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"Carica Papaya & Tamarindus Indica as Natural Coagulant for Treatment of Waste Water from Food Industry".

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Abstract - *Industrial pollutants are most harmful to the both environment and mankind. Treatment and disposal of industrial pollutants seems to be great risk for various industries due to its high pollutant concentration. In this study we are treating industrial waste water using natural coagulants such as Carica papaya and Tamarindus Indica.*

The experiments were conducted to determine the optimum dosage, contact time and proportion percentage of natural coagulants (Carica papaya, Tamarindus Indica.). The optimum dosage of Carica papaya and Tamarindus Indica was observed to be 2.5mg/L and 2.0mg/L respectively and the better combination was found to be 60%TI+40%CP mg/L.

***Key Words*: Carica Papaya, Tamarindus Indica, Coagulant, Food industry.**

1.INTRODUCTION

The total supply of fresh water on earth far exceeds human demand. About 96.5% of this water is in the oceans, and out of the remaining 3.5 %, only about 2.5 % is the accessible as freshwater that can be used for human demand. The foremost use of water by humans is for the biological survival. However, water need for the biological survival is not the only issue being discussed in the progressing world today.

To cater the increasing population in the present-day scenario it is important to balance the needs of the increasing demography with demand and supply. Therefore, it becomes more important to think in a more sustainable approach w.r.t to recycling of the generated waste water from the industries with more efficient and sustainable treatment methods/practices.

In India, the average water footprint for food consumption is about 800 m3/cap/year. The biggest water use in the food industry is cleaning, processing equipment and food products. This can account for up to 70% of a factory's water usage.

2. Food Processing Industrial Waste

The industrial processes inevitably result in uncontrollable and high production of wastewater which if not treated properly will contaminate the environment. There are many factories contributing to industrial wastewaters such as metal industry, complex organic chemicals industry, and food industry. Industrial wastewaters are considerably diverse in their nature, toxicity and treatability, and normally require pre-treatment before being discharged to sewer.

Food processing in particular is very dissimilar to other types of industrial wastewater, being readily degradable and largely free from toxicity. However, it usually has high concentrations of (BOD) and suspended solid. Compared to other industrial sectors, the food industry uses a much greater amount of water for each ton of product. One of a well-known food industry, chips industry, is also getting bigger in India throughout the years.

The process for chips or any other food processing plants normally uses immense volume of water, yielding large amounts of wastewater that must be treated. Excessive water uses and wastewater production results in economic and environmental burdens to the industry. The wastewater produced could be treated and recycled to the process.

2.1 Problem statement

The food manufacturing wastewater contains high concentrations of several organic compounds including carbohydrates, starches, proteins, vitamins; pectin's and sugars which are accountable for high chemical oxygen demand (COD) and suspended solids. The wastewater resulted from a series of processes (cleaning, cutting, slicing, washing, frying, salting, coating and packing) is one of the significant sources in environmental pollution. The produced wastewater streamed with different levels of pollution load (low, medium and high contamination) are normally collected and treated in an on-site installation or in a municipal sewage treatment plant.

3. OBJECTIVES

The objective of this study is:

- To determine the efficiency of Carica Papaya & Tamarindus Indica seed as natural coagulant in reducing the higher concentration of BOD, TSS, TDS and Turbidity.
- To determine the effect on various physio-chemical parameters by varying absorbent dosage and contact time.

4. MATERIALS AND METHODOLOGY

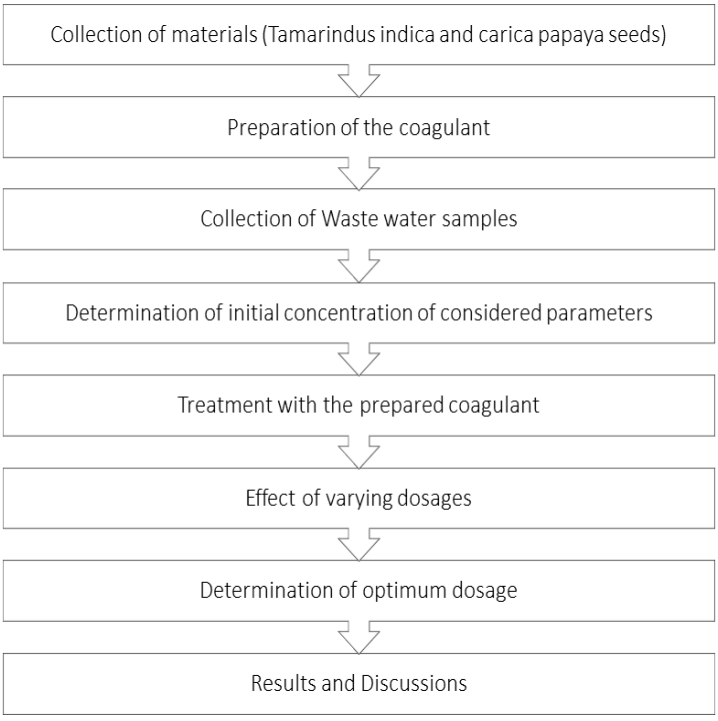
4.1 COAGULANTS PREPARATION

- **Tamarindus Indica**: Fresh seeds of Tamarind (leguminous tree) of the Fabaceae indigenous family were purchased from local vendors or markets. The seeds were washed thoroughly with water, sun-dried for a week, sorted to remove bad ones, shelled, grinded with an electric blender, The crushed seed powder is made to pass through 150 - micron sieves and stored ready for further analysis. The finer particles were then used as the coagulant.
- **Carica Papaya:** Papaya was obtained from the local market. Its seeds were collected and repeatedly washed to remove impurities, followed by oven drying at 110˚C for 10 hours. Dried seeds were then crushed and sieved to obtained papaya seeds powder pass through 150 - micron sieves.

4.2 COLLECTION OF FOOD INDUSTRY WASTE WATER

Grab sample: A sample collected at a particular time and place can represent only the composition of the source at that time and place. When a source is known to vary in time, grab samples collected at suitable time intervals and analyzed separately can be greater value.

4.3 METHODOLOGY



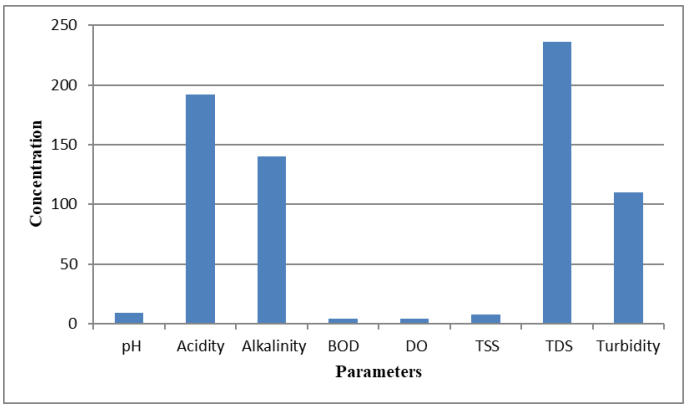
5. RESULTS AND DISCUSSIONS

5.1 RESULTS

Table -1: Initial results

Initial tests results			
SL NO	**Parameters**	**Unit**	**Initial results**
1.	pH	No Unit	9.0
2.	Acidity	mg/L	192
3.	Alkalinity	mg/L	140
4.	BOD	mg/L	3.94
5.	DO	mg/L	3.94
6.	TSS	mg/L	8
7.	TDS	mg/L	236
8.	Turbidity	NTU	110

This chapter presents analysis, results and discussions of parameters of water samples collected from Food processing industry. The Initial results obtained from laboratory are shown with the help of table and graph as below:



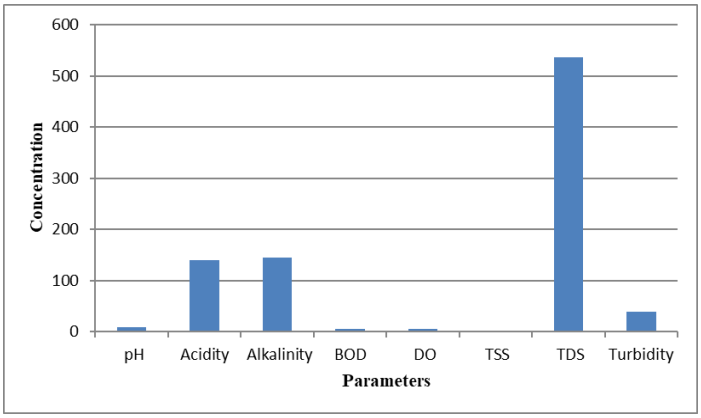
Graph -1: Graphical representation of Initial parameters results

The above graph shows the initial results of the parameters consider. Parameters is taken along X- axis and Concentration along Y- axis. The initial reading of pH 9.0, Acidity 192mg/L, Alkalinity 140mg/L, BOD and DO 3.94mg/L, TSS 8.0mg/L, TDS 236 ppm, Turbidity 110 NTU for water sample.

5.2 EFFECT OF CARICA PAPAYA AND TAMARINDUS INDICA SEEDS POWDER DOSAGE RESULTS

5.2.1 Carica papaya Seeds powder

Sl no	Dosage mg/L	pH	Acidity mg/L	Alkalinity mg/L	BOD mg/L	Do mg/L	TSS mg/L	TDS ppm	Turbidity NTU
1	0.5	9	172	168	2.46	2.46	8	528	78
2	1.0	9	164	164	3.45	3.45	8	531	74
3	1.5	8.8	156	156	3.75	3.75	4	534	65
4	2.0	8.7	148	152	4.10	4.10	0	536	52
5	2.5	8.6	140	144	4.45	4.45	0	536	39
6	3.0	9.1	136	140	4.64	4.64	0	540	47

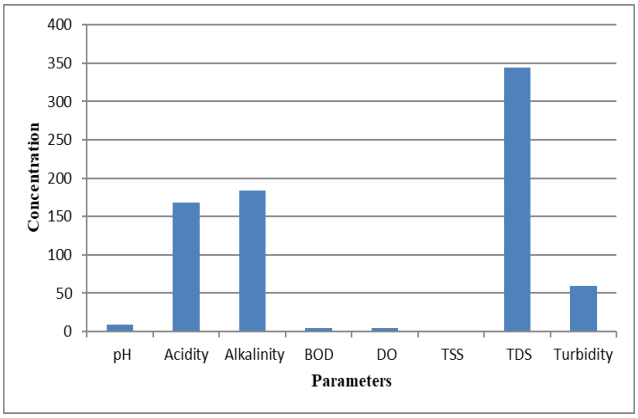


Graph -2: Graphical representation of Carica papaya Seeds powder parameters Dosage results

The above graph shows the effect of varying dosage of Carica papaya on parameters in consideration. In the above graph parameters is taken along X- axis and concentration is taken along Y- axis. Due to the optimum dosage consideration 2.5mg/L. The concentration the pH is reduced from 9.0 to 8.6 , Acidity reduced form 192 to 140mg/L , Alkalinity increased from 140 to 144mg/L, BOD & DO is increased from 3.94 to 4.45mg/L, TSS is reduced from 8 to 0mg/L , TDS is increased from 236 to 536ppm and Turbidity is reduced from 110 to 39 NTU for the dosage 2.5mg/L. We can see better reduction in the excess concentration values for the above dosage.

5.2.2 Tamarindus indica Seeds powder

Sl no	Dosage mg/L	pH	Acidity mg/L	Alkalinity mg/L	BOD mg/L	Do mg/L	TSS mg/L	TDS ppm	Turbidity NTU
1	0.5	9.2	192	168	3.45	3.45	8	330	72
2	1.0	9.2	196	156	3.84	3.84	8	342	70
3	1.5	9.1	184	168	4.34	4.34	8	344	67
4	2.0	8.8	168	184	4.73	4.73	0	344	59
5	2.5	8.6	156	196	5.03	5.03	8	342	69
6	3.0	8.6	152	192	5.33	5.33	8	342	70



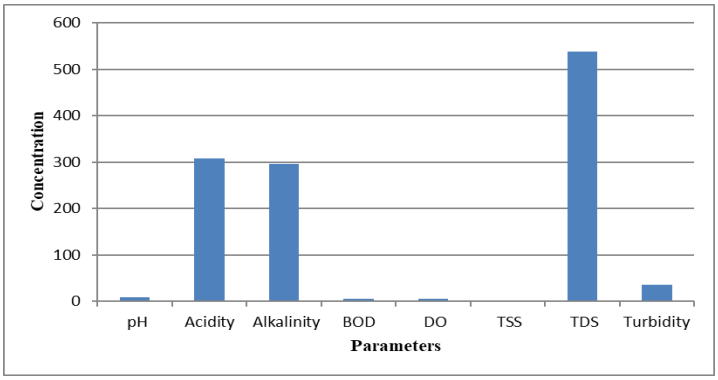
Graph -3: Graphical representation of Tamarindus indica Seeds powder parameters dosage results

The above graph shows the effect of varying dosage of Tamarindus indica on parameters in consideration. In the above graph parameters is taken along X- axis and concentration is taken along Y- axis. The concentration of pH is reduced from 9 to 8.8, Acidity reduced from 192 to 168mg/L , Alkalinity increased from 140 to 184mg/L, BOD & DO is increased from 3.94 to 5.03mg/L, TSS is reduced from 8 to 0mg/L , TDS is increased from 236 to 344ppm and Turbidity is reduced from 110 to 59 NTU as compared to initial reading for the dosage of 2.0mg/L. We can see better reduction in the excess concentration values for the above dosage.

5.3 EFFECT OF CARICA PAPAYA AND TAMARINDUS INDICA SEEDS POWDER CONTACT TIME RESULTS

5.3.1 Carica papaya Seeds powder

Sl no	Contact time (mins)	pH	Acidity mg/L	Alkalinity mg/L	BOD mg/L	Do mg/L	TSS mg/L	TDS ppm	Turbidity NTU
1	5	8.6	316	300	4.48	4.48	0	536	38
2	10	8.6	256	288	4.73	4.73	0	538	37
3	15	8.6	307	296	4.78	4.78	0	538	36
4	20	8.6	296	288	4.48	4.48	0	537	36
5	25	8.6	300	256	4.44	4.44	0	537	38
6	30	8.6	288	288	4.44	4.44	0	538	38

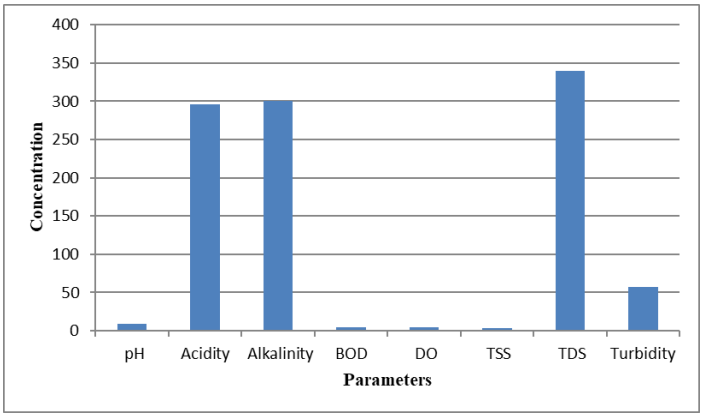


Graph -4: Graphical representation of Carica papaya Seeds powder parameters contact time results

The above graph shows the effect of varying dosage of Carica papaya on parameters in consideration. In the above graph parameters is taken along X- axis and concentration is taken along Y- axis. The concentration the pH is reduced from 9 to 8.6 , Acidity is increased from 192 to 296mg/L , Alkalinity is increased from 140 to 288mg/L, BOD & DO is increased from 3.94 to 4.48mg/L, TSS is reduced from 8 to 0mg/L , TDS is increased from 236 to 537ppm and Turbidity is reduced from 110 to 36 NTU for the contact time of 20min. We can see better reduction in the excess concentration values for the above contact time.

5.3.2 Tamarindus indica Seeds powder

Sl no	Contact time	pH	Acidity mg/L	Alkalinity mg/L	BOD mg/L	Do mg/L	TSS mg/L	TDS ppm	Turbidity NTU
1	5	8.8	336	296	4.73	4.73	0	344	59
2	10	8.8	288	256	4.58	4.58	4	340	59
3	15	8.7	296	300	4.68	4.68	4	340	57
4	20	8.6	288	296	4.48	4.48	4	340	58
5	25	8.8	328	300	4.44	4.44	4	338	57
6	5	8.8	336	296	4.73	4.73	0	344	59



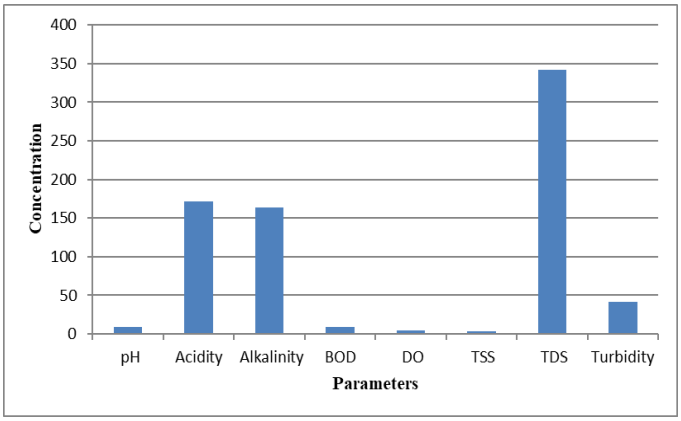
Graph -5: Graphical representation of Tamarindus indica Seeds powder parameters contact time results

The above graph shows the effect of varying dosage of Tamarindus indica on parameters in consideration. In the above graph parameters is taken along X- axis and concentration is taken along Y- axis. The concentration the pH is reduced from 9 to 8.7, Acidity is increased from 192 to 296mg/L , Alkalinity is increased from 140 to 300mg/L, BOD & DO is increased from 3.94 to 4.45mg/L, TSS is reduced from 8 to 4mg/L, TDS is increased from 236 to 340ppm and Turbidity is reduced from 110 to 57 NTU for the contact time of 15min.

We can see better reduction in the excess concentration values for the above contact time.

5.4 Effect of Carica Papaya seeds powder+ Tamarindus Indica seeds powder Dosage Results

SL. No	Dosage mg/L	pH	Acidity mg/L	Alkalinity mg/L	BOD mg/L	Do mg/L	TSS mg/L	TDS ppm	Turbidity NTU
1	80%CP+ 20%TI	9.2	192	184	11.54	11.54	4	329	59
2	60%CP+ 40%TI	9.0	184	168	9.37	9.37	4	342	57
3	20%CP+ 80%TI	8.8	172	164	8.58	8.58	4	342	42
4	60%TI+ 40%CP	8.6	164	156	7.59	7.59	4	344	52
5	80%CP+ 20%TI	9.2	192	184	11.54	11.54	4	329	59
6	60%CP+ 40%TI	9.0	184	168	9.37	9.37	4	342	57



Graph -6: Graphical representation of Carica Papaya seeds powder+ Tamarindus Indica seeds powder Dosage Results parameters results

The above graph shows the result of Carica papaya & Tamarindus indica dosage considered in varying proportions. on In the above graph parameters is taken along X- axis and concentration is taken along Y- axis. The concentration the pH is reduced from 9.0 to 8.6 , Acidity reduced from 192 to 164mg/L , Alkalinity increased from 140 to 156mg/L, BOD & DO is increased from 3.94 to 7.59mg/L, TSS is reduced from 8 to 4mg/L , TDS is increased from 236 to 344ppm and Turbidity is reduced from 110 to 52 NTU for the combination of 60%TI+ 40%CP. We can see better reduction in the excess concentration values for the above dosage.

6. CONCLUSIONS

By using Carica papaya seed powder as a natural coagulant, it is observed that better results were witnessed for the dosage of 2.5mg/L. By using Tamarindus indica seed powder as a natural coagulant, it is observed that better results were witnessed for the dosage of 2.0mg/L By using Carica papaya seed powder as a natural coagulant, it is observed that better results were witnessed for the contact time of 20mins.

By using Tamarindus indica seed powder as a natural coagulant, it is observed that better results were witnessed for the contact time of 15mins. By using Carica papaya + Tamarindus indica seed powder as a natural coagulant, it is observed that better results were witnessed for the dosage 60%TI+40%CPmg/L.

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