ADVANCED METHODS FOR SEWAGE SLUDGE TREATMENT

A THESIS SUBMITTED

TO

THE FACULTY OF ENGINEERING

AIN SHAMS UNIVERSITY

BY

ADEL ABDEL MONIEM SAYED MOHAMED BASSYOUNI

B. Sc. CIVIL ENGINEERING

IN PARTIAL FULFILMENT OF THE REQUIREMENTS

FOR

THE M. Sc. DEGREE IN CIVIL ENGINEERING

(SANITARY ENGINEERING)

1985

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EXAMINERS APPROVAL: SIGNATURE

Dr. AHMED ABDEL WARITH

Dr. MOHAMED ALI ALI FARAG

Dr. HAMDY IBRAHEEM ALI

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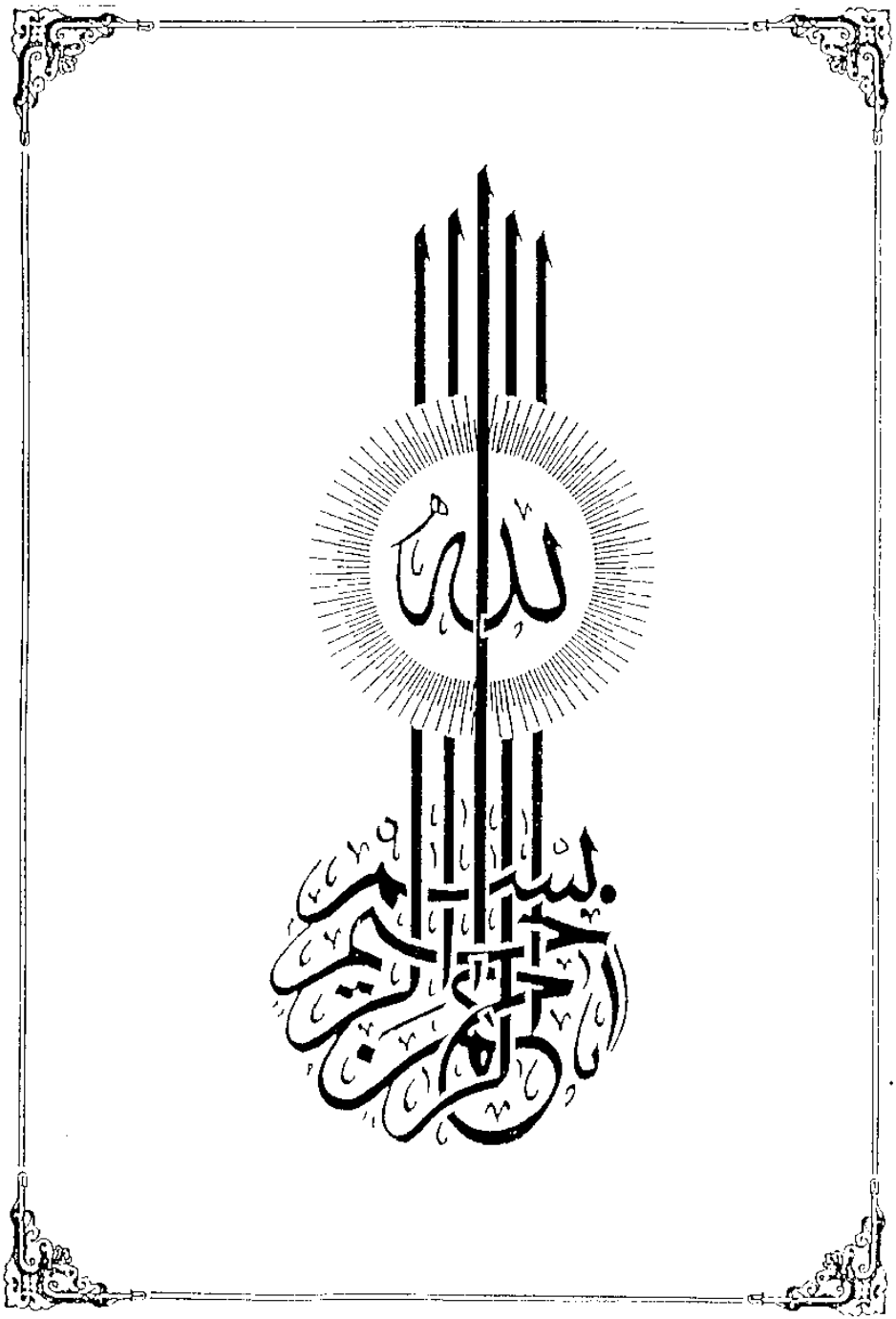

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ACKNOWLEDGMENT

The candidate is deeply grateful to **Dr. AHMED ABDEL WARITH**, Professor of Sanitary Engineering, Faculty of Engineering, Ain Shams University, for suggesting the problem and sponsoring this work and also, **Dr. MOHAMED ALI ALI FARAG**, Professor of Sanitary Engineering, High Institute of Public Health for his help during the preparing of this thesis.

The candidate wishes to express his gratitude to **Dr. M. S. El-KHOULY**, Associate Professor, Faculty of Engineering, Ain Shams University for his patient guidance and helpful suggestion as well as his continuous and generous help throughout the completion of this work.

The auther wishes to express his gratitude to the staff of the Water pollution Department, National Research Center and also the staff of the Sanitary Engineering Laboratory, High Institute of Public Health for their assistant and great help during the preparation and completion of this study.

Also, sincere acknowledgment is due to the staff and personnel of the Sanitary Section, Faculty of Engineering, Ain Shams University for facilities, interest, encouragement and help to complete this work.

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ABSTRACT

Sludge treatment and disposal is major consideration in the planning and design of new wastewater treatment plants and in the expansion and upgrading of existing facilities.

In Egypt, all the wastewater treatment plants are using the natural sludge dewatering system, sand drying beds method. But during the design phase of wastewater treatment plant for Alexandria City, a problem of land availability was faced. So, the study was done by using vacuum assisted-drying beds method for sludge dewatering instead of ordinary sand drying beds.

The different options for sludge dewatering were discussed then the vacuum assisted-drying beds method was chosen for the facing for the problem of land.

This study discusses the sludge dewatering using the vacuum assisteddrying beds method with or without the use of polymers additions and comparing it with the ordinary sand drying beds technically and economically.

Due the tests done, it can be seen that the success of the vacuum assisted-drying beds method for sludge dewatering is high with the use of polyelectrolyte polymer but in the other hand the designer must try the ordinary sand drying beds firstly before using this method for economy & its facilities in maintenance, labours requirements and construction.

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INTRODUCTION
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CHAPTER ONE

INTRODUCTION AND LITERATURAL REVIEW

Sludge treatment and disposal is major consideration in the planning and design of new wastewater treatment plants and in the expansion and upgrading of existing facilities. Along with the increasing sophistication of wastewater treatment comes more sludge and greator disposal problems.

Many wastewater treatment facilities have shown that satisfactory treatment and disposal of sludge can be the most complex and costly operation in municipal wastewater treatment system. A sludge disposal system which reduces the volume of material to be handled and disposed and saves or recovers needed energy and resources is very desirable. Solution have long been sought for better stabilization and disposal methods which are reliable and economical and able to render sludge either inert or stable. The sludge treatment and disposal includes many processes in line of design approach.

The options of these processes are shown in **Figure No.(1/1)** sludge dewatering process is one component of the wastewater solids treatment process which means removal of water from wastewater treatment plant solids to achieve a volume reduction. Dewatering is done primarily to decrease the capital and operation costs of the subsequent direct sludge disposal or conversion and disposal process.

Dewatering sludge from 5 to 20 percent solids concentration reduces volume by three-fourths and results in a non-fluid material so that performance of both the liquid and solids treatment schemes is optimized and total cost is minimized.

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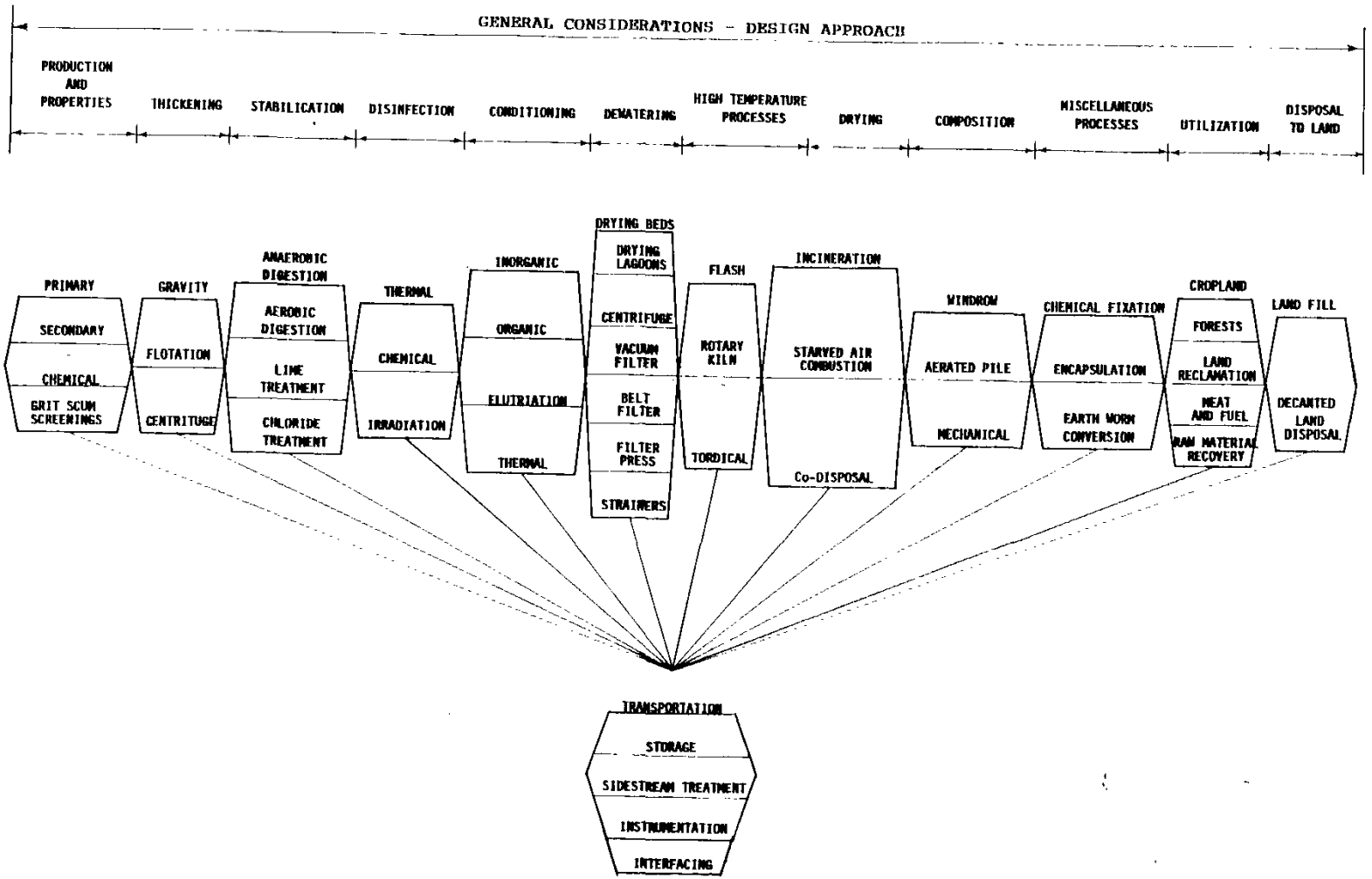

Fig. 1-1 classification of sludge treatment and disposal options

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Dewatering methods are divided to the following system:

I - Natural sludge dewatering system.
II - Centrifugal dewatering system.
III - Filtration dewatering system.
IV - Cyclons, screens and electro-osmosis.

In Egypt, all the wastewater treatment plants are using the natural sludge dewatering system. This system is extremely attractive from both capital and operation cost viewpoints. Considering escalating electrical power costs, this method is even more attractive.

Two types of the system can be categorized as natural: drying beds and drying lagoons. Drying beds are the most widely used method of municipal sludge dewatering in Egypt. In the United States two thirds of all United States wastewater treatment plants uilize drying beds and one-half of all the modern municipal sludge is dewatered by this method **(2)**. Although the use of drying beds might be expected in smaller plants and in the warmer sunny regions, they are also used in several large facilities in northern climates **(3)**, **(4)**. Drying beds can be used not only to dewater sludge, but also to dry it to a solids concentration of greater than 50 to 60 percent. Depending on the circumstances and particular device involved, dewatered sludge from a mechanical device may vary from a wet, almost flowable form, to a harder and more vriable form, **(1)**.

Research into the dewatering of sludge by drying beds has been conducted since the early 1900s, when it was noted that digested sludge dewatered more rapidly than raw sludge **(5)**. Design data, however, are still very empirical, and only recently has an effort, been made to develop a rational engineering design approach **(6-8)**. An excellent review of post work, detailed theoretical analysis, and current understanding of the sludge drying process is given by Adrian **(6)**. **Table (1/1)** lists advantages and disadvantages of the drying bed method.

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Table (1/1) : Advantages and Disadvantages of Sludge Drying Beds:

Advantages	Disadvantages
* Low capital cost (when land is readily available).	* Requires more land than fully mechanical methods.
* Small amount of operator attention and skill is required.	* Requires a stabilized sludge.
* Low energy consumption.	* Must be designed with careful concern for climatic effect.
* Less sensitive to sludge variability.	* May be more visible to the general public.
* Low to no chemical consumption.	* Lack of a rational engineering design approach.
* High dry cake solids contents.	* Removal usually labor intensive.

In Egypt sand drying beds are still the most common method of municipal wastewater sludge dewatering because we got good experience in operation and maintenance along about fifty years the system running successfully. But in the design phase of wastewater collection treatment, and disposal for the City of Alexandria, we faced a problem of land availability. The area of the existing treatment plants (two) are limited the calculated area for sand beds needed was more than twice much the available area of the treatment plants. The other alternative is the mechanical dewatering. Inhouse study has been made for mechanical dewatering systems. The conclusion which came fast that all the mechanical dewatering systems cannot work with unconditioned sludge.

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