Indian Institute of Information Technology, Tiruchirappalli – 620 015.

***Annexure 1 / B.Tech.***

**PREDICTIVE ANALYTICS ON LEAKAGE DETECTION IN A FLOW**



A thesis submitted in partial fulfillment of the requirements for

the award of the degree of

**B.Tech**

****

**in**

**COMPUTER SCIENCE AND ENGINEERING**

 By

**AMURU HAREESH CSE15U004**

**G KRISHNA MOHAN CSE15U017**

**J YASHWANTH RAJ CSE15U021**

**N SIVA HARISH DUTT CSE15U025**

****



**COMPUTER SCIENCE AND ENGINEERING OF INDIAN INSTITUTE OF INFORMATION TECHNOLOGY TIRUCHIRAPALLI-620015**

**MAY 2019**

|  |  |
| --- | --- |
| Thesis Guidelines | 11 |

Indian Institute of Information Technology, Tiruchirappalli – 620 015.



***Annexure 2***

**BONAFIDE CERTIFICATE**

This is to certify that the project titled **TITLE OF THE THESIS** is a bonafide record of the work done by

**Name of the Student (Roll Number)**

in partial fulfillment of the requirements for the award of the degree of **Bachelor of** **Technology** in **Specialization** of the **INDIAN INSTITUTE OF INFORMATION TECHNOLOGY, TIRUCHIRAPPALLI,** during the year 2018-2019.

**NAME** **NAME**

Guide Head of the Department

Project Viva-voce held on \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Internal Examiner** **External Examiner**

|  |  |
| --- | --- |
| Thesis Guidelines | 12 |

Indian Institute of Information Technology, Tiruchirappalli – 620 015.



**ABSTRACT**

Leakage detection and localization in pipelines has become an important aspect of water management systems. Since monitoring leakage in large-scale water distribution networks (WDNs) is a challenging task, the need to develop a reliable and robust leak detection and localization technique is essential for loss reduction in potable WDNs. Some of the existing techniques for water leakage detection are discussed and open research areas and challenges are highlighted. It is concluded that despite the numerous research efforts and advancement in leakage detection technologies, a large scope is still open for further research in this domain. One such area is the effective detection of background type leakages that have not been covered fully in the literature. The utilization of wireless sensor networks for leakage detection purposes, its technical challenges as well as some future research areas are also presented. In a general remark, practical application of these techniques for large-scale water distribution networks is still a major concern. In this paper, an overview of this important problem is addressed.

*Keywords*: wide distribution network(wdn), wireless sensors, leakage detetion.

|  |  |
| --- | --- |
| Thesis Guidelines | 13 |

Indian Institute of Information Technology, Tiruchirappalli – 620 015.



**TABLE OF CONTENTS**

**Title** **Page No.**

**ABSTRACT** i

**ACKNOWLEDGEMENTS** ii

**TABLE OF CONTENTS** iii

**LIST OF TABLES** v

**LIST OF FIGURES** vi

**CHAPTER 1** **INTRODUCTION**

1.1 General 1

1.2 Objectives 2

**CHAPTER 2** **LITERATURE REVIEW**

2.1 Membrane 3

2.2 Membrane Separation Technology 3

2.3 Types of Membranes 3

2.4 Membrane Separation Process 3

2.5 Liquid Emulsion Membrane 4

2.6 Types of Extraction Mechanism 6

**CHAPTER 3** **METHODOLOGY**

|  |  |
| --- | --- |
| 3.1 | Materials ......................................................................................................... |
| 3.1.1 | Span 80 ........................................................................................................... |
| 3.1.2 | n- Hexane........................................................................................................ |
| 3.1.3 | Sodium hydroxide........................................................................................... |
| 3.2 | Experimental Procedure ................................................................................. |
| 3.2.1 | Emulsion preparation...................................................................................... |
| 3.2.2 | Extraction process........................................................................................... |
| 3.3 | Operating Conditions...................................................................................... |
| **CHAPTER 4 RESULTS AND DISCUSSION** | |
| 4.1 | General............................................................................................................ |
| 4.2 | Effect of Span 80 ............................................................................................ |

7

7

8

8

9

9

10

11

14

14

Thesis Guidelines 14

Indian Institute of Information Technology, Tiruchirappalli – 620 015.



4.3 Effect of NaOH Concentration 15

4.4 Effect of n-Hexane 17

4.5 Effect of Stirring Speed During Extraction 18

4.6 Effect of Feed Concentration 19

**CHAPTER 5 SUMMARY AND CONCLUSION**

5.1 Summary 21

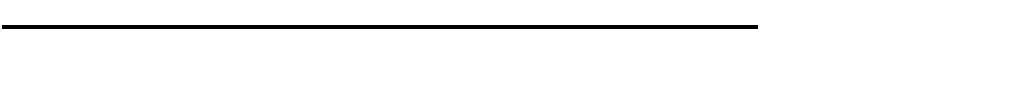
5.2 Conclusions 21

5.3 Scope for Future Work 21

**REFERENCES** 23

Thesis Guidelines 15

Indian Institute of Information Technology, Tiruchirappalli – 620 015.



***Annexure 6***

***(Sample)***

**LIST OF TABLES**

**Table No**. **Title** **Page No.**

3.1 Experimental Scheme for Dye Extraction 12

|  |  |
| --- | --- |
| Thesis Guidelines | 16 |

Indian Institute of Information Technology, Tiruchirappalli – 620 015.



***Annexure 7***

***(Sample)***

**LIST OF FIGURES**

**Figure No**. **Title** **Page No.**

2.1 Water/ Oil/ Water System 4

2.2 Nature of Surfactant 5

2.3 Extraction Mechanism- Type I 6

2.4 Extraction Mechanism- Type II 6

3.1 Structure of Span 80 7

3.2 Reaction Mechanism for Span 80 7

3.3 Structure of n-Hexane 8

3.4 Structure of Crystal Violet 9

3.5 Schematic Diagram of the Experimental Work 10

3.6 Calibration Curve for Crystal Violet 13

4.1 Effect of Span 80 on CV Extraction 15

4.2 Effect of NaOH Concentration on CV Extraction 16

4.3 Effect of n-Hexane on CV Extraction 17

4.4 Effect of Stirring Speed on CV Extraction 18

4.5 Effect of Feed Concentration on CV Extraction 20

|  |  |
| --- | --- |
| Thesis Guidelines | 17 |

Indian Institute of Information Technology, Tiruchirappalli – 620 015.



**ABBREVIATIONS**

AI Artificial Intelligence

AR Autoregressive Model

ARMA Autoregressive Moving Average Model

ARMAX ARMA with external input

ARX AR with external input

ASM1 Activated Sludge Model 1

ASM2 Activated Sludge Model 2

ASM3 Activated Sludge Model 3

ASP Activated Sludge Process

BOD Biochemical Oxygen Demand

BSRT Biological Solids Retention Time

COD Chemical Oxygen Demand

DO Dissolved Oxygen

F/M Ratio Food to Microorganism Ratio

GA Genetic Algorithm

***Annexure 8***

***(Sample)***

|  |  |
| --- | --- |
| Thesis Guidelines | 18 |

Indian Institute of Information Technology, Tiruchirappalli – 620 015.



NOTATIONS

K Specific substrate utilization rate constant

kd Microbial decay coefficient

Ks Substrate concentration when growth rate is half of maximum

*Q* Rate of wastewater flow to the aeration tank

q Specific substrate utilization rate

Qe Effluent flow rate

qm Maximum specific substrate utilization rate

Qr Rate of recycle sludge

*Qw* Rate of sludge wasting from the reactor

R Recirculation ratio

S Residual growth limiting substrate concentration

S0 Substrate concentration in the raw water

Se Steady state substrate concentration after treatment

V Volume of the aeration tank

X Biomass concentration in the Aeration tank

***Annexure 9 (Sample)***

|  |  |
| --- | --- |
| Thesis Guidelines | 19 |

Indian Institute of Information Technology, Tiruchirappalli – 620 015.



***Annexure 10***

***(Sample)***

**References**

1. **Papers with Single Author,**

**Bruce Rittmann, E.** (1996) How input biomass affects sludge age and process stability.*ASCE: Jour.Env.Engg,* **122**, 4-8.

1. **Papers with Two Authors,**

**Bliss, P. J. and D. Barnas** (1986) Modeling Nitrification in Plant Scale Activated Sludge.*Water Science and Technology*,**18**,139-148.

1. **Papers with more than two Author,**

**Capodaglio, A.G., H.V. Jones, V. Novotny and X. Feng** (1991) Sludge bulking analysisand forecasting: application of system identification and artificial neural computing technologies. *Water Res.,* **25**, 1217–24.

1. **Books**

**APHA, AWWA and WPCF** *Standard methods for the examination of water and**wastewater*, 17thEdition, Washington, D.C.: American Public Health Association, 1989.

|  |  |
| --- | --- |
| Thesis Guidelines | 20 |

Indian Institute of Information Technology, Tiruchirappalli – 620 015.



**QUICK REFERENCE**

**PAGE DIMENSIONS AND MARGIN**

Paper size

: 80 gsm. Standard A4 size (210 mm X 297 mm)

**Margins**

Top edge

Left side

Bottom edge

Right side

Print out

Font size (regular Text)

Spacing

Chapters

Sections

Subsections

: 1 inch (25 mm)

: 1 ½ inch (38 mm)

: 1 inch (25 mm)

: 1 inch (25 mm)

: Laserjet or Inkjet printer, **printed on only one side**

: Times New Roman of 12 pts

: 1.5 line spacing

: 14 pts bold Centre aligned (Capital Letters)

: 12 pts bold left aligned (Capital Letters)

: 12 pts bold left aligned (Title case)

Page numbers (Chapters)

: Bottom – centered – 12 pts (1, 2, 3…)

Page numbers (Preliminaries) : Bottom – centered – 12 pts / Roman numerals (i, ii, iii….)

Binding : Soft binding (edge with black color strip)

**Number of copies**

B.Tech . : (Number of students per group) + 1 (Guide(s) copy)

|  |  |
| --- | --- |
| Thesis Guidelines | 21 |