

# **Treatment of Dairy Effluent Using Cicer Arietinum**

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**ABSTRACT:** Dairy industry is one of the oldest industry characterized by high BOD, COD and suspended solids. Untreated effluent can cause damage to the environment. Coagulation flocculation is one of the important physico chemical treatments involved in wastewater treatment.

In this study cicer arietinum (chick pea) is used as natural coagulant to reduce turbidity and COD of effluent from dairy industry. Tests were carried out in conventional jar test apparatus. The optimum dosage and optimum pH of the chick pea were determined. The optimum dosage of chick pea was found to be 50 mg/l and optimum pH was found to be 4.5. The maximum reduction in COD and turbidity were found to be 58.9% and 86.29% respectively.

**KEYWORDS:** Chick pea, COD, Turbidity.

## **I. INTRODUCTION**

Food industry has one of the highest consumption of water and one of the largest producers of effluent per unit of production [1]. Dairy industry is one of the major food industries in India and one of the major sources of wastewater [2]. Large amount of water is used for cleaning purpose, therefore detergent, sanitizers, base, salts and organic matter can also be present in wastewater depending upon source. [3] Dairy effluent contain little soluble color and significant quantity of material that will result in turbidity of discharges. It is characterized by high BOD, COD, and suspended solids [4]. Discharge of untreated effluent can cause serious damage to the environment.

Coagulation is one of the most important physicochemical treatment steps in industrial wastewater treatment to reduce the suspended and colloidal materials responsible for turbidity of the wastewater and also for their reduction of organic matters which contributes to the BOD and COD content of the wastewater [5].

Alum, ferrous sulphate and ferric chloride are commonly used as coagulant in waste water treatment [6]. High COD removal is observed when alum is used along with lime [6]. However, various studies suggest that there are risk factors associated with these coagulants which are detrimental to both animals and human beings. This is because some studies have correlated alum usage with Alzheimer's disease [5]. Therefore in this study natural coagulant cicer arietinum (chickpea) is used.

No major studies have been done to clarify effluent from dairy industry using chick pea as natural coagulant. Hence this study was carried out to find the effect of chick pea in the treatment dairy effluent. The optimum dosage and optimum pH of the chickpea in order to achieve best performance in coagulation process were determined.

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## II. MATERIALS AND METHODOLOGY

### A. Sample Collection

Samples of dairy wastewater are collected from a dairy industry which is located in manipal, udupi district. The samples were stored in refrigerator below 5 °C.

### B. Coagulant Preparation

Chick pea seeds were removed from the hulls and then seeds were grounded to fine powder and sieved to get particle size of 600 $\mu$  (m) [5]. 10g of this powder is then dissolved 1L of distilled water. This suspension was stirred for 10 minutes on magnetic stirrer. The suspension was filtered through whatman filter paper [7]. The filtrate is stored in a refrigerator at 5 °C

### C. Jar test

Jar test is one of the experimental methodologies which is used for coagulation flocculation. A batch test is carried out using conventional jar test apparatus used in the experiments for the treatment of effluent from dairy industry with chick pea as coagulant. The apparatus consist of six 1 L capacity beakers with six spindle steel paddlers. Required dose of the coagulant solution 50mg, 100,200,300,400 is added simultaneously to the beaker containing wastewater. After inserting the paddles the apparatus is switched and test conducted in different rotating speed which include rapid mixing (100 rotations per minute rpm) for 1 minute and slow mixing (30rpm) for 15 minutes. After the agitation being stopped, the suspension is allowed d to settle for 20 minutes. Finally a sample was withdrawn using a pipette from middle of the supernatant for turbidity and COD test.

### D. COD and Turbidity Analysis.

COD of the effluent was determined according to the standard open reflux method prescribed in APHA2000. Turbidity was measured using nephlo turbidity meter.

## III. RESULT AND DISCUSSION

### A. Effect of Dosage:

Dosage is one of the important factor used to determine the optimum condition for the performance chick pea in coagulant flocculation test. In order to reduce the dosing and achieve the highest performance, it is crucial to determine the optimum dosage in treating wastewater.

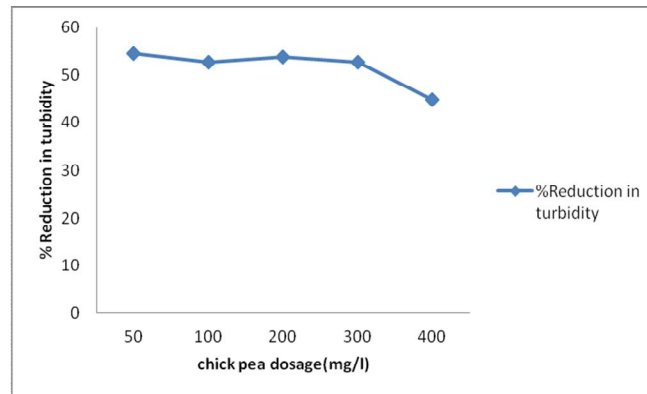
The effect of dosage is analyzed at pH 5.5, with rapid mixing speed of 100 RPM for 1 minute and slow mixing speed of 30rpm for 15 minutes followed by 20 minute settling. Chick pea dosage is varied from 50mg/l to 400 mg/l. The pH of the wastewater sample is adjusted to pH 5.5. pH is controlled by adding HCl and NaOH.

From jar experiment the result obtained is shown in the figures. Figure (a) shows the effect of dosage on %reduction in turbidity and figure (b) shows the effect of dosage % reduction in COD.

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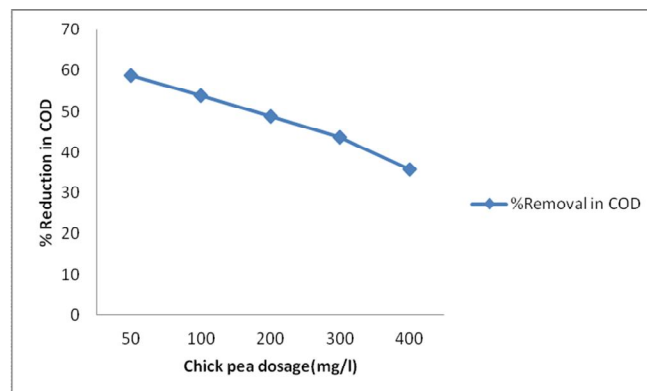
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Figure(a) Effect of dosage on % reduction in turbidity.

Highest turbidity removal is achieved at the dosage of 50mg/l. Turbidity removal is decreasing from 50mg/l to 400mg/l.



Figure(b) Effect of dosage on % reduction in COD

The effect of dosage on COD reduction decreasing when dosage increases. From above two graphs the optimum dosage of chick pea is found to be 50mg/l. At optimum dosage 54.6% turbidity reduction and 58.9 COD reduction were achieved.

## B. Effect of pH:

The surface of the coagulant and stabilization of the suspension is highly affected by pH. Hence it is essential to study the pH variation in order to find the optimum pH condition for the treatment.

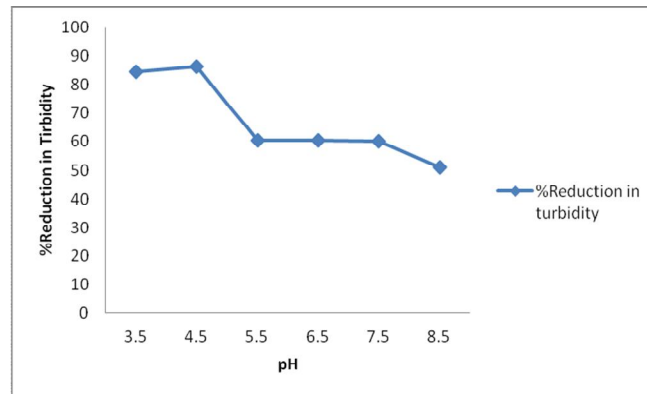
The effect of pH was analyzed at optimum dosage 50(mg/l) with rapid mixing speed of 100RPM for 1 minute and slow mixing speed of 30RPM for 15 minute followed by 20 minute settling for a range of pH varying from 3.5 to 8.5.

The result obtained from the jar test is shown in figures. Figure (a) shows effect of pH on % reduction in turbidity and Figure (b) shows effect of pH % reduction of COD.

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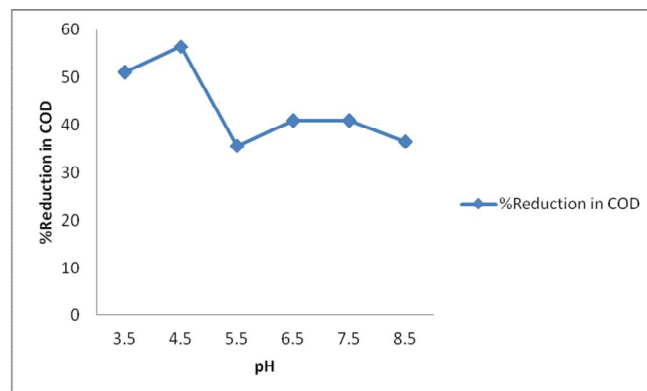
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Figure(a) Effect of pH on % reduction in turbidity.

pH plays an important role in turbidity removal. Chick pea is more efficient in acidic range. Maximum turbidity Removal is observed at pH 4.5 with 86.29% reduction. As pH increases efficiency of the chick pea decreases.



Figure(b) Effect of pH on % reduction in COD.

Highest COD removal also achieved at pH 4.5. The maximum percentage reduction is 56.36. As pH increases COD removal capacity of chickpea is decreased. The optimum pH of the chick pea is found to be 4.5 with 86.29% turbidity reduction and 56.36% COD reduction.

## IV. CONCLUSION

Use of natural coagulant should be encouraged as they are environmental friendly and they also reduce the problem of sludge disposal since it does not contain any hazardous substances. Chick pea is easily available and less expensive compared to chemical coagulants and significant reduction in turbidity and COD can be achieved.

In this study, the optimum dosage of the chick pea is found to be 50mg/l and optimum pH is found to be 4 for the treatment of dairy effluent.

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