



**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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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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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.

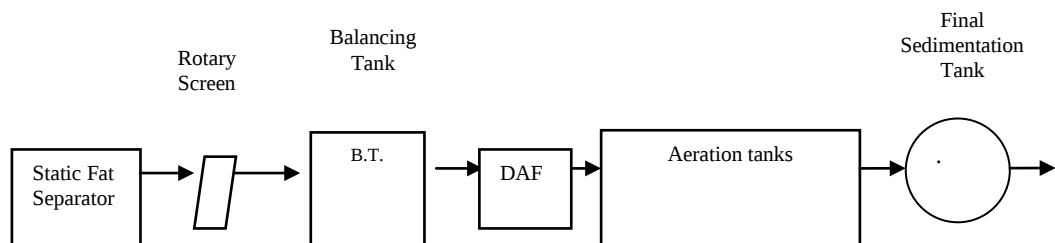
Aqua Design Modification 2 (2010 – to Date)

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