
**AIN SHAMS UNIVERSITY**
**FACULTY OF ENGINEERING**
Public Works Department

# Problems Solution for Dairy Industrial Wastewater Treatment

A Thesis Submitted in Partial Fulfillment for the Requirements of
the Degree of Master of Science in Civil Engineering

**(Public Works – Sanitary Engineering)**

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**AIN SHAMS UNIVERSITY**
**FACULTY OF ENGINEERING**
**Approval Sheet**

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Date 22/2/2014

# DEDICATION

I wish to dedicate this work to who suffered to educate, support and encourage me during the thesis work.

## TO MY FAMILY

Also, I wish to dedicate my thesis

To

**MY FRIENDS**

For their encouragement and support to complete this work

# STATEMENT

This dissertation is submitted to Ain Shams University, Faculty of Engineering for the degree of M.Sc. in Civil Engineering. The work included in this thesis was carried out by the author in the department of Public Works, Faculty of Engineering, Ain Shams University from 2007 to 2014.

No part of the thesis has been submitted for a degree or qualification at any other University or Institution. The candidate confirms that the work submitted is his own and that appropriate credit has been given where reference has been made to the work of others.

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Date 22 /2 / 2014

Signature

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# ACKNOWLEDGMENT

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I would like to convey my greatest gratitude to all engineers and technicians in the industrial wastewater treatment plant of ***Nestlé***' factory, who enabled and helped me during my work in the plant.

# ABSTRACT

**Name:** Ebtehal Yousry Amin Elsherbiny

**Title:** Problems Solution for Dairy Industrial Wastewater Treatment

**Faculty:** Faculty of Engineering, Ain Shams University

**Specialty:** Public Works, Sanitary Engineering

This thesis aims to evaluate the performance of dairy industrial wastewater treatment by undertaking a process auditing of one of the major factories in Egypt, namely Nestlé (Ice Cream) Factory in the 6th of October City. Type of treatment is extended aeration activated sludge process. Experimental work was done at Nestlé factory laboratory, the selected performance parameter is COD. Data are collected from Nestlé Factory for three design and operation phases:

***Degremont Original Design (2000 – 2008)***

The design consists of a static fat separator, a CAF unit, a balancing tank, three aeration tanks, and finally a clarifier.

- Degremont design was satisfactory but Nestlé factory did not construct the second stage of design, which made the plant hydraulically and organically overloaded, particularly the CAF unit.
- Overall COD removal ratio was poor ranging from 23 to 76% with an average of 52% in year 2007.
- The WWTP failed to comply with legal limits.

***Aqua Design Modification 1 (2009 – 2010)***

Aqua added new automated rotary screen with high capacity and DAF unit with flocculation unit, which improved the performance of the WWTP.

- The DAF achieved a significant average COD removal ratio of 32% in year 2010. However, the overall COD removal ratio was still low at 39%.

- The WWTP failed to comply with legal limits.

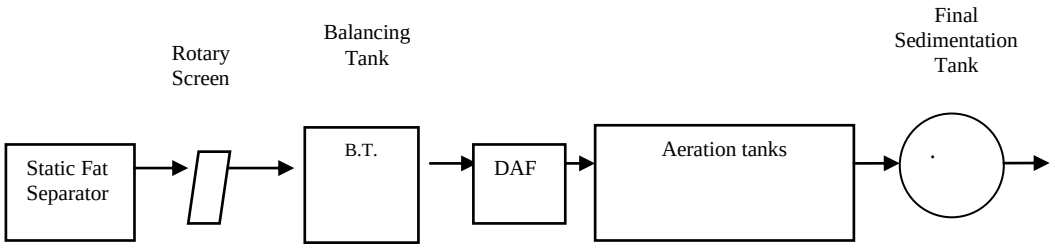
***Aqua Design Modification 2 (2010 – to Date)***

An aeration tank was added in series to the old ones and modifications are made for the balancing tank to be an aeration tank so that the aeration tanks become five connected in series, a new balancing tank was added before the CAF and DAF units, and finally a new clarifier was added to the old one.

- This modification achieved overall COD removal ratio 87% in year 2011
- The WWTP complied with legal limits.

***Recommendation***

Dairy wastewater treatment plant is best designed with the following flow line, this system can achieve COD removal ratio of about 90%.




**Supervisors:**

- Prof. Dr. Mohamed Hassan Abdel Razik
- Dr. Aisha Zaki Maged

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## *List of Acronyms*

| | |
|---|---|
| AC | :Anaerobic Contact |
| AF | : Air Floatation |
| AFB | : Anaerobic Fluidized Bed |
| ASCE | : American Society of Civil Engineers |
| AT | : Aeration tank |
| BOD | : Biochemical oxygen demand (mg/L). |
| BT | : Balancing tank: |
| CAF | : Cavitation Air Floatation |
| COD | : Chemical oxygen demand (mg/L). |
| DAF | : Dissolved Air Flotation |
| DO | : Dissolved oxygen |
| EPA | : Environmental Protection Agency |
| FFA | : Free fatty acids |
| FOG | : Fat Oil and Grease |
| FS | : Final sedimentation tank |
| GAC | : Granular activated carbon |
| IWW | : Industrial Wastewater |
| IWWTP | : Industrial Wastewater Treatment Plant |
| Lab. | : Laboratory |
| MLSS | : Mixed liquor suspended solids |
| MO | : Moringa oleifera |
| O&G | : Oil and Grease |

PAC : Powdered Activated Carbon

PACT : Powdered Activated Carbon Treatments

pH : The strength of the acid or base

PS : Pump Station

RAS : Returning Activated Sludge

RT : Retention time

SBR : Sequencing Batch Reactor

SP : Sample point

SS : Suspended Solids

SVI : Sludge volume index

TKN : Total Kjeldahl Nitrogen

TSS : Total Suspended Solids

UASB : Upflow Anaerobic Sludge Blanket

VFA : Volatile Fatty Acids

WAS : Waste Activated Sludge

WPCF : Water Pollution Control Federation

WWTP : Wastewater Treatment Plant