

# Dairy Waste Water Treatment By Natural Coagulant Cicer Arietinum

Navami. D<sup>1</sup>, Neethu. P<sup>2</sup>, Anitha. K<sup>3</sup>

Department of Environmental Engineering  
1,2,3 MCET

**Abstract-** The dairy industry is mainly considered to be largest source for food processing. These industries wastewater contain high COD, BOD, nutrients etc. Such wastewater is to be treated with natural coagulants and check the water characteristics like BOD, COD, pH and turbidity, etc are being analyzed. Natural coagulant used for treatment is Cicer arietinum seeds. The optimum coagulant dosage obtained is 0.4g/ml. There is not much change in pH and conductivity due to natural coagulants. The reduction of turbidity is 80.89%, reduction in BOD<sub>3</sub> is 69.70%, reduction in COD is 69.70%, reduction in total dissolved solids is 11.14% and reduction in total suspended solids is 89.10%. The efficiency of Cicer arietinum is compared with artificial coagulant alum and efficiency of Cicer arietinum depends upon the protein content which is present in the natural coagulant. The increase of dosage causes the increase of turbidity

**Keywords-** BOD-Biochemical oxygen demand, COD-Chemical oxygen demand, TDS-Total dissolved solids

## I. INTRODUCTION

Water resources are sources of water that are being potentially used. Water is used for agricultural, industrial, household, recreational and environmental activities. 97% of water on earth is salt water and 3% is fresh water. The sources of fresh water are surface water like river, lake or fresh water wet land, under river flow, ground water, frozen water, desalination. Water scarcity is the lack of sufficient water resources to meet water. More than 1.2 billion people lack availability of clean drinking water. Water scarcity involves water stress, water shortage, and water crisis. Water shortage caused by climate change, such as altered weather, increased pollution, and increased human demand and overuse of water. A water crisis is a situation where the available potable, unpolluted water within a region is less than region's demand. Streams are polluted by point sources, urban runoff, sewage, power plants, mining, sediments etc.

The dairy industry is generally considered to be the largest source of food processing wastewater in many countries. Dairies collect milk from the producers, simply bottle it for marketing, or produce different milk foods. Large quantity of

dairy wastewater originates from different operations. The organic substances in the wastes comes either in the form in which they were present in milk, or in a degraded form due to their processing.

Dairy is one of the industries producing waste water rich inorganic matter and creates odor and high COD containing water. Dairy cleaning waters contain sterilizing agents and various acid and alkaline detergents. Thus, pH of the dairy waste waters can vary.

Dairy wastewaters are characterized by high biochemical oxygen demand (BOD) and chemical oxygen demand (COD) concentrations. It also contains total solids, total dissolved solids, nitrogen and phosphorous. Turbidity imparts a great problem in dairy waste water treatment. Important indicators for the quantification of organic load of dairy plant effluents are biological oxygen demand (BOD), chemical oxygen demand (COD), the ratio of COD to BOD indicates the biodegradability of organic materials under aerobic or anaerobic condition.

Coagulants are components that are used for removing turbidity in water treatment process. Coagulants are classified into artificial, inorganic, synthetic organic polymers and natural coagulants. Cicer arietinum is one of the commonly used coagulant in treating drinking water and it is also used as disinfectant in drinking water treatment.

The purpose of dairy waste water treatment using natural coagulants is to find out the parameters such as color, turbidity, pH, BOD, COD, total dissolved solids, total suspended solids.

## II. RESEARCH

Coagulation is a chemical water treatment technique that is applied prior to sedimentation and filtration to enhance the ability of a treatment process for removing particles. In dairy water treatment, coagulation occurs when a coagulant is added to water to "destabilize" colloidal suspensions. Factors effecting coagulation are temperature, residual aluminum, sequence of chemical addition, rapid mixing, and pH.

Widely used artificial coagulants are Aluminum sulphate {Alum}, Poly aluminum chloride {PAC}, Ferrous sulphate, Sodium Aluminate, Silicon Derivatives, Lime, Synthetic Organic Polymers. Alum and PAC are extensively used in water treatment. Natural coagulants are not available in usable form and it needs to be prepared. This is usually done just before the process to keep the coagulant fresh. Coagulation with extracts from natural and renewable vegetation has been mostly used. There are variety of natural coagulants used around the world, depending on their availability.

Cicer arietinum seeds are large in size, salmon-white in color, and also contain high levels of carbohydrate (41.10–47.42%) and protein (21.70–23.40%). Starch is the major carbohydrate fraction, representing about 83.9% of the total carbohydrates. The chemical composition of Cicer arietinum is contains ash 3.1 +/- 0.2, fat 5.0 +/- 1.0, protein 19.5 +/- 1.2 and fiber 3.7 +/- 2.1. Chickpea (Cicer arietinum.) seed is a potential source of protein ingredients with high nutritional and functional properties.

Proteins of ground chickpea seed are being extracted with sodium hydroxide and citric acid solutions and then precipitated with addition of acid and by cryoprecipitation. The protein contents of the protein preparation ranges from 49% to 97%. The microstructures of chickpea protein are examined by scanning electron microscope (SEM) reveals that the presence of starch grains in the cryoprecipitates from citric acid extraction but not in isoelectric precipitates. It joins with the solid in the water and sinks to the bottom. So can remove 85% of turbidity.

The coagulant which is used is Cicer arietinum for treatment of dairy wastewater. The natural coagulant is collected from the Perinjalam market. The dairy waste water is collected from Cattle Feed Plant (MILMA) Kerala Co-operative Milk Marketing Federation Ltd Ramavarmapuram in Thrissur district.

The seed pods of Cicer arietinum is being collected, and then dried naturally by sunlight. And remove the seeds from the pod manually. The dried seeds are ground to fine powder by domestic blender. This powder is then sieved through 600µm sieve. This powdered Cicer arietinum is used as coagulant for dairy waste water treatment.

### III. FINDINGS

#### 3.1 Initial characteristics of dairy waste water

The initial characteristics of dairy waste water such as pH, turbidity, BOD3, COD, total dissolved solids, total suspended solids, color are being observed. Initial characteristics of dairy waste water is being analyzed and is given in table 1

Table 1 Initial characteristics of dairy waste water

Parameters	Unit	Initial value
pH	-	5.7
Turbidity	NTU	313.0
BOD3	mg/l	1720.0
COD	mg/l	3760.0
Total dissolved solids	mg/l	619.0
Total suspended solids	mg/l	8216.5
Colour	-	Thick off white

The coagulant Cicer arietinum is used at various dosages and the corresponding values of turbidity and optimum pH is being analyzed in table 2

Table 2 Optimum turbidity and pH for corresponding coagulant dosage

Coagulant dosage (gm/l)	Turbidity (NTU)	pH value
0.05	79.5	6.2
0.1	100.0	7.1
0.2	84.9	7.3
0.3	67.8	7.3
0.4	59.6	7.3
0.5	59.8	7.5

#### 3.2 Optimum dosage

The optimum dosage of coagulants are determined by varying the dosage of coagulant are 0.05gm, 0.1gm, 0.2gm, 0.3gm, 0.4gm, 0.5gm at original pH of dairy wastewater (pH =5.7). The optimum coagulant dosage adopted for natural coagulant Cicer arietinum is 0.4gm.

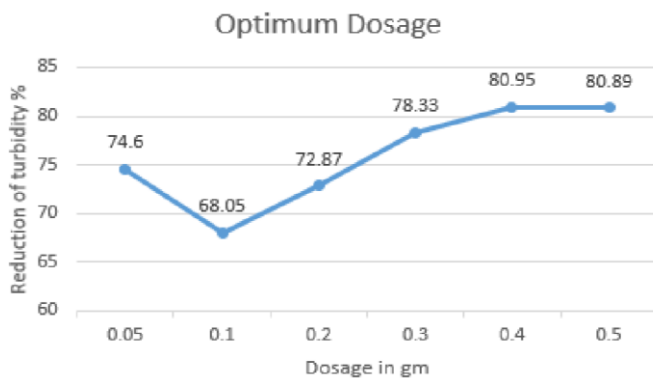


Chart 1 Optimum Dosage

**A. 3.3 Optimum pH**

Optimum pH is pH at which the maximum reduction of turbidity takes place. Optimum pH can be determined by varying the pH value as 6.2, 7.1, 7.3, 7.3, 7.3 and 7.5. The optimum pH adopted for natural coagulant *Cicer arietinum* is 7.3.

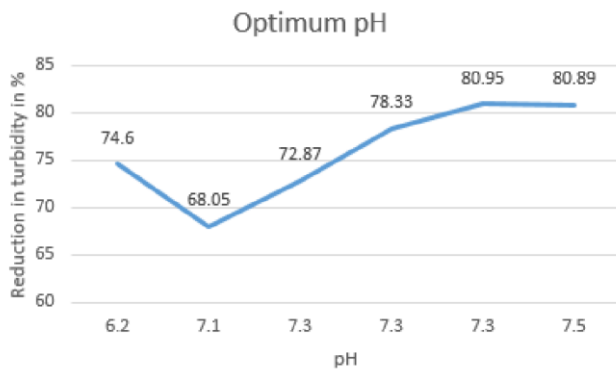


Chart 2 Optimum pH

Dairy waste water is being treated with coagulant *Cicer arietinum* with optimum dosage of 0.4gm/l, and final characteristics of treated dairy waste water is being analyzed in table 3.

Table 3 Final characteristics of treated dairy waste water using optimum coagulant dosage

Parameters	Unit	Final value
pH	-	7.3
Turbidity	NTU	59.8
BOD <sub>3</sub>	mg/l	521.0
COD	mg/l	1344.0
Total dissolved solids	mg/l	550.0
Total suspended solids	mg/l	896.0
Color	-	Light off white

**B. 3.4 Efficiency of *Cicer arietinum***

To determine the efficiency of *Cicer arietinum*, the optimum dosage and optimum pH can be maintained. Optimum dosage is 0.4gm/l and optimum pH is 7.3. The reduction in turbidity for the dairy wastewater is 80.89%, reduction in BOD<sub>3</sub> is 69.70%, reduction in COD is 69.70%, reduction in total dissolved solids is 11.14% and reduction in total suspended solids is 89.10% by the influence of the natural coagulant *Cicer arietinum*.

**IV. CONCLUSION**

The characteristics of untreated dairy wastewater are pH is 5.7, COD is 3760.0mg/l, BOD<sub>3</sub> is 1720.0mg/l, total dissolved solids is 619.0mg/L, total suspended solids is 8216.5mg/l, turbidity is 313NTU. The optimum dosage of *Cicer arietinum* seed powder as a coagulant is found to be 0.4mg/l. The optimum pH of *Cicer arietinum* is found to be 7.3. The reduction of turbidity is 80.89%, reduction in BOD<sub>3</sub> is 69.70%, reduction in COD is 69.70%, reduction in total dissolved solids is 11.14% and reduction in total suspended solids is 89.10%. Maximum removal of turbidity is obtained from *Cicer arietinum* plant with parts that have high active coagulation extract yields which contain recognized active coagulant agents including galacturonic acid. The efficiency of *Cicer arietinum* depends upon the protein content which is present in the natural coagulant. Efficiency of *Cicer arietinum* is being compared with the efficiency of artificial coagulant alum. Hence the *Cicer arietinum* as a natural coagulant is effective for treatment of dairy wastewater, and the treated dairy waste water can be used for irrigational purposes.

The scope of further study is that the coagulant efficiency can be further analyzed by varying temperature, time and mixing speed.

**ACKNOWLEDGMENT**

I express my deep sense of gratitude to my guide, Mrs. Anitha. K, Assistant Professor, Department of Civil Engineering, Malabar College of Engineering And Technology, for the valuable guidance and creative suggestions offered during the course of this work and also in preparing this report.

I express my sincere thanks to Prof. Anil Kumar. B, Head of the Department, Department of Civil Engineering, Malabar College of Engineering And Technology, for his valuable support and advice.

I express my sincere thanks to Dr. V. Nandan, [12] Principal of Malabar College of Engineering and Technology, for providing necessary facilities and his sincere co-operation.

My sincere thanks are extended to all my friends and my parents for their help and support. Above all I thank God, [13] the almighty for his grace without which it would not have been possible to complete this work in time.

### REFERENCES

- [1] C.Ramamurthy et al. - Evaluation of eco-friendly coagulant from *Trigonella foenum-gracecum* seed, *Journal of Advances in Biological Chemistry*, vol.2, pp.5863, 2012
- [2] Chitteti Ramamurthy et al. - Evaluation of eco-friendly coagulant from *Trigonella foenum-graecum* seed, *Advances in Biological Chemistry*, vol. 2, pp.58-63, 2012
- [3] G.Vijayaraghavan et al. - Application of plant based coagulants for waste water treatment *International Journal of Advanced Engineering Research and Studies, IJAERS/Vol. I/ Issue I/October-December, 2011/88-92*
- [4] Harush.D.P et al. - Treatment of dairy wastewater using aerobic biodegradation and coagulation *International Journal of Environmental Sciences and Research Vol. 1, No. 1, 2011, pp. 23-26*
- [5] Md. Asrafuzzaman et al. - Reduction of Turbidity of Water Using Locally Available Natural Coagulants *ISRN Microbiology Volume, Article ID 632189, 2011*
- [6] M.N.Rao et al. - Wastewater treatment, Rational Methods of design an industrial practices, Oxford & IBH Publishing Co.Pvt.Ltd, 3rd Edition, 1999
- [7] N.Murali Mohan et al. - Experimental study on removal efficiency of blended coagulants in textile wastewater treatment *IMPACT: International Journal of Research in Engineering & Technology (IMPACT: IJRET) ISSN (E): 2321-8843; ISSN (P): 2347-4599 Vol. 2, Issue 2, Feb 2014*
- [8] ] S.V.Maruti Prasad et al. - Environmental sciences a low cost water treatment by using a natural coagulant *IJRET: International Journal of Research in Engineering and Technology, Volume: 02 Issue: 10 | Oct-2013*
- [9] Sonal Choubey - Comparison of Efficiency of some Natural Coagulants Bioremediation, *International Journal of Emerging Technology and Advanced Engineering, ISSN 22502459, Volume 2, Issue 10, pp.429-434, 2012*
- [10] Sri Suhartini et al. - Comparison of Efficiency of some Natural Coagulants Bioremediation *International Journal of Emerging Technology and Advanced Engineering (ISSN 2250-2459, Volume 2, Issue 10, October 2012)*
- [11] Syeda Azeem et al. - Efficiency studies with dolichos lablab and solar disinfection for treating turbid waste waters, *Journal Of Environmental Protection Science, vol.4,pp.8-12, 2010*
- [12] T.Phani Madhavil and R.Raj Kumar - Utilisation Of Natural Coagulant For Reduction Of Turbidity From Waste water *International Journal of ChemTech Research CODEN (USA): IJCRGG, ISSN : 0974-4290 Vol.5, No.3, pp1119-1123, April-June 2013*
- [13] Tasneem banu Kazi et al. - Treatment of Tannery Wastewater Using Natural Coagulants *International Journal of Innovative Research in Science, Engineering and Technology, Vol. 2, Issue 8, 2013, pp: 43-47*
- [14] Onet Crisian et al. - Characteristics of the untreated wastewater produced by food industry *Journal of Environmental Sciences, Vol. XV, 2010*
- [15] Parmar Gaurang and Parikh Punita - An evolution of turbidity removal from industrial waste by natural coagulants obtained from some plants, *Journal of Environmental Research and Development, Vol. 7 No. 2A*
- [16] Prof. Chidanand Patil and Ms. Manika Hugar - Treatment of dairy wastewater by natural coagulants *International Research Journal of Engineering and Technology (IRJET) Volume: 02 Issue: 04 | July-2015*