2g(M)+2g(N) =4g**	**3g(M)+3g(N) =6g**	**4g(M)+4g(N) =8g**
pH	5.1	6	5.2	4.9
TOTAL DISSOLVED SOLIDS	70 mg/l	79 mg/l	90 mg/l	84 mg/l
TOTAL HARDNESS	500 mg/l	540 mg/l	875 mg/l	425 mg/l
CHLORIDE	116.3 mg/l	124.07 mg/l	194.9 mg/l	168.3 mg/l
TOTAL SUSPENDED SOLIDS	60 mg/l	77 mg/l	79 mg/l	79 mg/l
TOTAL SOLIDS	10 mg/l	20 mg/l	15 mg/l	11 mg/l
TURBIDITY	46 NTU	25.4 NTU	120.8 NTU	115.9 NTU
BOD	340 mg/l	465 mg/l	435 mg/l	356 mg/l

(d) Physical and Chemical Characteristics of the Mat effluent (sample-2) after treatment for 10 ml is given in Table – 4 below which is mixed with moringa powder and neem powder.

Table 4: Characteristics of Mat effluent (sample-2) after treatment with MO powder and neem powder.

PARAMETERS	**SAMPLE – 2 (AFTER TREATMENT)**			
DOSAGE	**1g(M)+1g(N) =2g**	**2g(M)+2g(N) =4g**	**3g(M)+3g(N) =6g**	**4g(M)+4g(N) =8g**
pH	5	6	5.3	5.2
TOTAL DISSOLVED SOLIDS	510 mg/l	600 mg/l	530 mg/l	520 mg/l

TOTAL HARDNESS	3800 mg/l	4600 mg/l	5300 mg/l	7000 mg/l
CHLORIDE	359.81 mg/l	310.18 mg/l	288.91 mg/l	294.23 mg/l
TOTAL SUSPENDED SOLIDS	76 mg/l	150 mg/l	90 mg/l	69 mg/l
TOTAL SOLIDS	200 mg/l	110 mg/l	130 mg/l	150 mg/l
TURBIDITY	45.9 NTU	110.8 NTU	88.2 NTU	121 NTU
BOD	623 mg/l	702 mg/l	650 mg/l	565 mg/l

Table 5:Characteristics of Textile Effluent (sample 1) after treatment with neem powder.

PARAMETERS	**SAMPLE – 1 (AFTER TREATMENT WITH NEEM)**		
DOSAGE	**1g (N)**	**2g (N)**	**3g (N)**
pH	5.7	6	5.8
TOTAL DISSOLVED SOLIDS	250 mg/l	305 mg/l	279 mg/l
TOTAL HARDNESS	450 mg/l	875 mg/l	540 mg/l
CHLORIDE	177 mg/l	194.9 mg/l	124 mg/l
TOTAL SUSPENDED SOLIDS	30 mg/l	9 mg/l	4 mg/l
TOTAL SOLIDS	220 mg/l	275 mg/l	213 mg/l
TURBIDITY	41.2 NTU	61.5 NTU	52.5 NTU
BOD	512 mg/l	650 mg/l	423 mg/l

Table 6: Characteristics of Mat Effluent (sample 2) after treatment with neem powder.

PARAMETERS	**SAMPLE – 2 (AFTER TREATMENT WITH NEEM)**		
DOSAGE	**1g (N)**	**2g (N)**	**3g (N)**
pH	5.2	5.7	5.5
TOTAL DISSOLVED SOLIDS	78 mg/l	90 mg/l	60 mg/l
TOTAL HARDNESS	615 mg/l	755 mg/l	525 mg/l
CHLORIDE	250 mg/l	257 mg/l	244 mg/l
TOTAL SUSPENDED SOLIDS	67 mg/l	80 mg/l	53 mg/l

TOTAL SOLIDS	11 mg/l	37 mg/l	10 mg/l
TURBIDITY	6.5 NTU	21.5 NTU	13.5 NTU
BOD	532 mg/l	702 mg/l	432 mg/l

Table 7: Characteristics of Textile Effluent (sample 1) after treatment with moringa powder.

PARAMETERS	**SAMPLE – 1 (AFTER TREATMENT WITH MORINGA)**		
DOSAGE	**1g (M)**	**2g (M)**	**3g (M)**
pH	5.5	5.9	5.8
TOTAL DISSOLVED SOLIDS	200 mg/l	190 mg/l	180 mg/l
TOTAL HARDNESS	575 mg/l	670 mg/l	630 mg/l
CHLORIDE	168 mg/l	71 mg/l	138 mg/l
TOTAL SUSPENDED SOLIDS	10 mg/l	90 mg/l	60 mg/l
TOTAL SOLIDS	100 mg/l	190 mg/l	120 mg/l
TURBIDITY	24 NTU	66.7 NTU	55.6 NTU
BOD	312 mg/l	562 mg/l	450 mg/l

Table 8:Characteristics of Mat Effluent (sample 2) after treatment with moringa powder.

PARAMETERS	**SAMPLE – 2 (AFTER TREATMENT WITH MORINGA)**		
DOSAGE	**1g (M)**	**2g (M)**	**3g (M)**
pH	5.8	5.9	5.7
TOTAL DISSOLVED SOLIDS	200 mg/l	380 mg/l	320 mg/l
TOTAL HARDNESS	105 mg/l	140 mg/l	130 mg/l
CHLORIDE	301 mg/l	292 mg/l	276 mg/l
TOTAL SUSPENDED SOLIDS	100 mg/l	380 mg/l	130 mg/l
TOTAL SOLIDS	190 mg/l	290 mg/l	190 mg/l
TURBIDITY	61.6 NTU	131.5 NTU	70.2 NTU
BOD	550 mg/l	650 mg/l	585 mg/l

Bar graphs are drawn for the Physical and Chemical Characteristics with the Dosage of Moringa and Neem powder in the x-axis and the Characteristics of the effluent in the y-axis.

Fig 12: Total Solids for Textile and Mat effluent with different concentration of MO and Neem powder.

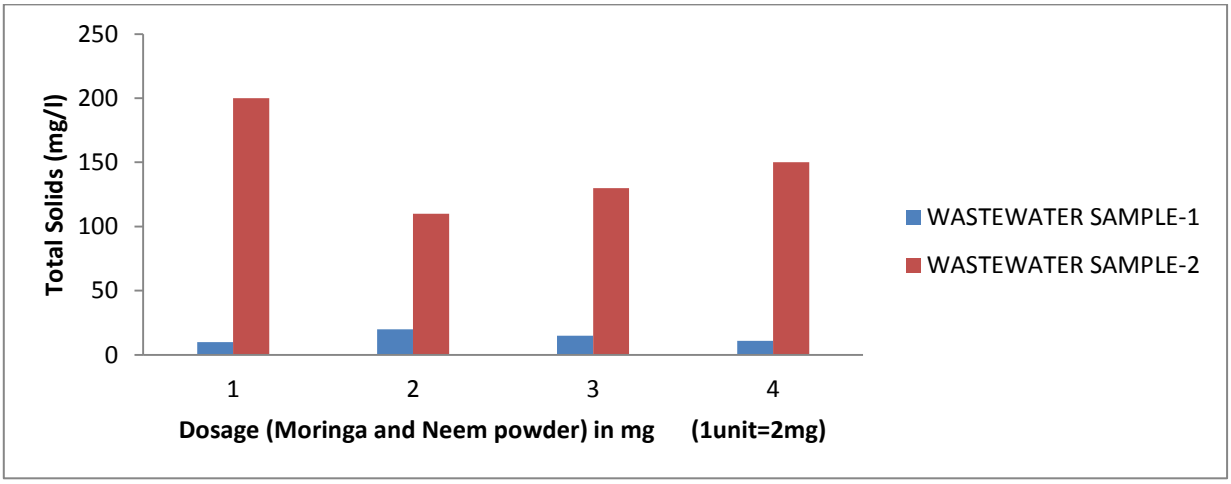


Fig 13: pH for Textile and Mat effluent with different concentration of MO and Neem powder.

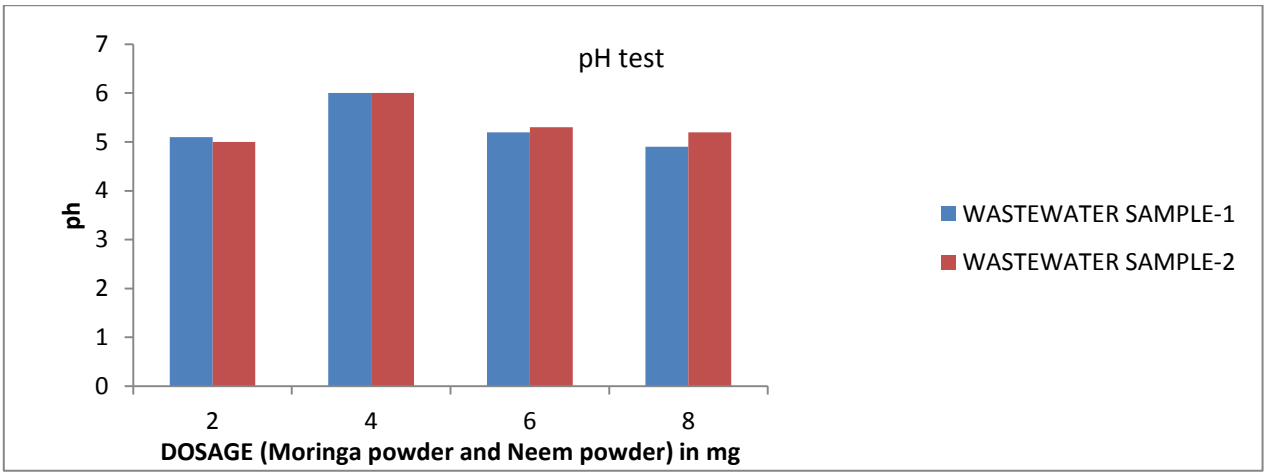


Fig 14: Total Hardness for Textile and Mat effluent with different concentration of MO and Neem powder.

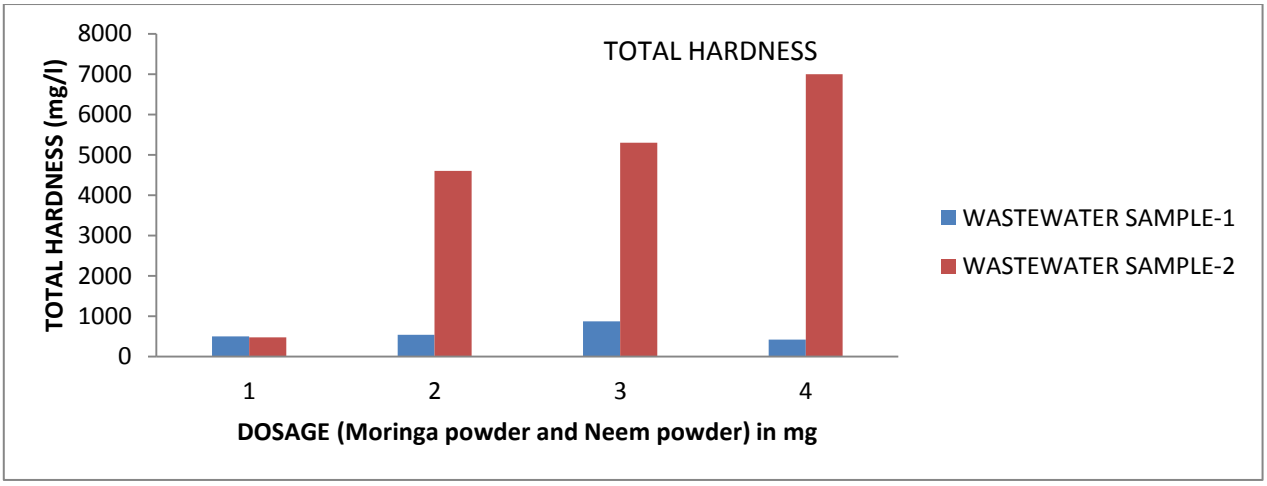


Fig 15: Chloride content for Textile and Mat effluent with different concentration of MO and Neem powder.

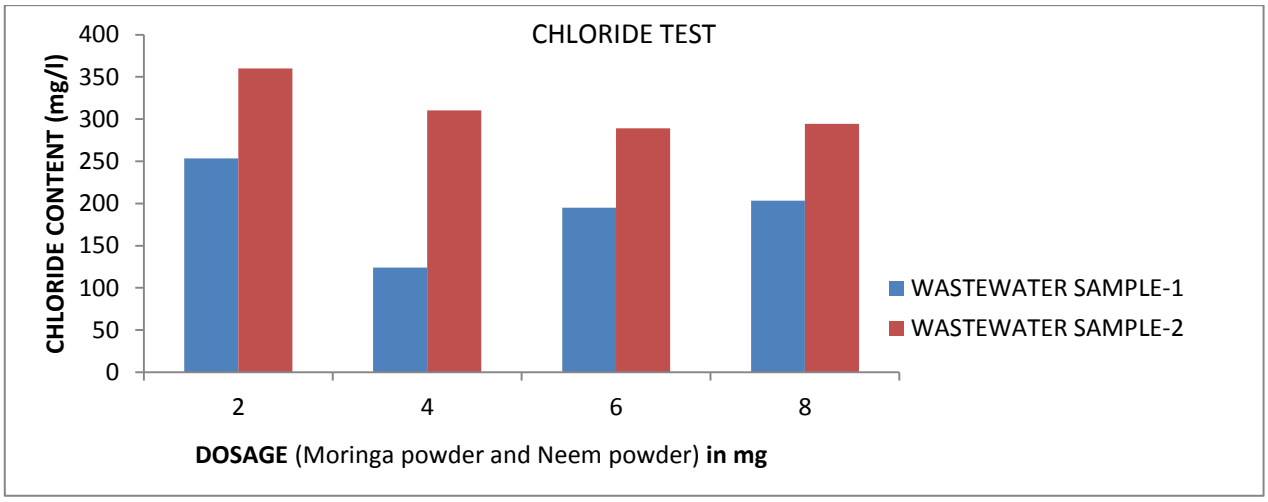


Fig 16: Turbidity for Textile and Mat effluent with different concentration of MO and Neem powder.

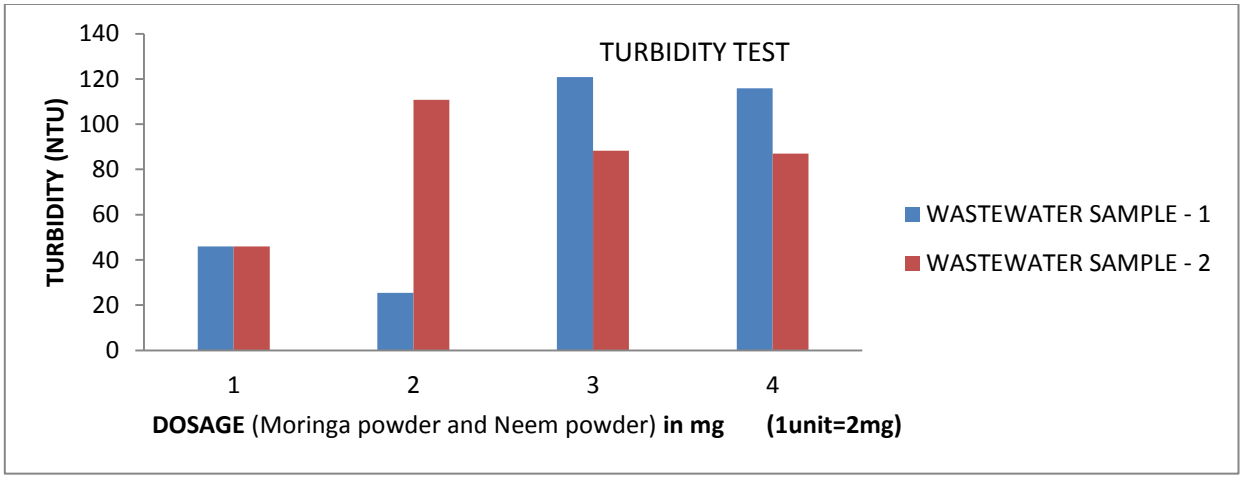


Fig 17: Total Dissolved Solids for Textile and Mat effluent with different concentration of MO and Neem powder.

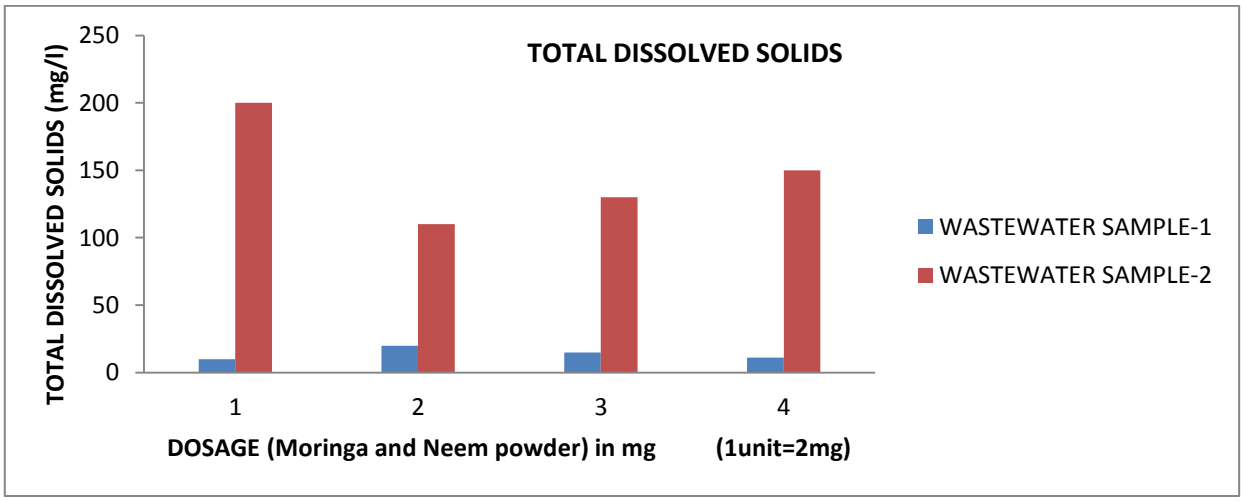


Fig 18: Total Suspended Solids for Textile and Mat effluent with different concentration of MO and Neem powder.

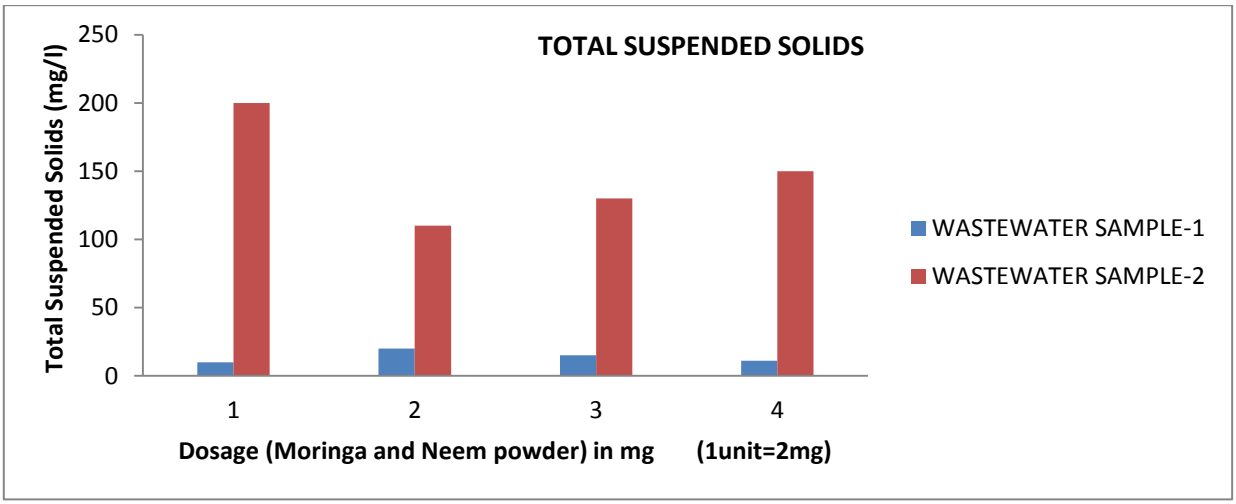


Fig 19: Biochemical Oxygen Demand for Textile and Mat effluent with different concentration of MO and Neem powder.

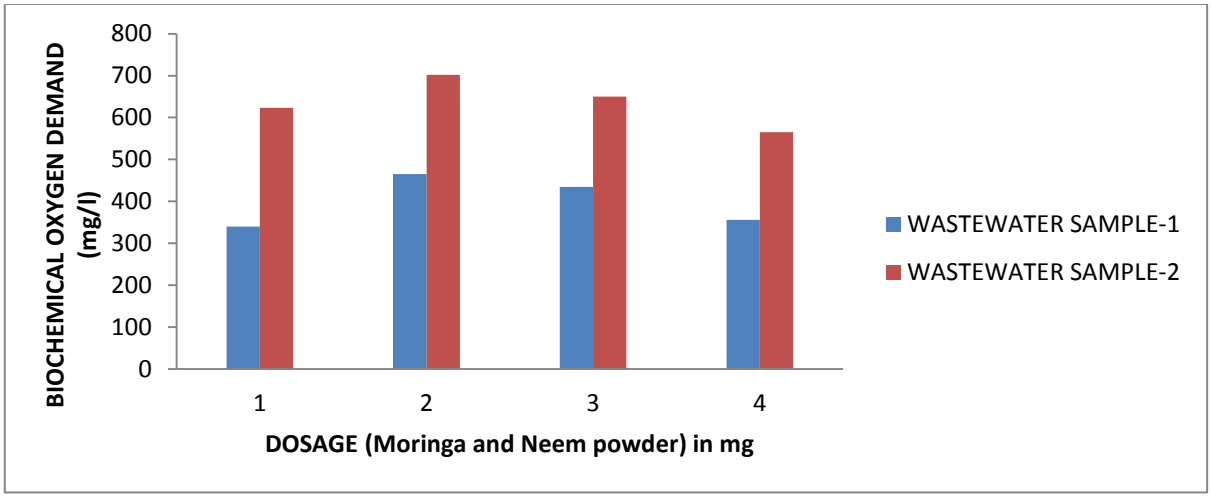


Fig 20: Total Dissolved Solids for Textile and Mat effluent with different concentration of Neem powder.

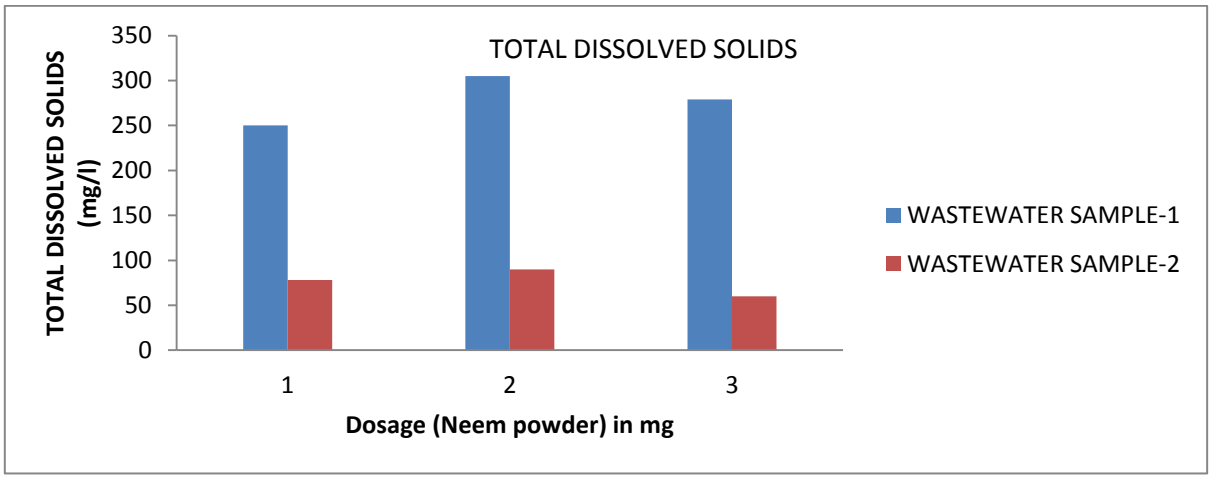


Fig 21: pH for Textile and Mat effluent with different concentration of Neem powder.

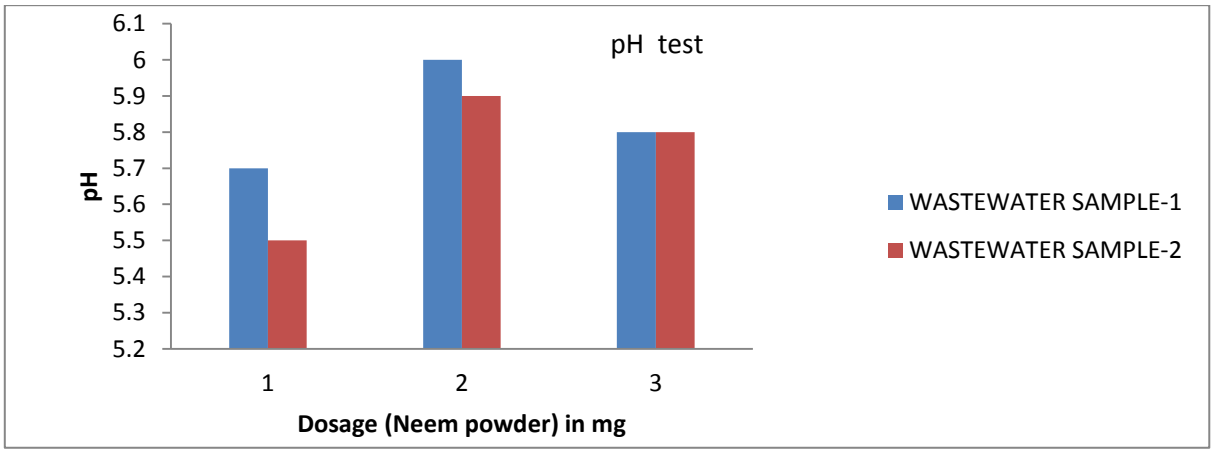


Fig 22: Total Hardness for different concentration of neem powder.

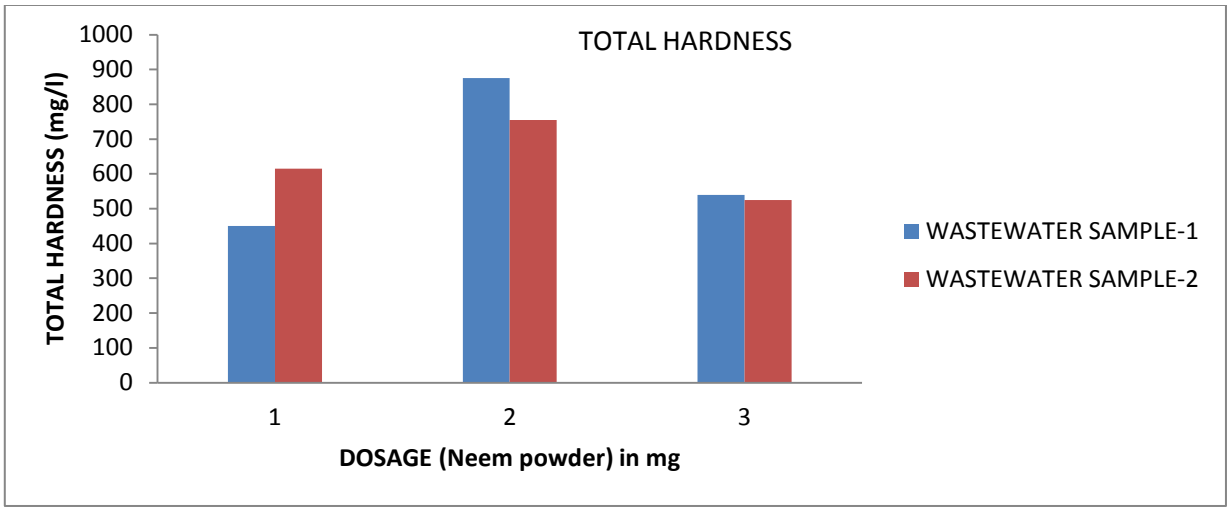


Fig 23: Chloride test for different concentration of neem powder.

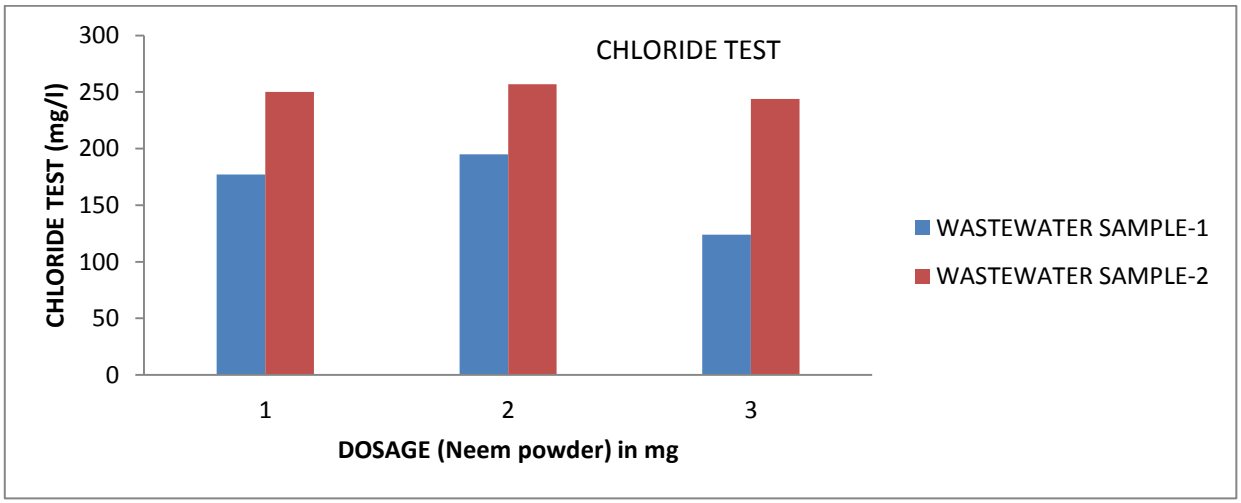


Fig 24: Total Suspended Solids for different concentration of neem powder.

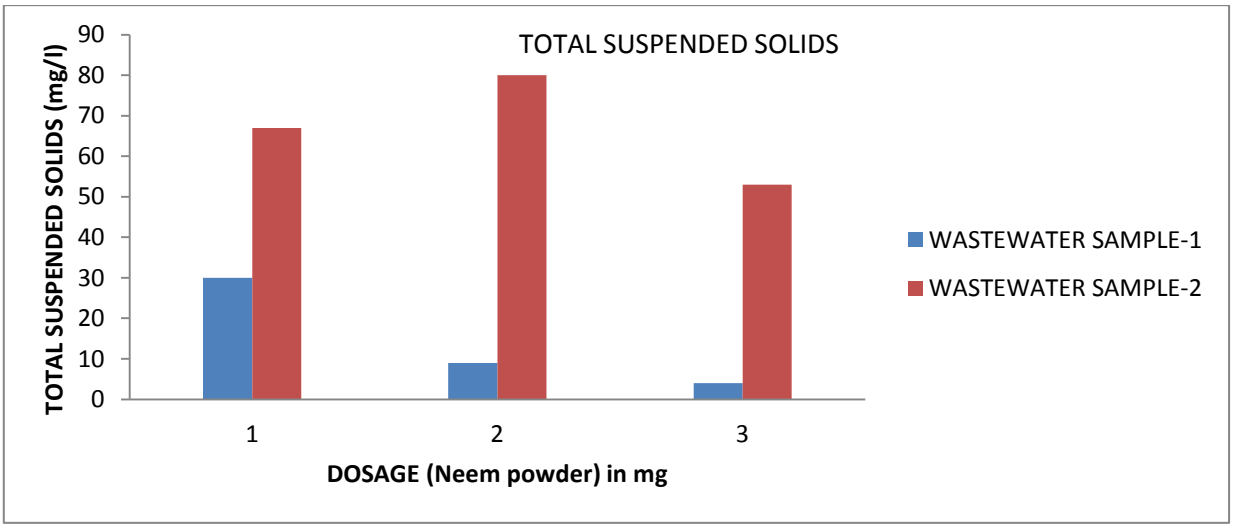


Fig 25: Total Solids for different concentration of neem powder.

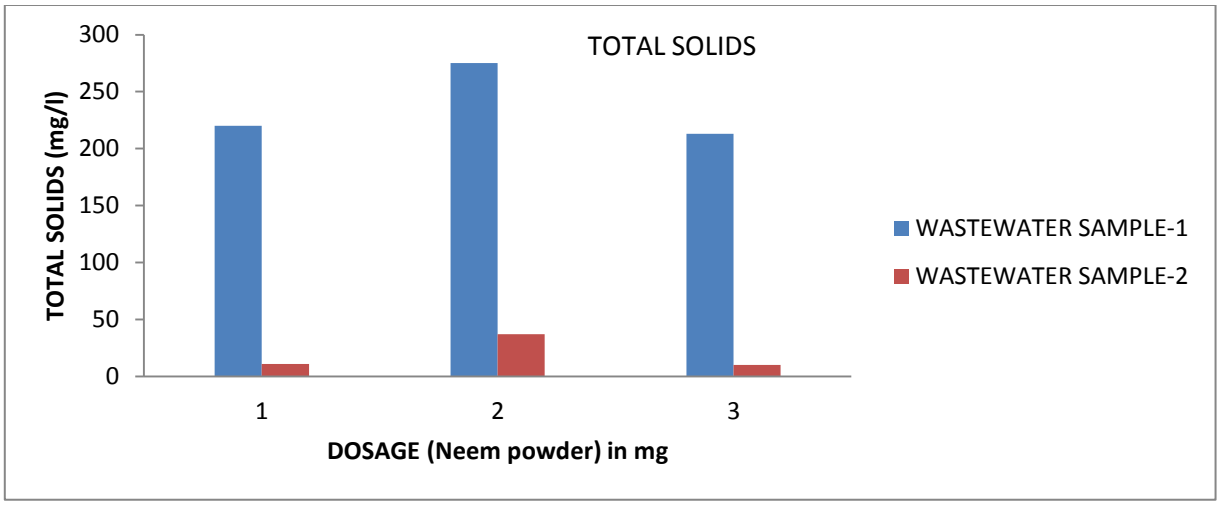


Fig 26: Turbidity for different concentration of neem powder.

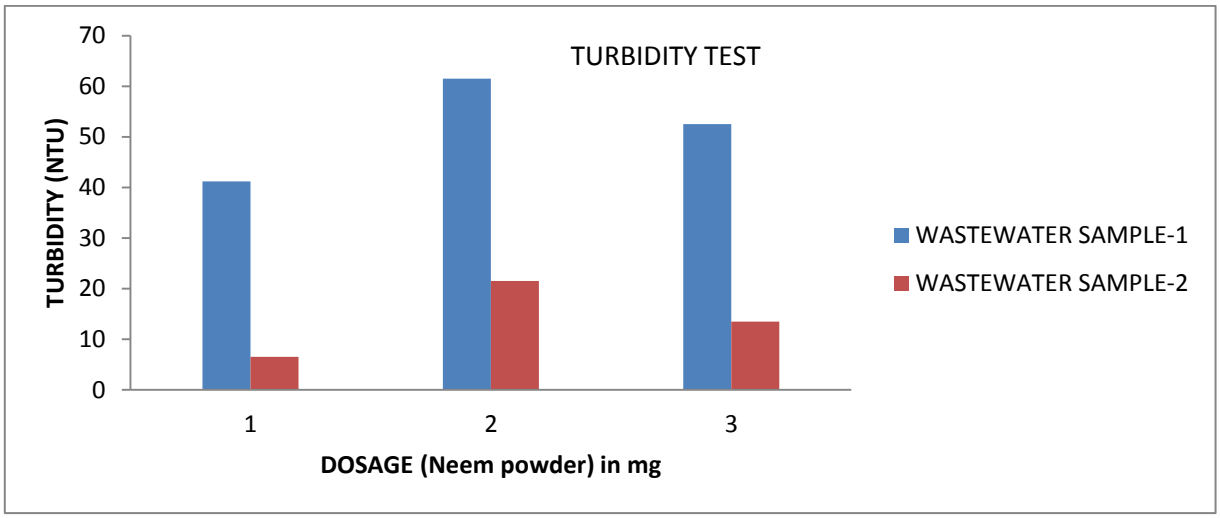


Fig 27: Biochemical Oxygen Demand for different concentration of neem powder.

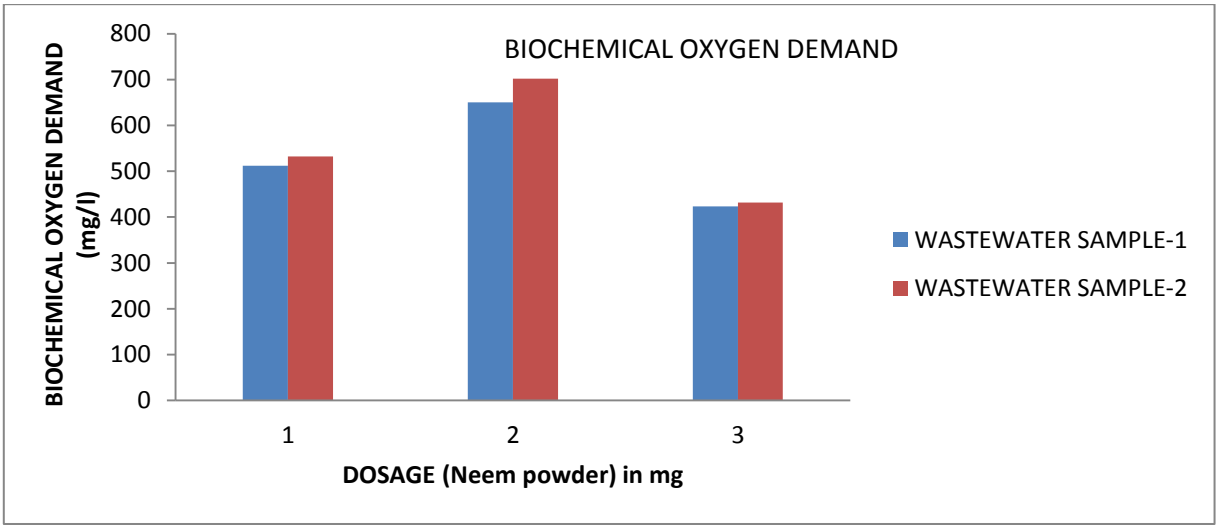


Fig 28: pH for different concentration of moringa powder.

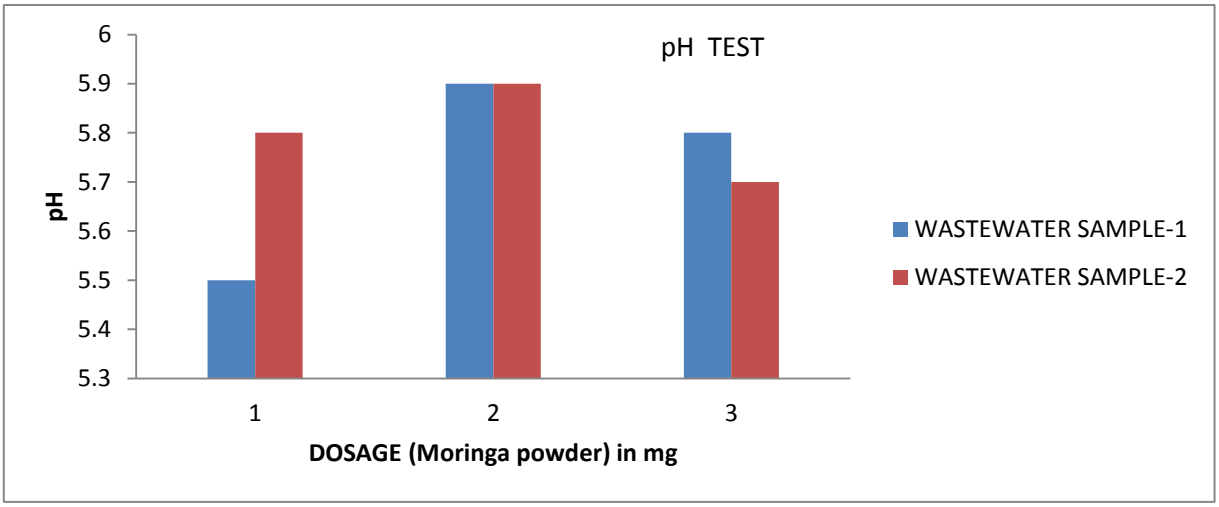


Fig 29: Total Dissolved Solids for different concentration of moringa powder.

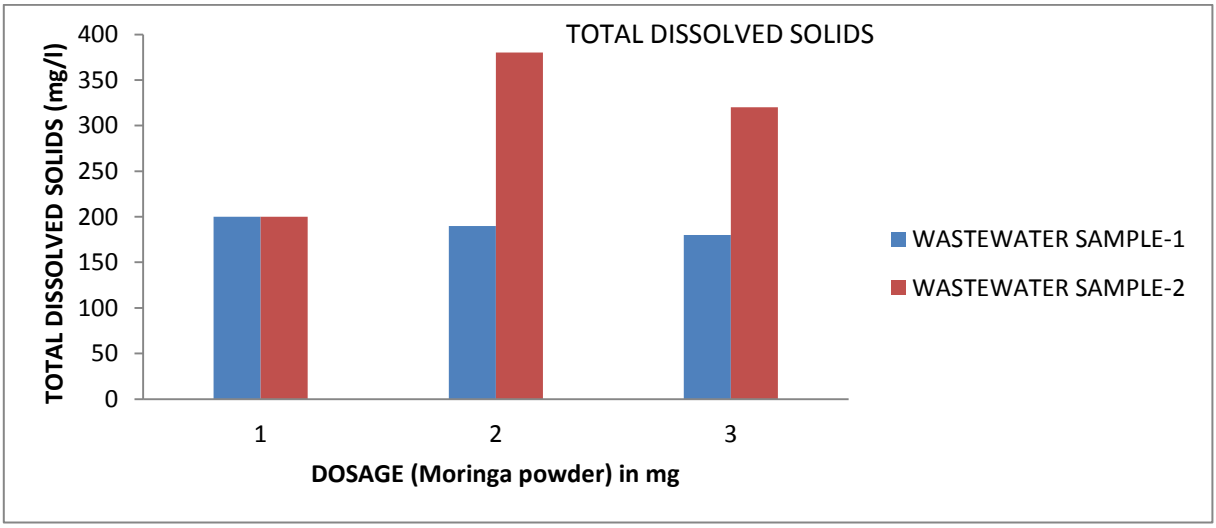


Fig 30: Total Hardness for different concentration of moringa powder.

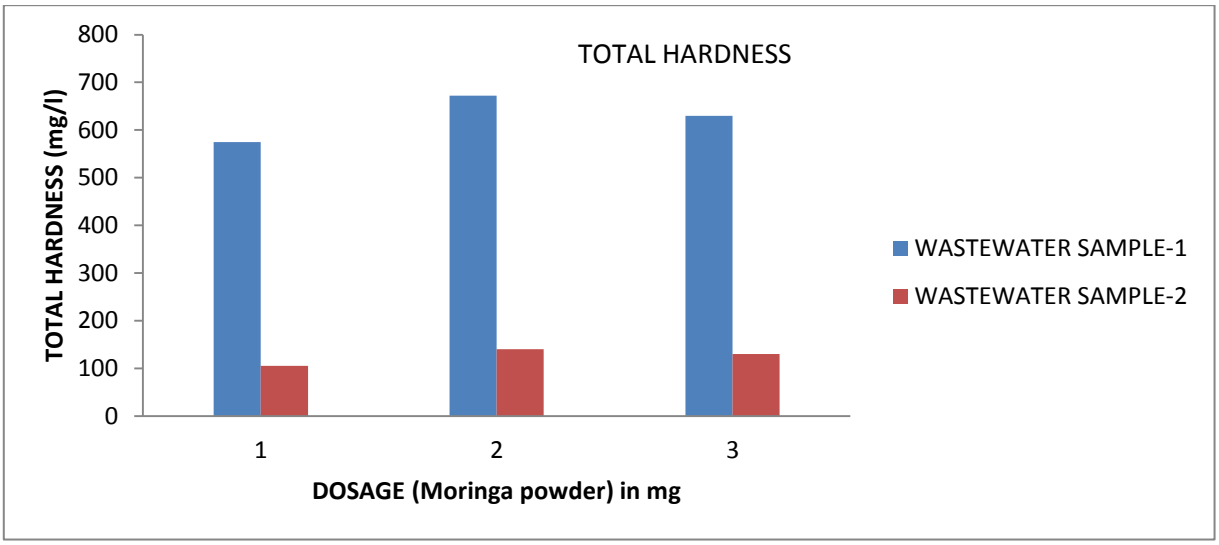


Fig 31: Chloride test for different concentration of moringa powder.

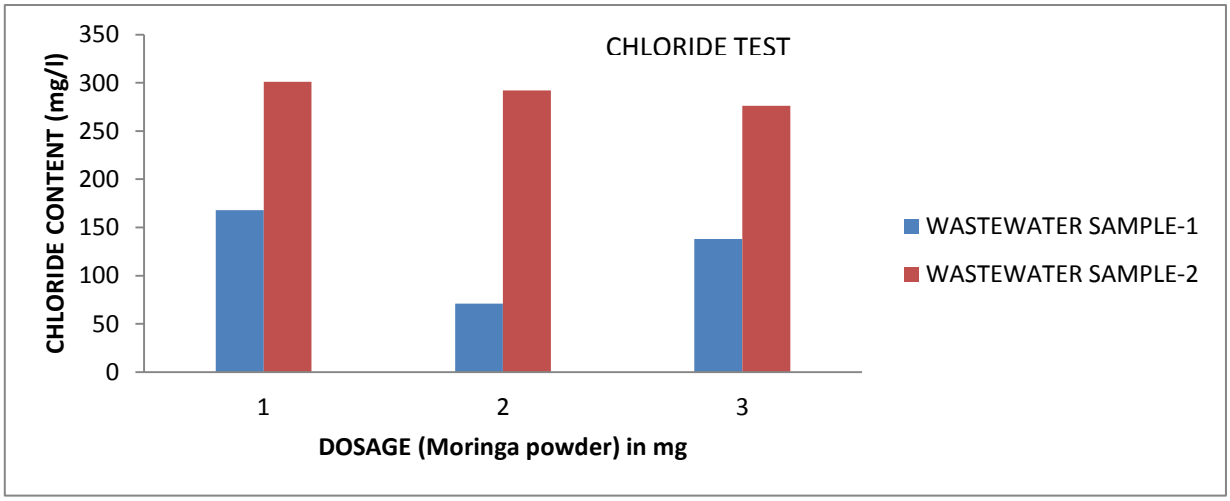


Fig 32: Total Suspended Solids for different concentration of moringa powder.

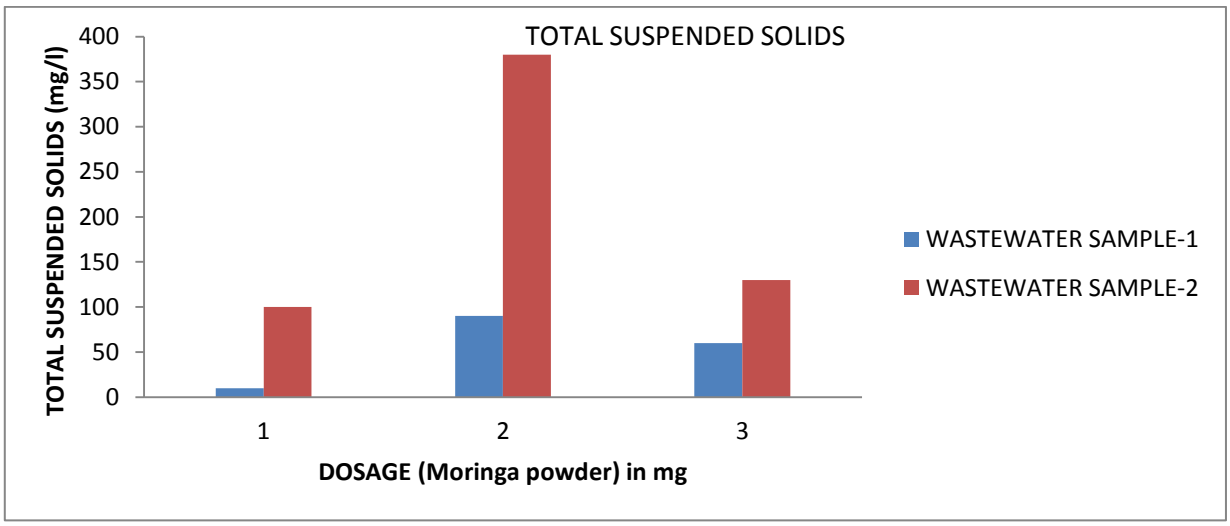


Fig 33: Total Solids for different concentration of moringa powder.

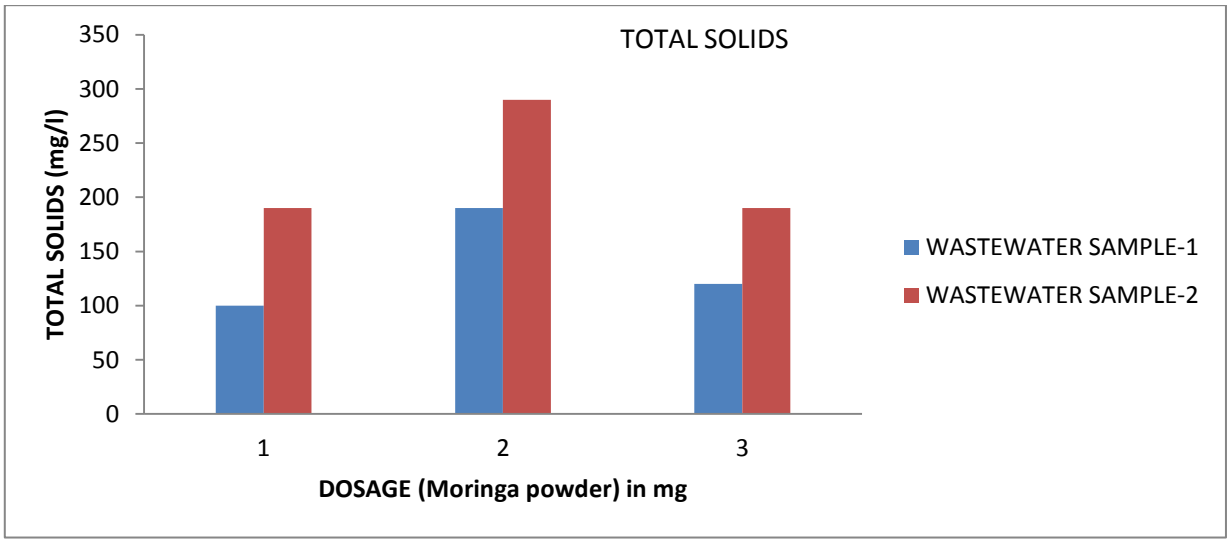


Fig 34: Turbidity for different concentration of moringa powder.

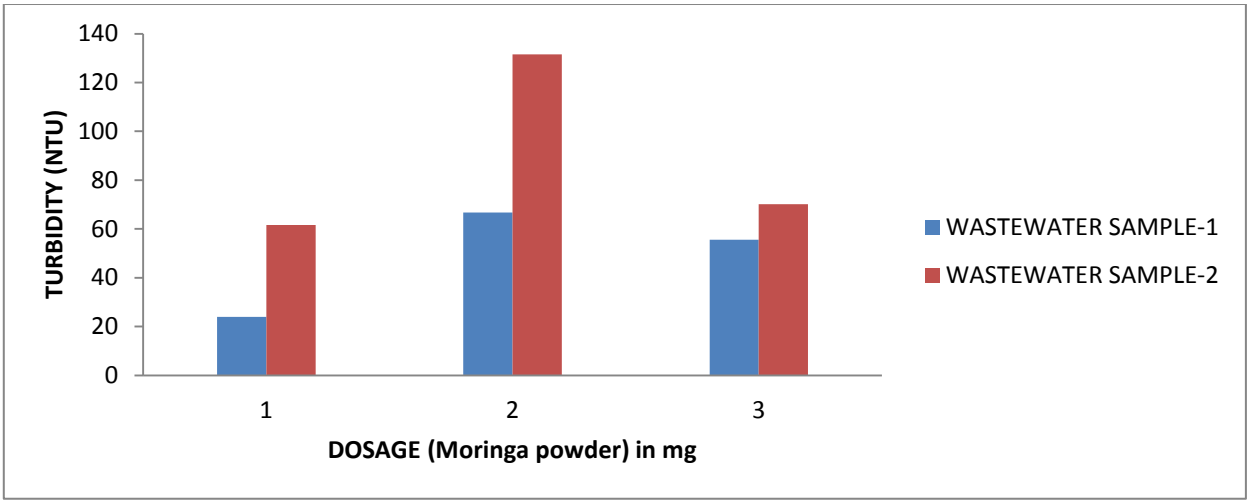
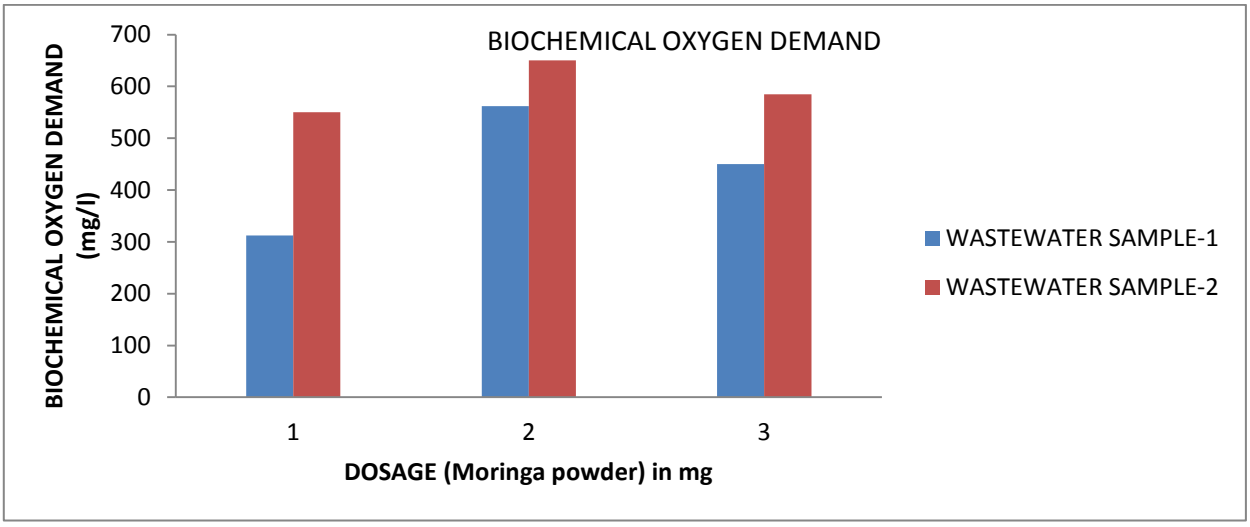


Fig 35: Biochemical Oxygen Demand for different concentration of moringa powder.



4. CONCLUSIONS

The following conclusions are drawn from the experimental study conducted on the treatment of the textile and mat effluents using natural coagulants:

Among the natural coagulants used for the wastewater treatment, the maximum reduction of the pH, Total solids, Total Dissolved Solids, Total Suspended Solids, Turbidity, Chloride content, Biochemical Oxygen Demand and Total Hardness is found to be 73.2% with the addition of Moringa Oleifera.

From the above results, it is observed that the resulted characteristics are within the permissible limit for the industrial purpose.

5. REFERENCES

(1)Aminu.I, M. D. Garba, Z. Y. Abba," Biosorption Potentials of Moringa Oleifera Seed in Textile industry".

(2)Meena Solanki, S. Suresh, Shakti Nath Das, Kanchan Shukla, (2007) "Treatment of Real Textile Wastewater Using Coagulation Technology"

(3)Muralimohan.N, Palanisamy.T,(Jan-2014),"Treatment of textile effluent by natural coagulants in Erode District", Asian Journal of Chemistry, Vol. 26, No.3, pp 911-914.

(4)Veeramalini, Sravanakumar and Joshua Amarnath, (2012),"Removal of reactive yellow dye from aqueous solutions by using natural coagulant (moringa oleifera)". International Journal of Science, Environment and Technology, Vol. 1, No 2, 56 – 62.

(5)Mangale.S.M, Chonde.S.G, Jadhav.A.S, and Raut.P.D, (2012) "Study of Moringa oleifera (Drumstick) seed as natural Absorbent and Antimicrobial agent for River water treatment", pp: 89-100.

(6)Nandkishor kumawat, Nikhil Koul, Jayesh Indrekar ,Shubham Payghan(Apr-2017)"Treatment of textile effluent by using natural coagulants",7th International Conference on Recent Trends in Engineering, Science and Management, pp: 531-539.