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STUDIES ON REMOVAL OF TURBIDITY AND TDS FROM AQUEOUS
SOLUTION BY USING EMBLICA OFFICINALIS AND CANNABIS
SATIVA LEAF POWDER

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Abstract

Water is a vital natural resource that occurs on the earth. In many places having fresh and clean water is a crucial issue. This study focuses on the removal of turbidity and total dissolved solids from aqueous using Emblica Officinalis and Cannabis Sativa Leaf Powder. The results were found that turbidity removal increases with an increase in pH value with different dosage and concentration. However, the percentage of removal of total dissolved solids starts decreasing after a certain pH i.e. at pH 9 for individual experiments and pH7 for combined.

1 INTRODUCTION

Turbidity is the puddly countenance of fluid which caused by numbers of different particles. The measurement of turbidity is very important parameter of water quality. The fluids which impart different sizes of suspended solid. Some suspended material will be huge and heavy enough to speedily settle down in the in the container. Tinny solid particles make the liquid to muddy because they were unable to settle in the container. There are many reason of turbidity some are natural and other are artificial like manmade. There are many industries, like mining and agriculture that play

huge role to creating the turbidity in water resources. It's caused by dissolved and suspended solid like clay particles and silt particles fine organic and inorganic matter, soluble colored organic compound, algae, etc.

Total Dissolved Solids are referred to that any types of minerals which is present in water some are in suspended form and other are in dissolved form. Total dissolved solid includes inorganic salts (principally calcium, magnesium, potassium, sodium, bicarbonates, chlorides, and sulfates) and organic matter that are dissolved in water. TDS in drinking water generates from natural sources, sewage, urban run-off, industrial wastewater, and chemicals used in the water treatment process. Natural environmental features such as mineral springs carbonate deposits, salt deposits, and seawater intrusion discharges are reason for elevated TDS Ruiz (2015). Total dissolved solid changes the color and taste of water. TDS gives harmful effects on human health because, carbonates, nitrate anions, chloride, sulphate potassium cations etc are present in it. Limits of TDS in various types of water bodies are Freshwater 500 ppm, brackish water 500-30000 ppm, and Saline water 30000-40000 ppm.

Emblica Officinalis is known as the Indian gooseberry. It is the traditional Indian medicine plant. *Emblica Officinalis* contains tannins, alkaloids, phenolic, amino acids, and carbohydrates. The huge amount of vitamin C (478.56 mg/100 ml) found in this plants fruit. The compounds which apart from *Emblica Officinalis* in traditional Indian medicine, dried and fresh fruits of the plant are used. The all parts of the plant are used in much Ayurvedic medicine, including the fruit, seed, leaves, root, bark, and flowers (Habib-ur-Rehman et al., 2007). It useful for different purpose like eating, shampoos, hair oils, the high tannin content of Indian gooseberry fruit serves as a mordant for fixing dyes in fabrics. These fruits accommodate large amounts of ascorbic acid (vitamin C) and have a brittle taste that may derive from a high density of ellagitannins, such as emblicanin A 37%, emblicanin B 33%, punigluconin 12%, and pedunculagin 14% (Bhattacharya et al., 1999). Amla also contains punicafolin and phyllanemblinin A, phyllanemblin other polyphenols, such as flavonoids, kaempferol, ellagic acid, and gallic acid (Tarwadi & Agte 2007).

Cannabis Sativa is a herbal indigenous plant to eastern Asia but now cosmopolitan distribution due to extensive cultivation. It has been harvested throughout history, used for different purposes like industrial fiber, seed oil, food, recreation, devout and spiritual purposes, and medicine. Each part of this plant is harvested by different methods according to the purpose of its use. Seeds of *Cannabis sativa* are maximum used for make hempseed oil which is used for lamps, cooking, paints and lacquers. It is also used as caged-bird feed, as they provide a source of nutrients for some animals. Psychoactive chemical compounds found in the flowers, leaves and fruits of this plants which known as cannabinoids that are used for recreational, medicinal, and devout purposes (Bonini et al., 2018). The devising of flowers and fruits known as marijuana and leaves and devising from resinous extract (e.g., hashish) are used for smoking, vaporizing, and oral ingestion.

2 MATERIALS AND METHOD

Glassware:

The glassware used for performing the Jar test operation is made of borosilicate. After each experiment, all the glassware were washed with chromic acid and then neutralized with a dilute alkali solution.

Preparation of Natural Coagulants:

The leaves of *Emblica Officinalis* and *Cannabis Sativa* plants were dried naturally and were crushed into fine powder form. The sieve analysis of powdered materials was done to retain the 300, 150, 75-micron size of *Emblica Officinalis* and *Cannabis Sativa* leaf powder. The 150-micron size of *Cannabis Sativa* and *Emblica Officinalis* leaf powder were used for experimental study.

Preparation of aqueous solution:

The synthetic turbid aqueous solution for jar tests was prepared by adding clay materials to the tap water. The entire synthetic aqueous solution was made ready by adding fuller earth at a ratio of 5 gm per 1000 ml of tap water. The suspension was stirred for about 1 hour to achieve a uniform dispersion of clay particles. Then it was allowed to settle for at least 24 hours for utter hydration of the clay materials. The supernatant suspension of synthetic turbid water was put into the sample water to attain the desired turbidity just prior to coagulation.

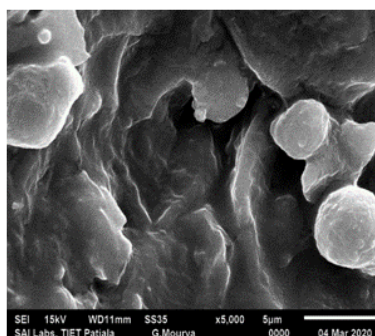
Jar Test:

The conventional jar test apparatus was used in the experiments to coagulate a sample of synthetic turbid water using *Emblica Officinalis* and *Cannabis Sativa* leaf powder as coagulants. It was carried out as a batch test, accommodating a series of six beakers together with six spindle steel paddles. Before operating the jar test, the sample was mixed homogeneously then, the samples ought to be measured for turbidity by turbidity meter and TDS by TDS meter.

Sulphuric acid (H_2SO_4) and sodium hydroxide (NaOH) were used for maintaining the pH of the sample. The 4g of sodium hydroxide flakes were added in 100ml of distilled water to get 40 N NaOH solutions.

3 CHARACTERIZATION OF NATURAL COAGULANTS

The SEM (Scanning Electron Microscopy) of *Cannabis Sativa Leaf Powder* were carried out at X 5000 and X1000 as shown in Figure 1 and 2 and *Emblica Officinalis Leaf Powder* at X5000 and X1000 Figure 3 and 4 respectively.



The above given Figure-1 and 2 shows the morphology of Cannabis Sativa

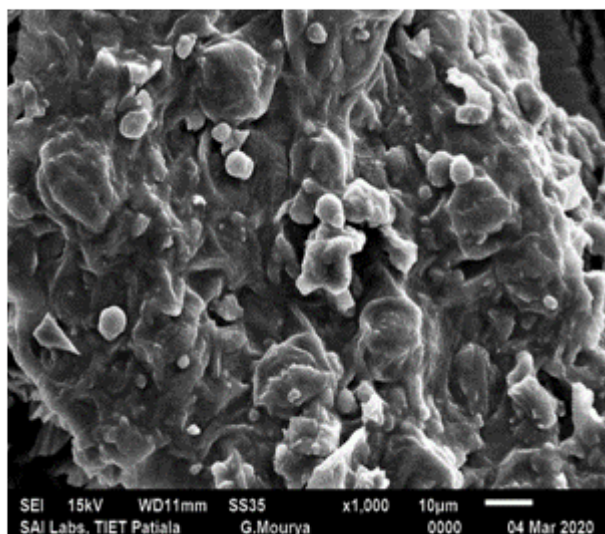


Figure-2 Cannabis Sativa Morphology (X1000)

at different modification levels i.e. X5000 and X1000, respectively.

The Emblica Officinalis Leaf Powder Morphology can be seen from the above pictures at scale varying at X5000 respective of Figure-3 to Figure-4. The SEM test of Emblica officinalis Leaf Powder for arrangements of atoms and size elements finds all are out in Figure 3-4.

The morphology of Cannabis Sativa Leaf Powder and Emblica Officinalis Leaf Powder shows that there are different sizes of pores and texture in these materials before experiments, these textures and pores may help in removing of turbidity and TDS. Some of the element textures are irregular and rough so it's easily removing the TDS in flocculation process or size of pores helps for removal of turbidity.

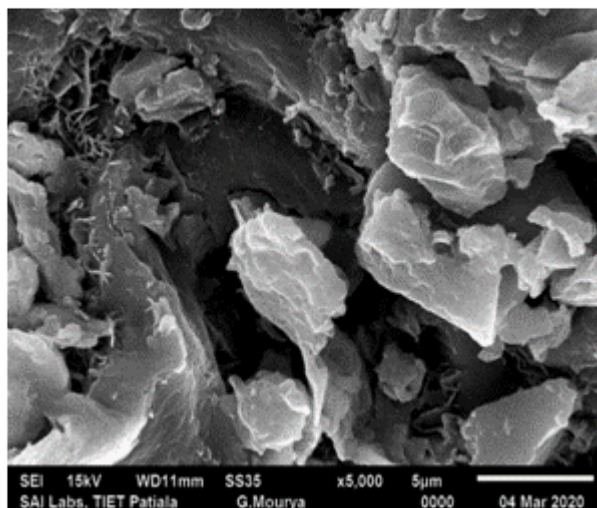


Figure no.3 *Emblica Officinalis* Morphology (X5000)

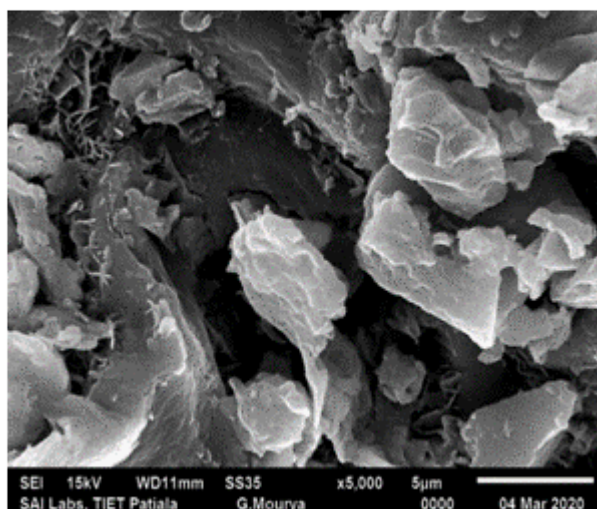


Figure no.4 *Emblica Officinalis* Morphology (X1000)

The EDX spectra of Cannabis Sativa Leaf Powder shown in Figure-5 and Table-1 represent the elements intensity at different levels. The Carbon can be seen at its highest (52.5 %), Oxygen (43.51%), Magnesium (0.33%), Aluminium (0.33%), Silicon (0.06%), Chlorine (0.09%), Potassium (1.51%), and Calcium (1.68%).

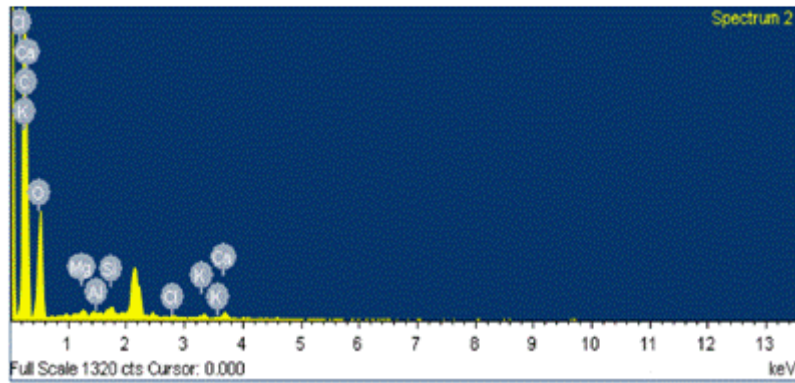
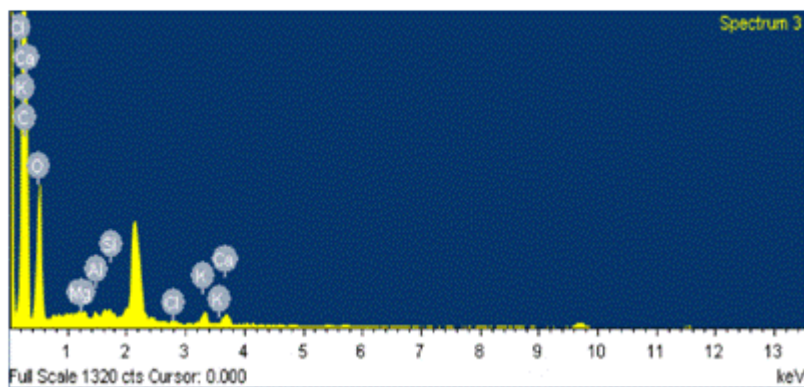


Figure-5: Cannabis Sativa Leaf Powder Intensity for Spectrum 3

Element	Spectrum 3
C	52.5
O	43.51
Mg	0.33
Al	0.33
Si	0.06
Cl	0.09
K	1.51
Ca	1.68

Table-1: Elements intensity of Cannabis Sativa Leaf Powder

Table-1 shows that, the presence of highest concentration of Carbon (C) and the minimum concentration are Si and Cl in Cannabis Sativa Leaf Powder.



Element	Spectrum 2
C	49.56
O	47.08
Mg	0.63
Al	0.10
Si	0.73
Cl	0.04
K	0.73
Ca	1.14

Table-2: Elements intensity of *Emblca Officinalis* Leaf Powder

The EDX spectrum of *Emblca Officinalis* Leaf Powder shown in Figure-6 and Table-2 represents the element intensity at different levels. The contents of different mineral are Carbon (49.56%), Oxygen (47.08%), Magnesium (0.63%), Aluminium (0.1%), Silicon (0.73%), Chloride (0.04%), Potassium (0.73%) and Calcium (1.14%).

Table-2 shows that maximum intensity of Carbon and the minimum intensity of Chlorine, Aluminium, Magnesium and Silicon are present in *Emblca Officinalis* Leaf Powder.

The XRD analysis of *Emblca Officinalis* Leaf Powder and Cannabis

Figure-6: *Emblca Officinalis* Leaf Powder Intensity graph for Spectrum 2

Sativa Leaf Powder are shown in Figure 7. The XRD diffraction is used for analysis of crystalline material and gives information about unit cell dimension and chemical composition of minerals.

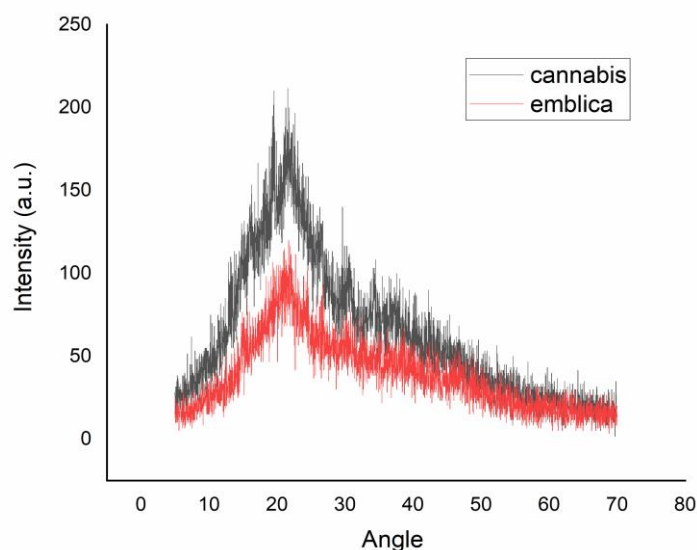


Figure-7: XRD Graph of Cannabis Sativa and Emblica Officinalis Leaf Powder

The XRD analysis of Cannabis sativa fresh material shows the presence of Aluminium carbide (Al_4C_3) at 2 theta value 21.30 (Referring JCPDS card no.03-065-9731), Sodium Germanium Fluoride Na_2GeF_6 at 2 theta value 19.58 (Referring CAS no.21087-90-1) and Copper (Cu) at 2 theta value 21.82 (Referring JCPDS card no.04-0836). The XRD analysis of Emblica officinalis fresh material shows the presence of Ammonium magnesium selenate hydrate $(NH_4)_2Mg(SeO_4)_2$ at 2 theta value 21.96, potassium calcium hydrogen phosphate $K_3CaH(PO_4)_2$ at 2 theta value 21.170 and Calcium aluminium silicate Ca_2Al_2SiO at 2 theta value 20.97.

RESULTS AND DISCUSSION :

pH	TDS (ppm)			TURBIDITY(NTU)		
	Initial	Final	Percentage Removal	Initial	Final	Percentage Removal
2	709	334	50.15	556	450	22.3
3	709	355	49.92	556	426	23.38
4	709	380	46.4	556	392	29.49
5	709	413	41.74	556	334	39.92
6	709	443	37.51	556	293	47.3
7	709	573	19.18	556	263	52.936
8	709	708	0.141	556	191	65.64
9	709	841	-18.61	556	149	73.2

It is found from the Table-3 that the percentage of Turbidity removal increases with an increase in pH. The maximum removal was 73.2 % at pH

9 and the minimum was at pH 2 i.e. 22.3%. On the other hand, TDS removal was found to be maximum at pH 2 (50.15%) and after pH 6 the % removal (37.51%) start decreasing that's why the experimental study was not carried out after pH 9.

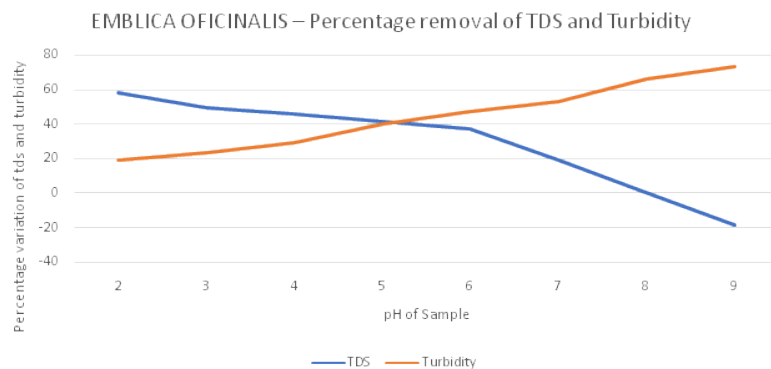
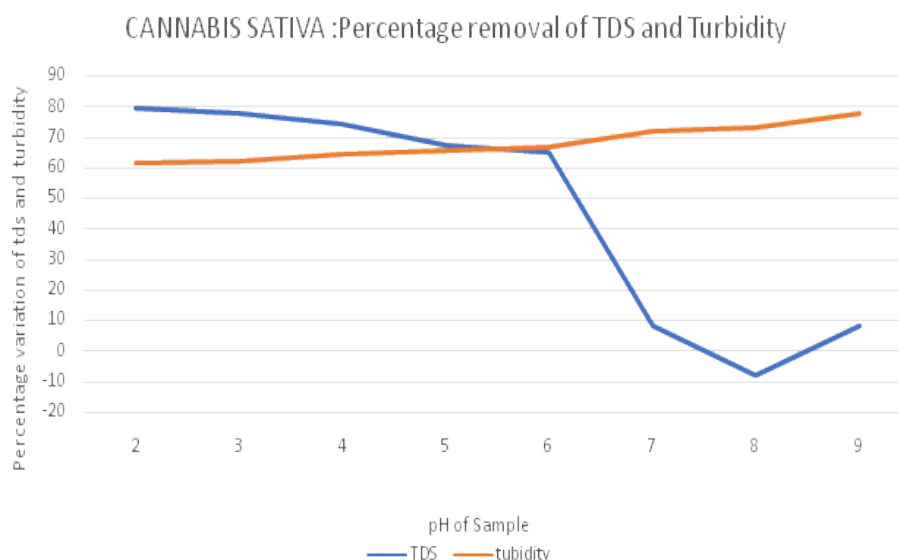


Figure-8 Percentage removal of TDS and Turbidity by Emblica Officinalis Leaf Powder

pH	TDS (ppm)			TURBIDITY(NTU)		
	Initial	Final	Percentage Removal	Initial	Final	Percentage Removal
2	709	359	79.4	556	252	61.33
3	709	283	77.71	556	211	62.05
4	709	383	74.18	556	199	64.02
5	709	232	67.27	556	186	65.46
6	709	247	65.16	556	156	66.54
7	709	352	8.03	556	149	71.94
8	709	767	-818	556	122	73.2
9	709	651	8.18	556	114	78.05

Table-4 Percentage removal of TDS and Turbidity by Cannabis Sativa Leaf Powder

It is found from the Table-4 that the percent Turbidity removal increases with an increase in pH. The maximum removal 78.05% was obtained at pH9 and the minimum was at pH2 i.e. 61.33%. On other hand, TDS removal was found to be maximum at pH 2 (79.4%) and after pH6 (65.16%) removal start decreasing that's why the experimental study was not carried out after pH9.



pH	TDS (ppm)			TURBIDITY(NTU)		
	Initial	Final	Percentage Removal	Initial	Final	Percentage Removal
2	556	263	62.9	556	306	44.9
3	556	373	47.39	556	290	47.84
4	556	269	62.05	556	199	64.2
5	556	185	73.9	556	186	66.54
6	556	242	65.86	556	175	68.52
7	556	179	74.75	556	243	56.29
8	556	562	20.73	556	478	14.02
9	556	590	16.78	556	500	10.07

Table-5 Percentage removal of TDS and Turbidity by Cannabis Sativa Leaf Powder and Emblica Officinalis Leaf Powder

It is found from the Table-5 that the percent Turbidity removal increases with an increase in pH. The maximum removal 68.52% was obtained at pH6 and the minimum was at pH9 i.e. 10.07%. On the other hand, TDS removal was found to be maximum at pH7 (74.75%) and after pH7 removal start decreasing that's why the experimental study was not carried out after pH9.

CANNABIS SATIVA AND EMBLICA OFFICINALIS PERCENTAGE REMOVAL OF TURBIDITY AND TDS

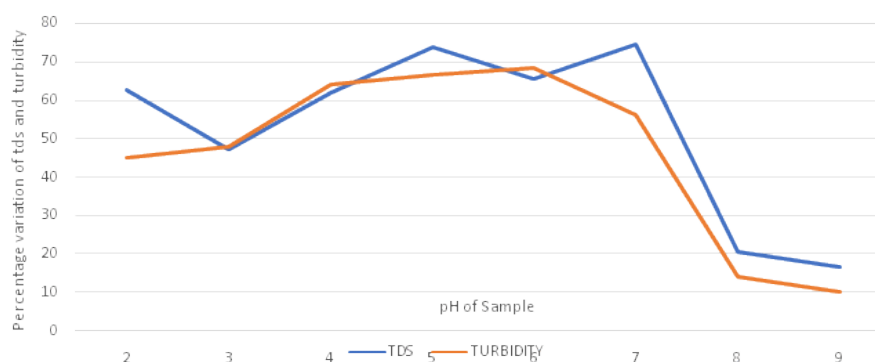


Figure-10 Percentage removal of TDS and Turbidity by Cannabis Sativa

4. CONCLUSION

It is concluded from this study that the *Cannabis Sativa* and *Embllica Officinalis* Leaf Powder are strong natural coagulants that can be used for the treatment of Turbidity and TDS containing wastewater. These substances proved to be efficient (more than 78.05% for Turbidity and 79.4% for TDS), low cost and natural coagulants for the removal of Turbidity, TDS, and other pollutants. The water treated with *Cannabis Sativa* and *Embllica Officinalis* Leaf Powder is much useful for further uses like irrigation, public uses parks, cleaning of roads etc. The scope of natural coagulants in water and waste treatment increasing day by day as compared to other chemicals.

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