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Exploring the use of Cactus and Neem Leaf Powder as an Alternative Coagulant in Treatment of Wastewater

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Abstract*: *Opuntia and Neem leaf is a natural based bio-coagulation that can be utilized in bio-coagulation process of kitchen used water collected from the college (MKCE). Opuntia (prickly pear) and neem tree leaf (Azadirachta indicia) powder are used as a Bio-coagulant. Jar test was conducted and the treated samples were evaluated for pH, turbidity, hardness. The dosage of the Bio-coagulant utilized in jar apparatus is 0.2 to 1 g/L for both neem leaf and opuntia powder. The dosage for the Bio-coagulant solution utilized is 5 to 25mL/L. When the Bio-coagulant are utilized directly turbidity was reduced to 50%. When Bio-coagulant are partially utilized with alum the efficiency is about 95% for neemleaf powder and 96% for opuntia powder. So the process reduces the consumption of chemical to 50%. Opuntia and neem could be utilized as an effective natural Bio-coagulant since it costs less when compared with chemical coagulant.

Index Terms*: *Jar tests apparatus, Kitchen used water, Neem leaf, Opuntia, pH, Turbidity.

I. INTRODUCTION

Water is very important elements that are involved in human life for good health. Portable water is treated from the raw water sources with the help of bio-coagulation to eliminate turbidity in the raw water sources [1,2]. Due to quick population and industrialization discharge the amount of drain disposed to water sources have polluted the quality of water. There are various remediation techniques for the development of water quality. The salt of aluminium and iron are majorly utilized as primary coagulant [4,5,6]. But these coagulants are unfavorable to the environment and human. Alzheimer's disease, cancer, nervous disorders are caused by aluminium, when it is mixed in water. This highlights the need to find for natural Bio-coagulant for low cost, easy remediation of used water. The opuntia and neem leaf powder isutilized as a natural Bio-coagulant. Water remediation is very economic when the natural Bio-coagulants are utilized [3,7,8]. Bio-coagulation process is recent process involved in the remediation of water. The objective is to reduce the turbidity level of the used water collected from the college. In coagulation process two materials are utilized [9,10,11,12]. They are inorganic coagulant (aluminium and ferric salt) and synthetic organic polymers (polyethylene mine) these chemical are utilized to remove the turbidity from the water. The inorganic coagulants are creating secondary contamination of water with toxic polymers. This is major problem in coagulation water remediation process. This study aims to find out the effectiveness of using opuntia and neem leaf powder as coagulant.

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II. MATERIAL AND METHOD

Used water (Kitchen wastewater) was collected from college campus (MKCE). The collected water is preserved and stored in the refrigerator. The samples are tested in the laboratory to obtain the parameters such as pH, turbidity, hardness.

PARAMETER	VALUE
pH	8.3
Turbidity	174 NTU
Hardness	1024 mg/L

Table-I: Characteristics of kitchen wastewater

A. Neem leaf powder (NLP) preparation

Neem leaf were collected from nearby sources and dried for 2 or 3 days. Then the dried leaf was grained with the help of grinding tool to get fine particles. The powder is activated at a temperature of about 400^{o}C. Then the powder was sieved by the IS standard sieve size of 90 micron. Sieved powders are washed with double distilled water and filtered using the filter paper. Then washed powder is dried and it is ready to be utilized as a Bio-coagulant. The fine powder was collected and stored in airtight container to keep away from moisture in

Fig-1: Neem Powder

B. *Opuntia* powder (OP) preparation

Dried opuntia was collected from nearby sources and then collected opuntia is grained into fine particle.
Washed with double distilled water and filtered with filter paper. Then washed powder is dried and it is ready to be utilized as a Bio-coagulant. The fine powder was collected and stored in airtight container to keep away from moisture in it.

Fig-2:Opuntia Powder

C. Jar test Apparatus

Coagulation is the important method utilized to take away of color, turbidity, microorganism, suspended matter, and odour producing matters. Adding the coagulant to bring down the small destabilized particles to form large matter then they are automatically settle with the help of gravity and separated from the waste water. Neem leaf powder is feed to the waste water in different dosages. First quick mixing is carried out for 3 minutes at 100 rpm along with slow mixing for 25 minutes at 20 rpm. The samples are permitted to settle for 30 minutes. Then the supernatant water was filtered and their parameters were find out. Same procedures are followed by opuntia powder, neem leaf solution and opuntia solution.

Fig-3: Jar Test Apparatus.

III. RESULTS AND DISCUSSION

Ideal bio-coagulant dosage was calculated from different dosage of bio-coagulant as 0.2 to 1 g/L for waste water. Nephelometric turbidity meter is utilized to calculate the turbidity and pH is determined by pH meter.

DOSAGE (g/L)	TURBIDITY (NTU)	pH
0.00	90	8.01
0.20	46.1	7.86
0.40	43.4	7.75
0.60	43	7.93
0.80	42.2	7.95
1.00	51	8.20

Table-II: Turbidity and pH for various coagulant dosage(OP).

Processing with opuntia powder, ideal bio-coagulant dosage is 800 mg/L. Turbidity decreases to about 55% .

DOSAGE (g/L)	TURBIDITY (NTU)	pH
0.00	90	8.01
0.20	38.7	7.86
0.40	34	7.84
0.60	41.6	7.7
0.80	42	7.72
1.00	58	7.9

Table-III: Turbidity and pH for various coagulant dosage(NLP).

Processing with neem powder, ideal bio-coagulant dosage is 400 mg/L. Turbidity decreasing to about 65%.

Fig- IV: Turbidity vs. Coagulant dosage (OP and NLP)

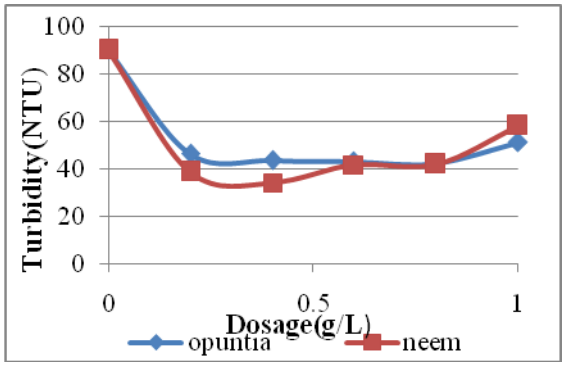
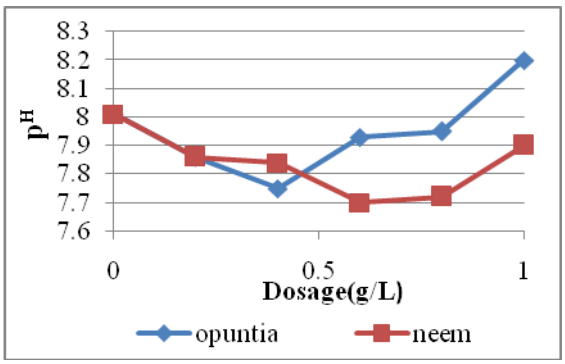


Fig- V:pH vs. coagulant dosage (OP and NLP)



Ideal bio-coagulant dosage was finding out by difference solution as 5 to 20 mL/L for kitchen used water. Then the results are showed in below tables.

DOSAGE (mL/L)	TURBIDITY (NTU)	pH
0.0	90	8.01
5.0	41.5	7.64
10.0	39.6	7.61
15.0	38.5	7.69
20.0	44	7.70

25.0	61	7.8

Table-IV:Turbidity and pH for various Coagulant Solution (NS).

Processing with neem solution (NS), ideal bio-coagulant dosage is 15 mL/L of waste water. Turbidity decreases to about 55%.

DOSAGE (mL/L)	TURBIDITY (NTU)	pH
0.0	90	8.01
5.0	40.1	7.60
10.0	38.2	7.58
15.0	33	7.55
20.0	32.1	7.67
25.0	45	7.84

Table-V:Turbidity and pH for various Coagulant Solution (OS).

Processing with opuntia solution (OS), ideal bio-coagulant dosage is 20 mL/L of waste water. Turbidity decreases to about 55% .

Figure-6:Turbidity vs Coagulant Dosage (OS and NLS).

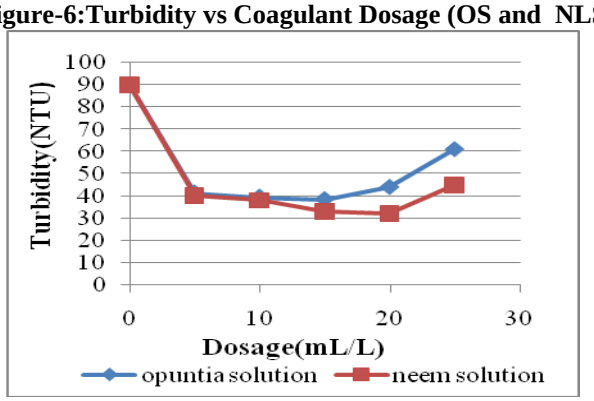
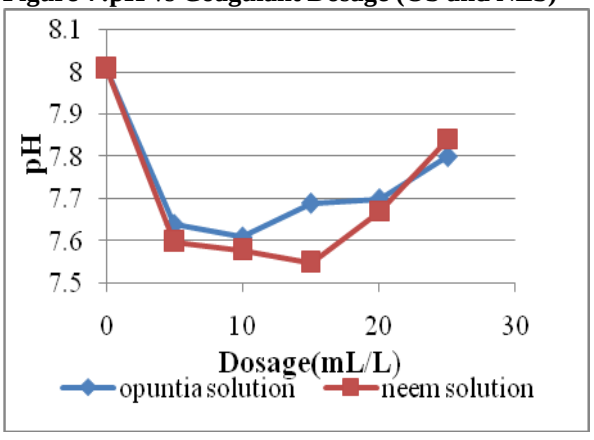


Figure-7:pH vs Coagulant Dosage (OS and NLS)



The bio-coagulant are partially used with alum it gives good result. Then the chemical are minimized by the help of bio-coagulation. The results are showed in table below.

DOSAGE(g/L)	TURBIDITY (NTU)	pH
0.0	90	8.01
0.20	5.1	7.40
0.40	3.5	7.34
0.60	4.5	7.43
0.80	6.9	7.55
1.00	7.3	7.60

Table-VI:Turbidity and pH with varying Coagulant (opuntia powder 50% and alum 50%)

Processing with opuntia powder and alum, ideal bio-coagulant dosage is 0.4 mg/L of waste water. Turbidity decreases to about 96% .

DOSAGE(g/L)	TURBIDITY (NTU)	pH
0.0	90	8.01
0.20	6.5	7.59
0.40	4.1	7.46
0.60	4.7	7.67
0.80	7.4	7.69
1.00	8.3	7.70

Table -VII:Turbidity and pH with varying Coagulant (NLP 50% and Alum 50%)

Processing with neem powder and alum, ideal bio-coagulant dosage is 0.4 mg/L of waste water. Turbidity decreases about 95%.

IV. CONCLUSION

This study mainly focuses on the removal of turbidity. Turbidity reduction of neem and opuntia powder is 55% and 65% respectively. When neem leaf powder is used partially with alum then the percentage reduction on turbidity is 95%. When opuntia and alum are used partially then 96% removal efficiency is obtained. It is a nontoxic and eco-friendly way of treatment of wastewater, and subsequently, it is being suggested for large-scale water treatment. So that cactus and neem leaf powder is an alternative coagulant of water treatment plant.

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