

**PERFORMANCE EVALUATION OF DAIRY EFFLUENTS  
TREATMENT PLANT**



By

**P.E.A.N. Liyanaarachchi**



FTC275

Main Library, Eastern University, Sri Lanka

**Department of Bio System Technology**

**Faculty of Technology**

**Eastern University, Sri Lanka**

**Chenkalady**

**2025**

## ABSTRACT

The dairy industry, a critical sector for food production, is recognized as a significant contributor to water pollution due to its substantial water usage and high organic wastewater loads. Fonterra Brands Lanka, a leading dairy producer in Sri Lanka and a subsidiary of Fonterra, a global dairy exporter, faces the challenge of managing its wastewater effectively. This research investigated the performance of the Fonterra Brands Lanka effluent treatment plant (ETP), which employs a multi-stage process including screening, effluent collection, dissolved air flotation (DAF), anaerobic treatment, aerobic treatment, clarification, sludge treatment, and disinfection. The objectives of this study are to assess the efficiency of the effluent treatment plant in removing pollutants such as BOD, COD, pH and total nitrogen from dairy wastewater. The study evaluated four key water quality parameters: Chemical Oxygen Demand (COD), Biochemical Oxygen Demand (BOD), Total Nitrogen (TN), and pH over four days, collecting samples from eight designated points within the ETP. Statistical analysis revealed significant variations ( $p < 0.05$ ) in influent wastewater characteristics. The wastewater treatment system demonstrated exceptional overall removal efficiencies, achieving 100% for BOD, 99.33% for COD, and 97.29% for TN. The DAF unit achieved up to 72.09% BOD and 62.12% COD removal, although its performance dropped on certain dates, while the denitrification tank showed fluctuating results, with 60.23% COD removal and a significant drop to 36.2% for BOD removal on certain dates. The aeration tank and circular clarifier performed consistently well, achieving 77.8% and up to 95% BOD removal, respectively. pH levels fluctuated between 2.8 and 8.5 across the treatment stages, with the inlet pH ranging from 2.8 to 6.8. These findings reflect the treatment system's variable performance, largely driven by fluctuations in influent composition and the effectiveness of individual treatment units.

**Keywords:** Dairy Industry, Effluent Treatment Plants, Wastewater, Wastewater Characteristics

## TABLE OF CONTENTS

ACKNOWLEDGEMENT .....	vi
ABSTRACT .....	vii
LIST OF TABLES .....	x
LIST OF FIGURES .....	xi
LIST OF ABBREVIATIONS .....	xii
CHAPTER 01 .....	1
INTRODUCTION .....	1
CHAPTER 02 .....	7
LITERATURE REVIEW .....	7
2.1 Global dairy industry .....	7
2.2 Sri Lankan dairy industry .....	7
2.3 Dairy industry and waste .....	8
2.4 Characteristics of dairy wastewater .....	10
2.5 Impact of dairy wastewater .....	11
2.6 Dairy wastewater treatment .....	13
CHAPTER 03 .....	16
MATERIALS AND METHODOLOGY .....	16
3.1 Materials and equipment .....	16
3.2 Location and time duration .....	17
3.3 The stages of wastewater treatment in WWTP .....	17
3.3.1 Screening .....	19
3.3.2 Equalization tank .....	19
3.3.3 Dissolved Air Flotation (DAF) treatment .....	19
3.3.4 Anaerobic treatment .....	20
3.3.5 Denitrification .....	21
3.3.6 Aerobic treatment (MBBR) .....	21
3.3.7 Clarification .....	22

3.3.8 Sludge Treatment .....	22
3.3.9 Disinfection (Chlorination) .....	23
3.4 Research Design.....	23
3.5 Statistical analysis.....	23
3.6 Performance efficiency calculations .....	23
3.5 Analytical methods.....	24
3.5.1 Determination of Biochemical Oxygen Demand (BOD).....	24
3.5.2 Determination of Chemical Oxygen Demand (COD) .....	28
3.5.3 Determination of pH .....	30
3.5.4 Determination of Total Nitrogen (TN).....	31
CHAPTER 04 .....	34
RESULTS AND DISCUSSION.....	34
4.1. Wastewater parameters.....	34
4.1.1. Biochemical Oxygen Demand (BOD).....	34
4.1.2. Chemical Oxygen Demand (COD).....	40
4.1.3. pH.....	47
4.1.4. Total Nitrogen (TN) .....	50
CHAPTER 05 .....	54
CONCLUSIONS.....	54
REFERENCES .....	56