

Removal of turbidity from of water using natural coagulant and comparison study with chemical coagulant

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Abstract— Among the natural resources water is the most vital parameter. Turbidity is the cloudiness or haziness of a fluid caused by large number of individual particles that are generally invisible to the naked eye, similar to the smoke present in the air. In this present study, an attempt has been made to evaluate the comparative effectiveness of chemical coagulant Alum with Natural Coagulant such as banana peel and orange peel for reduction of Turbidity in waste water sample has been collected from the origin source with impurities present in it. The tests were carried out using the turbidity meter test apparatus. The comparative results of turbidity reduction after addition of Alum, banana peel powder and orange peel powder were experimented. It was found that natural coagulant banana peel powder shows better treatment with wastewater. The utilisation of locally available natural coagulant was found to be suitable, easier, cost effective and environment friendly for waste water treatment.

Index Terms—Coagulation, Turbidity, Chemical coagulant, Natural Coagulant, Alum, banana peel and orange peel powder, Waste water.

1 INTRODUCTION

Turbidity in wastewater is caused by suspended matter, such as clay, silt, finely divided organic and inorganic matter, soluble coloured organic compounds, and plankton and other microscopic organisms. Turbidity is the cloudiness or haziness of a fluid caused by large number of individual particles Turbid water has muddy or cloudy appearance and it is aesthetically unattractive. The turbidity increases as sewage becomes stronger. Coagulants neutralise the repulsive electric charge(negative) surrounding particles allowing them to “stick together” creating flocs. Flocculants facilitate the sticking of the coagulated particles to form larger floccules and their by fasten gravitational settling. Coagulation is the destabilisation of colloids by neutralizing the forces that keep them apart. Cationic coagulants provide positive electric charges to reduce the negative charge of the colloids. As a result, the particles colloide to form larger particles (flocks). Rapid mixing is required to disperse the coagulants thorough the liquid. Wastewater with high concentration of dissolved solids, suspended solids, chlorides, color, chromium etc., were being discharged every day in the receiving water. sedimentation, or alternative clarification processes. The natural coagulants that are locally available have bright future and are concerned by many researchers because of their abundant source, low price, environment friendly, and biodegradable nature in water purification. Coagulation and flocculation processes are intended to form particles large enough to be separated and removed by subsequent subsequent sedimentation, or alternative clarification processes. The natural coagulants that are locally available have bright future and are concerned by many researchers because of their abundant source, low price, environment friendly, multifunction, and biodegradable nature in water purification.

2 METHODOLOGY

2.1 Preparation of Natural coagulants

The The banana peel and orange peel were collected and kept in the laboratory oven for a time duration of 15 days. The dried peels were ground to fine powder by means of crushing. This powder was sieved through 600µm sieve. Also, waste water sample has been collected from the origin source with impurities present in it.

2.2 Turbidity test with alum and natural coagulants

The measurement of turbidity is the key test of water quality and also in addition these small solid particles cause the liquid to appear turbid. The waste water sample that was collected from the source of origin and had it composition greenish-yellow in color and appearance. The ph. of the waste water sample was denoted to be 6.75. Also, the sample of the waste water had undergone a primary treatment and could also be used on various sources respectively. The waste water also had its natural composition darker in color and also had several suspended impurities mixed along with it. The sample of waste water also had an estimated hardness also associated within its composition. The waste water also had an unpleasant odor with its dark composition.

The apparatus and equipment's used is nephelometer and pH meter used for determining the turbidity and pH test respectively. The tests are conducted to 3-4 times per sample. Further tests were conducted using alum, banana peel extract and orange-peel extract by adding them to the respective water sample collected. By performing these tests with various extracts there were observations made on how the turbidity varied by using different natural coagulants other than alum

Therefore, significant positive results were obtained in removal of turbidity by using these natural coagulants a graph was

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plotted based on varying turbidity of all the natural coagulants that were used in this study.

2.21 Test for sample after adding Alum

Alum is most common coagulant used for removal of turbidity. Since alum can be formed in huge amount for a comparatively less amount it used in most treatment plant.

In the first attempt of removal of turbidity using natural coagulants alum is taken which is very well known for its impurity removal property from any given sample of solution. Alum also known as $Al_2(SO_4)_3$ in terms of chemical formula is used as a primary coagulant. Also, for every 100 ml solution, alum is added in varying in increasing order.

Also, the turbidity is measured in terms of NTU, which has observed from the device used. The nephelometer device shows that for every amount of the alum coagulant added there is drastic decrease in the turbidity value of the given sample. Hence, we can conclude saying that alum is an excellent natural coagulant to reduce the turbidity in any given sample of solution.

2.22 Test for sample after adding orange peel extract

In the second attempt of removal of turbidity from a given sample of solution a concentration of turbidity from the sample used. Orange peel extract is a natural substance that is extracted from the fruit and kept in the oven at a temperature of 102 degree Celsius for time duration of 15 days. Later the sample obtained is grinded into a fine powder which is orange in appearance. This extract is added with 25ml of distilled water and for every 100ml of given solution of waste water sample this extract is added in varying increasing order progressively. The organic extract obtained is mixed with given volume of distilled water and later passed through a filter paper resulting in obtaining standard orange peel extract. Take sample or a suitably diluted aliquot and determine its turbidity by reading on turbidity meter. Report the readings in turbidity meter. We can make an observation stating that every increasing solution mixture added naturally the turbidity value rises exponentially. The pH of the solution is monitored which remains the same without any much difference.

2.23 Test for sample after adding banana peel extract:

In the third attempt of removal of turbidity from a given sample of solution a natural substance such as banana peel extract was used to determine the concentration of turbidity from the sample used. Banana peel extract is a natural substance that is extracted from the fruit primarily and kept in the laboratory oven at a temperature of 102 degree Celsius for a time duration of 15 days. Later the sample is further grinded into a fine powder which is dark black in terms of appearance. The extract is added with 20ml of distilled water and for every 100ml of the given solution of waste water sample this extract is added in varying increasing order progressively. This banana extract obtained is mixed with given volume of distilled water and later passed through a filter paper resulting in obtaining standard banana peel extract. Take sample or a suitably diluted aliquot and determine its turbidity by reading on

turbidity meter. Report the readings in turbidity meter. We can make an observation that for every increasing solution mixture added naturally the turbidity value decreases exponentially. The pH Value of the solution is monitored which remains the same without any much difference. Therefore, we can conclude by stating that the banana peel can be used as a natural coagulant to remove the turbidity from the given sample of waste water solution.

2.24 Test for sample after adding orange peel extract with alum:

We can make an observation stating that every increasing solution mixture added naturally the turbidity value rises exponentially. The pH of the solution is monitored which remains the same without any much difference.

3 RESULTS AND DISCUSSIONS

3.1 Results For Alum $Al_2(SO_4)_3$

Table 1. Table for Alum as Coagulant

Sl. No.	Sample Solution ml	Alum (Al ₂ SO ₄) ₃ solution added, ml	Turbidity (NTU)
1	100	20	19
2	100	30	17.3
3	100	40	16.1
4	100	60	14.2
5	100	80	13.6

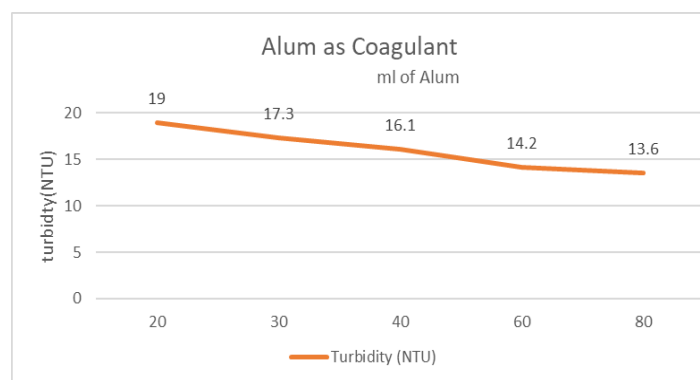


Figure 1. Graph for Alum as Coagulant
From the graph we can observe that:

- For 20 ml of turbidity is high when compared to 80 ml.
- So we can denote that the as quantity of alum increases turbidity decreases.
- So ml of alum is indirectly proportional to turbidity.
- Alum is good coagulant property.

3.2 Result for Orange peel Extract.

Table 2. Table for Orange Peel Extract as Coagulant

Sl. No.	Sample Solution ml	Orange peel extract solution added, ml	Turbidity (NTU)	pH
1	100	20	46	6.4
2	100	30	47.5	6.4
3	100	40	53.7	6.4

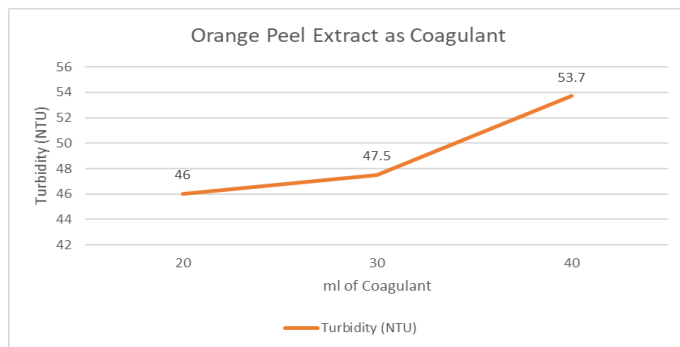


Figure 2. Graph for Orange Peel Extract as Coagulant

From the graph we can observe that:

- For 20 ml of turbidity is low when compared to 40 ml.
- So we can denote that the when quantity of coagulant increases, turbidity increases.
- So ml of orange coagulant is directly proportional to turbidity.
- Orange peel doesn't have good coagulant property

3.3 Result for Banana peel extract.

Table 3. Table for Banana Peel Extract as Coagulant

Sl. No.	Sample Solution ml	Banana peel extract solution added, ml	Turbidity (NTU)	pH
1	100	20	12.1	6.7
2	100	30	10.9	6.7
3	100	40	9.3	6.8

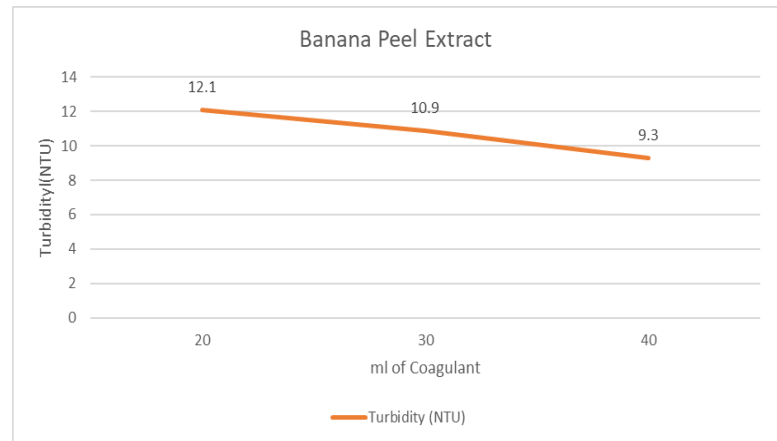


Figure 3. Graph for Banana Peel Extract as Coagulant

From the graph we can observe that:

- For 20 ml of turbidity is high when compared to 40 ml.
- So we can denote that the when quantity of coagulant increases, turbidity decreases.
- So ml of banana coagulant is indirectly proportional to turbidity.
- Banana peel have good coagulant property

3.4 Result for Orange peel extract with Alum.

Table 4. For Orange Peel Extract and Alum as Coagulant

Sl. No.	Sample Solution ml	Orange peel extract solution added, ml	Alum solution added, ml	Turbidity (NTU)	pH
1	100	20	15	42.7	6.1
2	100	20	10	45.1	6.1
3	100	20	5	49	6.1

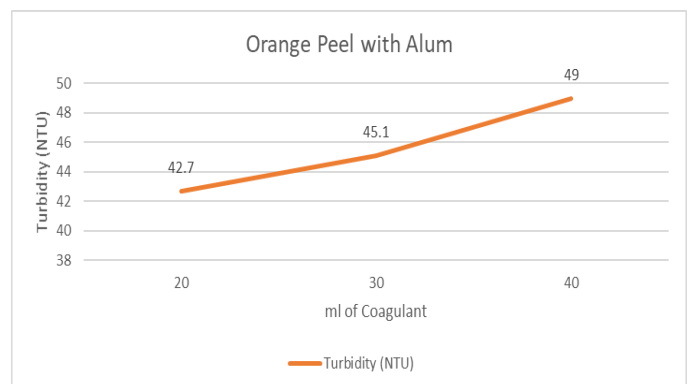


Figure 4. Graph for Orange Peel Extract and Alum as Coagulant

From the graph we can observe that:

- For 20 ml of turbidity is low when compared to 40 ml.
- So we can denote that the when quantity of coagulant increases, turbidity increase.
- So ml of banana coagulant is directly portional to turbidity.
- Orange peel with Alum does not have good coagulant property

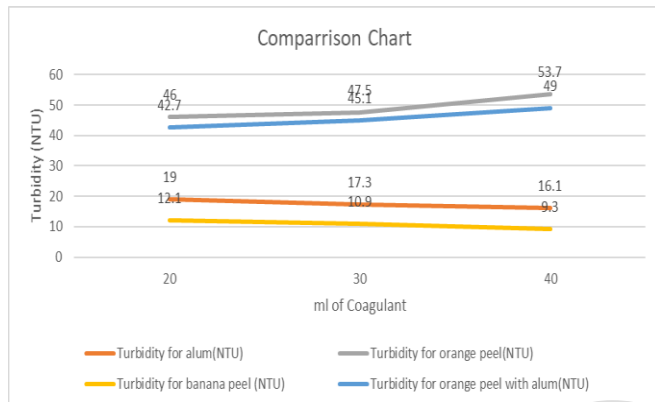


Figure 5. Comparison Chart for Coagulants

4 CONCLUSION

- Banana peel have best coagulant property even more than alum and it's of natural property.
- Alum have second best coagulant property compared to other coagulant.
- Even mixing with alum and orange peel turbidity doesn't decrease.
- pH of solution does not varies much as quantity of coagulant increases.

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