NEW TECHNIQUE FOR TANNERY INDUSTRY WASTEWATER TREATMENT

A Thesis
Submitted to the Faculty of Engineering
Ain Shames University for the Fulfillment
of the Requirement of M.Sc. Degree
In Civil Engineering

Prepared by

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B.Sc. in Civil Engineering, June 2005
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(SANITARY ENGINEERING)

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Date:- ---/--/2010

DEDICATION

To the persons who suffered, support and encourage me during this long journey of hard work;

To my grand parents and,
TO MY FATHER & MOTHER,SISTER LAMIA
TO MY DEAREST HUSBAND HANY AND MY LOVELY SON HAMZA

Also, I wish to dedicate my thesis
TO MY DEAR PROFESSOR
PROF.DR.MOHAMED EL HOSSEINY EL NADI
for his encouragement and help 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 September 2006 to September 2009.

No part of the thesis has been submitted for a degree or a 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

Date:- ---/-- /2010

Signature:- ----------

Name:- ***salma Nabil Mohamed El Ghatit***

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ABSTRACT

NAME :- **SALMA NABIL MOHAMED EL GHATIT**

Titl :- **"**NEW TECHNIQUE FOR TANNERY INDUSTRIAL WASTEWATER TREATMENT**".**

Faculty :- Faculty of Engineering, Ain Shams University.

Specialty:- Civil Eng., Public Works, Sanitary Eng..

Summary:-

With the interest in environmental protection the interest in industrial wastewater treatment had increased especially with enlargement in industry and increase the treatment cost that affect the products prices.

This study concentrate on the application of the Dual Biological Aerated Filter DBAF as new technique system for biological treatment preceded by a chemical precipitation to treat industrial wastewater of tannery industry .

This new technology decreases construction costs, O&M costs and safe land required with high efficiency.

The researcher worked on plant erected in Shahien tannery. Where studied the factors affect the plant efficiency under all operation conditions due to operation program, chemicals used and rates and the effects on plant loads to obtain its suitability for such type of wastewater.

The study proved the applicability of the system for such wastewater. The removal ratios for BOD, COD, Cr removal were 88.05%, 85.5%, 98.85% respectively .Which are high values for treatment efficiency of such type of wastewater and a good efficiency for TSS removal achieved. Also the system did not affected by sudden variations in loads or the non uniformity in tannery operation. The economic comparison with other treatments previously used approved the economy of this system.

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INTODUCTION

1.1 GENERAL

Leather industry is one of the major sources of hard currency in Egypt; leather industry goes to the ancient Egyptians

The main industrial zone of the leather industry in Egypt lies at old Cairo city, the remaining are located in Alexandria, at el max district, it holds about 19 tanneries, other areas are distributed among Egypt mainly in Damnhour and Assiut **[1]**.

There are three types of tanneries classified by size as follows **[2]**:

1. Small tanneries: number of drums ranges from 1to 4 drums and it produces 44% of the total product
2. Medium tanneries: number of drums ranges from 5 to 8 drums and it produces 30% of the total production of old Cairo tanneries
3. Large tanneries: number of drums is largerr than 9 drums and it produces 26% of the total production of old Cairo tanneries.

The wastewater produced from this industry is a highly chemically and biologically polluted (Cr > 5ppm& BOD > 1500ppm) **[3]** that make a big troubles shouting in the municipal sewerage system or at any other disposal point.

There is a lack of proper wastewater treatment practice in Egypt for the existing factories are old and no place for treatment and also the high cost of treatment that prevent the private factories to make it **[2]**. This leads to disposing there wastewater effluent directly to sewerage system that destroyed the existing sewers and cause streets flooding with bad smell wastewater specially in seasons as Barium feast. This leads to a need for new technique can deal with this wastewater with low O&M needs and with low initial cost and suitable area need to fit with existing situation**.**

1.2 STUDY OBJECTIVE

The main target is to apply and evaluate a new technique by applying DBAF proceeded by chemical treatment for treating tanning industrial wastewater that achieves low cost with suitable efficiency that could solve the problem for small and medium tanneries especially the private one.

1.3 SCOPE OF WORK

The study had been done on a plant erected in a Tannery factory to illustrate all the work conditions and wastewater variations. The work included the following:

1- Theoretical study including literature review for tannery industry & its wastewater treatment
2- Practical study of the DBAF application in Shahien tannery factory & evaluate the study applied results.
3- Discussion for the practical results including comparison for the studied system results with other literature applications & evaluate the system success.

1.4 THESIS ORGANIZATION

The thesis will include the following :

CHAPTER I: INTRODUCTION

That illustrates the study problem about the tannery industrial wastewater treatment and its difficulties and costs, than presents the study objectives that concentrated on the evaluation of new treatment procedure using DBAF system for tannery wastewater treatment and obtain its suitability in such case.

The chapter covers the scope of work and illustrates the thesis organization to cover all the work done and its conclusions.

CHAPTER II: LITERATURE REVIEW

That illustrates the tannery industry methods and the different kinds of industry production lines including the applied chemicals and the produced wastewater characteristics in each step of the industry.

Then it presents the wastewater treatment methods that applied for this industry wastewater around the world. The chapter also covers the industry in Egypt and different wastewater treatment applications for it. This was done through presentation for all the collected literatures and the governmental data available through reports and official studies.

CHAPTER III: MATERIALS & METHODS

This chapter illustrates the study practical work location, the applied plant description and its components with its design information and the study operation system.

Also the chapter shows the sampling procedure frequency and locations and the physco chemical parameters measuring procedures.

CHAPTER IV: RESULTS

This chapter presents the study practical results during the plant operation period and shows the presentation of obtained concentrations for measured parameters through the applied plant during the study period.

CHAPTER V: DISSCUSION

This chapter shows the discussion of the study practical results for the plant parts and the evaluation of these results compared with the law limits for effluent and the other methods of treatment which mentioned in the literature review.

CHAPTER VI: CONCLUSION

This chapter shows the study conclusions and the researcher recommendations for the system application for such type of wastewater and for previous studies for this wastewater treatment and DBAF system method.

CHAPTER II

LITTERATURE REVIEW

2.1. GENERAL

The tanning industry is one of the leading economic sector in many countries generates large quantities of heavily polluted wastewater containing ,ammonia, sulfides & organic substances including tannins ,these substances are derived from hides, skins and from the addition of reagent during processing of these materials **[1]**.

The uncontrolled release of tannery effluents in natural water bodies increases the environmental pollution & the health risks. Tannery wastewater treatment represents a serious environmental & technology problem **[2]**.

The process of tanning industry consist of the transformation of animal skin to leather , the skin is submitted to different processes to eliminate meat, fat ,&hair with different chemicals such as sodium hydroxide ,sodium hypochlorite , enzymes, lime, chlorides, euphoric acid ,ammonium salts, kerosene, chlorobenzene. The obtained hide is then treated with chromium or tannins minerals salts & colors to obtain leather. The effluent contains large concentration of sodium, sulfate & chloride, pathogens &toxic organic components **[3]**.

Wastewater from leather industry is very complex due to the high organic load **[4]**. Leather industry faces the major & serious problem of the disposal of tanneries sludge & solid wastes after the precipitation & the precipitation & separation after completion of the manufacturing processes . In addition, there are solid wastes of un-tanned and tanned hides leather such a result of fleshing process, trimming,

The un-tanned wastes are used in the glue industry .the tanned product are used in fiberboard manufacturing some other wastes to be disposed in land. The sludge in sedimentation tank can be used as fertilizers.

The use of treated water in irrigation will be carried out after biological treatment in central treatment facility .So the main role of the central treatment of

tanneries wastes is to control the environmental pollution resulting from the leather industrial activities & the treated wastewater in irrigation purposes **[5]**.

2.2. TANNARY INDUSTRY

2.2.1. PRE-TANNING (OR BEAM HOUSE) OPERATIONS:

The first step in the tanning process is inspection of the hides for defects as they come into the tannery, and the cutting off ends .The next step is the cleansing of the hides to remove dirt, manure, & salt in order to restore them in a natural soft hydrated state. This is done in soaking operation.

The soaking & washing of hides are quit important, because if moisture is not restored the hide will not respond properly to the different tanning operation. The soaking process is carried out in drums of 2.5 m diameter & 2 m its speed ranges from 4 -7 r.p.m. the soaking duration process varies from 4 to 24 hrs according to the type of the hide used.

The used water and chemicals in this phase are as follows:

a- Water is about 300%-400% from hides weight /wash.
b- Industrial detergent.
c- Soaking agent with concentration of 0.01%.
d- Preservative agent to minimize bacteria activities.

The soaking process sequence is carried out on three phases

a- Preliminary washing to remove dry salt dirt stacked to the hide surface.
b- Secondary washing
c- Final washing.

The hide weight increases during the soaking process. To control the end of the soaking process, a cut is done in the thickness part of the hide to enable the inspection of the internal tissues.

2.2.2. LIMING:

Liming is a mean of loosing & removing the epidermis & hair from the hide & is usually done in paddle vats, drums &pits. Liming process is carried out