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EXPERIMENTAL INVESTIGATION ON TREATMENT OF DAIRY WASTEWATER USING NATURAL COAGULANTS

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Abstract –*The aim of the project is to investigate the technical feasibility of treating dairy wastewater with natural coagulants. Increase in demand for milk and milk products, many dairies of different sizes have come up in different places mainly in villages. Large quantity of wastewater originates due to their different operations like packing milk, butter milk, Yogurt preservating process by using chemicals, producing different milk product like paneer, cheese, butter etc,. As such, the dairy wastes, is biodegradable are very strong in nature. These industries wastewater is defined by high COD, BOD, nutrients etc. Such wastewater is to be treated by three process namely biological process, chemical process, physical process. But in this project we are using natural coagulants due to its adsorption efficiency, economy and eco-friendly and then the tests are to be conducted to check the water characteristics like BOD, COD, pH and turbidity, etc. The Natural coagulants used in this process are Sennaauriculate, Strychnospotatorum, Phyllanthusemblica, Carica papaya seeds are easily available raw material and easy to prepare for the adsorption process. For variation of doses of these natural coagulants and the reduction of solids takes place in the process. In this experimental study after determination of the initial parameters of the pH, Turbidity,COD,BOD,Chlorides, Sulphates it was subjected to adsorption study using natural coagulants.*

***Key Words*:**pH, Turbidity, BOD ,COD, DO, TDS, Dairy Wastewater, Natural coagulants.

1. INTRODUCTION

The Dairy industry is generally considered to be the largest source of food processing waste water in many countries. Although the dairy industry is not commonly associated with severe environmental problems, it must continually considered its environmental impact-particularly as dairy pollutants are mainly of organic origin. At present, in order to decrease waste hazards and to restrict the resulted effects on the environmental, investigators studying the possibility of using natural coagulant to treat waste dairy water. All steps in the dairy chain, including production, processing, packing, transportation, storage, distribution and marketing, operation creates waste of different quality and quantity which, if not treated could lead to increase disposal and severe pollution problems. In general, waste from the dairy processing industry contain high concentration of organic materials such as proteins, carbohydrates and lipids, suspended solids, high biological oxygen demand(BOD) and chemical oxygen demand (COD), high nitrogen concentration, high suspended oil or grease contents and large variations in pH, which necessitates "specially" treatment so as to prevent or minimize environmental problems, many plants have been used to treat wastewater. These include *Sennaauriculate*, *Strychnospotatorum, Phyllanthusemblica, Carica papaya* these are very efficient natural coagulants. Naturally occurring coagulants are usually presumed safe for human health, use of natural coagulants gives considerable savings in chemical and sludge handling cost may be achieved, the level of treatment is normally by environmental regulations applicable to the specific area, while most larger dairy factories have installed treatment plants or if available, dispose of their waste water into municipal sewers, cases of waste water disposal into the sea or disposal by means of land irrigation do occur. In contrast, most smaller dairy factories dispose of their waste water by irrigation into agricultural lands or pastures surface and groundwater pollution is therefore, a potential threat posed by these practices.

1.1 Characteristic of Wastewater

The dairy waste water to be treated, these industries waste water characterized by high COD, BOD, nutrients etc., Dairy industry, one of the largest types of food industry, contributes to a great extent to pollution with pollutant being organic in nature normally consisting of 1/3 dissolved,1/3 colloidal, and 1/3 suspended substance. The dairy industry in India arises as the largest industry to have maximum waste generation and related environmental problems are increasing importance. Water is used in all processes in the dairy industry in the ratio of 1:10(water:milk) per litre of milk, containing high concentration of organic materials. Adsorption technique emerges as promising techniquein the removal efficiency(COD) economy and operation.

Table – 1: Characteristic of Dairy Wastewater

Parameters	Initial value (untreated)
PH	8
Turbidity (NTU)	690
Total dissolved solids (mg/l)	380
Totalsuspended solids (mg/l)	784
BOD (mg/l)	460
COD (mg/l)	1100
Dissolved oxygen (mg/l)	370
Chlorides(mg/l)	750
Sulphates(mg/l)	759

2. MATERIALS AND METHODOLOGY

2.1 Collection of Diary Wastewater

Dairy water samples were collected from the local dairy industry. The physico-chemical characteristics of samples were analysed samples of dairy effluent were collected in clean can of 5liter capacity.

2.2 Collection of Natural Coagulant

The coagulant which is used in the study to treat dairy wastewater is flowers *of Sennaauriculate,* seed of*Strychnospotatorum,* seed of*Phyllanthusemblica,* seed of*Carica papaya.* These natural coagulant has the adsorption properties and are low in cost. These natural coagulant are collected from the local markets of Erode, Tamil Nadu, India.

Fig -1: Sennaauriculate

Fig -2: Strychnospotatorum

Fig -3: Phyllanthusemblica

Fig -4: Carica papaya

2.3 Preparation of Natural Coagulants

The natural coagulant such as flowers of *Sennaauriculate,* seed of *Strychnospotatorum*, seed of *Phyllanthusemblica*, seed of *Carica papaya* are collected from the local market and the collected specimens are dried in natural sunlight. The specimens are dried atleast for 30 days till it get dry. The dried specimens are grained into fine powder by using home blenders. And then the grained specimens are sieved through 600µm sieve. These sieved specimen are used as a natural coagulant to treat dairy waste water.

2.3.1 Sennaauriculate

Sample of *sennaauriculate* is collected and washed several times with distilled water and then sun dried for 48 hours to remove the moisture content and they were grinded and used as absorbent.

2.3.2 Phyllanthusemblica

Samples of *phyllanthusemblica* is collected bark was washed with tap water. Removed easily and sun dried for 3 days. Completely dried bark was cut into small pieces and washed with double distilled water. Washed bark was again sun dried for a day. The cut pieces of bark were grounded and sieved through 600 µm.

2.3.3Carica papaya

Carica papaya seeds were collected from the market. The fruits were sliced open using a clean knife, seeds were taken and washed severally with water. Then the seeds were dried under sunlight for 7 days before crushing. The seed were made into fine powder using home grinder and sieved through a size of 600µm. Powder are collected and finer particles are used as coagulant.

2.3.4 Strychnospotatorum

The *Strychnospotatorum* plant seed were collected and dried at room temperature for 2 – 3 days and further dried at 60℃.The extracts seed are filtered with the Whattman filter paper and then dried by using rotary evaporator. The collected powder are sieved through the size of 600 micron.

2.4 Coagulation

Coagulation tests were carried out using a jar apparatus test. The most widely applied method for evaluating and optimizing the coagulation – flocculation process based on standard methods. The dosage of four jars of 1000ml are taken and a known amount of adsorbent 2gm, 4gm, 6gm, 8gm, 10gm are added in dairy waste water. The initial speed for agitation is 5min of rapid mixing 120rpm followed by 30 min of slow mixing 45rpm for

flocculation.Then, the treated water was allowed to settling time for this coagulation process is 45 min.

3. RESULT AND DISCUSSION

3.1 Dosage

The optimum dosage of coagulants are determined by varying the coagulants dosage of *Sennaauriculate, Strychnospotatorum, Phyllanthusemblica, Carica papaya* are 2gm, 4gm, 6gm, 8gm, 10gm for 1litre of dairy waste water respectively.

The coagulant dosage and respective parameter such as turbidity, BOD, COD, DO, chlorides, sulphates etc. are tabulated as follows:

Table – 3.2: Characteristic Of Treated waste water Using *Sennaauriculate*

Parameters	2g/l	4g/l	6g/l	8g/l	10g/l
pH	7.79	7.68	7.62	7.48	7.31
Turbidity (NTU)	178	170	165	158	142
Total dissolved Solids (mg/l)	1022	1005	987	930	915
Total suspended solids (mg/l)	110	98	82	75	70
BOD(mg/l)	98	95	89	78	76
COD(mg/l)	290	278	274	250	248
DO(mg/l)	328	331	339	341	358
Chlorides (mg/l)	454	444	423	410	392
Sulphates (mg/l)	484	474	456	442	412

Table – 3.3: Characteristic Of Treated waste water using *Strychnospotatorum*

Parameters	2g/l	4g/l	6g/l	8g/l	10g/l
pH	7.83	7.46	7.38	7.27	7.16
Turbidity (NTU)	120	106	94	89	72
Total dissolved Solids (mg/l)	1090	999	978	952	923
Total suspended solids (mg/l)	110	99	89	82	76
BOD(mg/l)	97	91	88	78	72
COD(mg/l)	210	189	174	168	143
DO(mg/l)	350	359	365	372	375
Chlorides (mg/l)	445	422	410	390	387
Sulphates (mg/l)	460	451	447	440	436

Table – 3.4: Characteristic Of Treated Wastewater using *Phyllanthusemblica*

Parameters	2g/l	4g/l	6g/l	8g/l	10g/l
PH	7.79	7.74	7.53	7.42	7.23
Turbidity (NTU)	159	132	126	112	82
Total dissolved Solids (mg/l)	1008	1001	992	971	953
Total Suspended Solids (mg/l)	118	102	93	87	71
BOD (mg/l)	92	87	81	77	75
COD(mg/l)	182	171	166	157	150
DO(mg/l)	328	330	337	342	350
Chlorides (mg/l)	472	459	439	421	396
Sulphates (mg/l)	495	469	451	423	394

Table – 3.5: Characteristic Of Treated Waste water using *Carica papaya*

Parameters	2g/l	4g/l	6g/l	8g/l	10g/l
pH	7.81	7.79	7.63	7.54	7.41
Turbidity (NTU)	143	138	121	114	97
Total dissolved solids (mg/l)	1190	1182	1163	1054	1028
Total suspended solids (mg/l)	390	372	347	322	295
BOD (mg/l)	98	92	84	79	72
COD (mg/l)	189	172	167	160	156
DO (mg/l)	314	325	327	330	335
Chlorides (mg/l)	478	472	465	431	413
Sulphates (mg/l)	491	474	442	414	392

3.2 Graphical Representation of Effect of Dairy Industry Wastewater

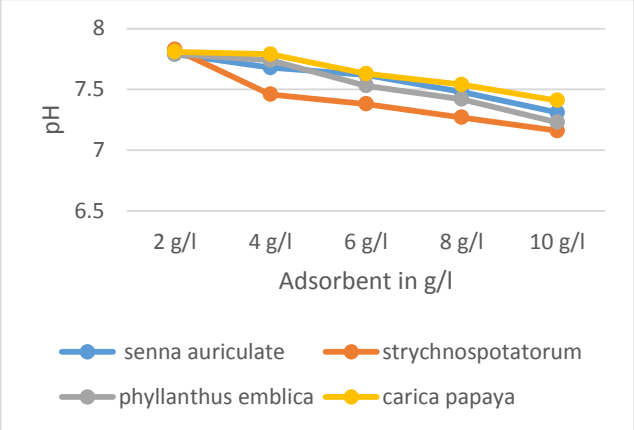

Chart -1: Graphical representation of variation in PH value of treated dairy wastewater

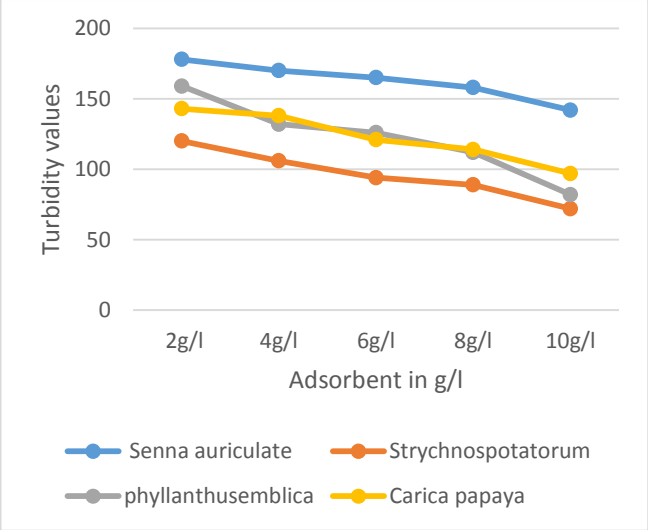

Chart -2: Graphical representation of variation in Turbidity of treated dairy wastewater

3.3. Percentage Of Removal Efficiency

The experimental test were carried out for varying parameters to find the percentage of removal efficiency by using natural coagulants such as sennaauriculate, strychnospotatorum, phyllanthusemblica, carica papaya is the adsorbent. The following formula was used to determine the removal efficiency.

% Removal efficiency = $\frac{C_o - C_e}{C_o} * 100$

Where,

C_o – Initial level of concentration

C_e – Final level of concentration

4. CONCLUSION

As the waste water from the dairy industry causes environmental and health problems proper treatment is necessary the use of natural coagulant from plant based sources represents a vital development in sustainable environmental technology as it focuses mainly on the improvement of quality of life for under developed communities. A natural coagulant *Sennaauriculate, Strychnospotatorum, Phyllanthusemblica, Carica papaya*. Color and odour removal is highly efficient by using all the adsorbents by increasing the dosage. pH of the collected dairy waste water is 8 and it is reduced to 7.31, 7.16, 7.23, 7.41 and then it gets increase in dosage when decreased in pH. Removal of efficiency of turbidity are 79.4%, 89.5%, 88%, 85.9% for natural coagulants at 10mg/l then the efficiency is reduced when the dosage is increased. Hence, the present study shows that the *strychnospotatorum*seed powder is more effective than the *sennaauriculate, Phyllanthusemblica, Carica papaya* in treating the dairy industry wastewater.

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