CONTROL OF ALGAE IN OXIDATION PONDS EFFLUENT

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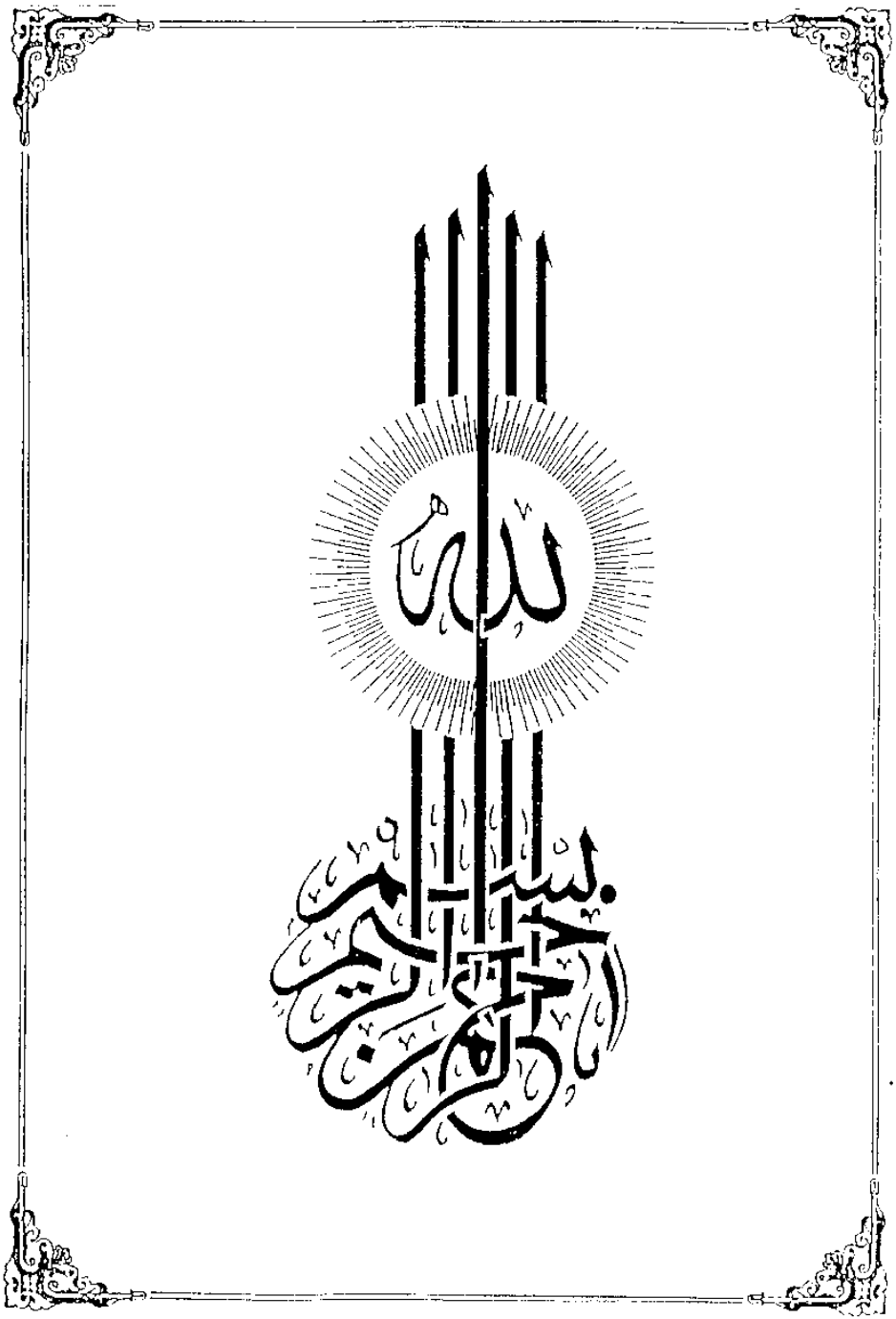

ABSTRACT

A major limitation of oxidation ponds is the presence of occasionally large quantities of algae in the effluent which may add significantly to the organic load and suspended solids of the receiving stream.

This study aims to the control of algal growth by in-pond precipitation of soluble phosphorus which is a major element required for algae nutrition.

A wide range of alum doses was tested. It was noted that at the naturally high pH of the pond, a large alum dose (over 200 mg/l) was required to achieve 50% algae removal. By lowering the pH value to between 6.0 and 8.0, an economical alum dose of just 50 mg/l was needed to achieve the same result.

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LIST OF ABBREVIATIONS

BOD_5 - BIOLOGICAL OXYGEN DEMAND .

DO - DISSOLVED OXYGEN .

TSS - TOTAL SUSPENDED SOLIDS .

EPA - ENVIRONMENTAL POLLUTION ASSOCIATION .

SS - SUSPENDED SOLIDS .

RR - REMOVAL RATIO .

COD - CHEMICAL OXYGEN DEMAND .

TIN - TOTAL INORGANIC NITROGEN .

OD - OPTICAL DENSITY .

TS - TOTAL SOLIDS .

CHEMICAL ABBREVIATIONS :-

H_2S - HYDROGEN SULFIDE .

SO_2 - SILICON DIOXIDE .

CO_2 - CARBON DIOXIDE .

P - PHOSPHORUS .

N - NITROGEN .

C - CARBON .

$Mg(OH)_2$ -MAGNESIUM HYDROXIDE .

Mg - MAGNESIUM .

CA - CALCIUM .

AL - ALUMINIUM .

$AL(PO_4)$ - ALUMINIUM PHOSPHATE .

H_2SO_4 - SULFERIC ACID .

HCL - HYDROGEN CHLORIDE .

VSS - VOLATILE SUSPENDED SOLIDS .

VTS - VOLATILE TOTAL SOLIDS .

CHAPTER ONE

1.1 – INTRODUCTION.

1.2 – BASICS OF STABILIZATION PONDS.

1.3 – LITERATURAL REVIEW.

1.4 – AIM OF STUDY.

1.1 INTRODUCTION

Human waste disposal problems have been the focus of attention for a number of years, but now, with the population increasing rapidly, more stringent controls over waste material are urgently needed to protect our potable and recreational waters. A primary goal of waste treatment management is to develop more efficient systems of waste stabilization, leading ultimately to water purification and recycling.

Wastewater lagoons are the most popular and inexpensive method of treating domestic wastewater in small communities . They generally cost less than half as much as other treatment methods (provided that land costs are not excessive) and require a minimum of maintenance .

Waste stabilization ponds have been used effectively to treat many types of wastewater . The low cost of construction and operation of this type of wastewater treatment has resulted in its wide adoption by municipalities and industries.This rapid spread of oxidation ponds as a method of wastewater treatment should have been accompanied by a research program aimed toward furnishing the operational data that would make possible the controllable operation of oxidation ponds .

The first recorded use of stabilization ponds as a formal sewage treatment system was during the 1920's in California. Since that time,it has been estimated that over 5,000 municipalities have been utilizing waste treatment lagoons all over the world and about one third of all municipal wastewater treatment plants in the U.S.A. are stabilization ponds [23]. The use of stabilization ponds is not limited to domestic sewage treatment only; it has been recorded that over 31 types of industrial wastes can also be treated by waste stabilization ponds. The advantages and disadvantages of the use of stabilization ponds in wastewater treatment are given in Table (1.1).

Table (1.1):Advantages And Disadvantages Of Stabilization ponds.

Advantages	Disadvantages
- They can achieve any required degree of purification at the lowest cost and with the minimum of maintenance by unskilled operators.	- They require larger areas of land than other methods of sewage treatment.
- They can effectively treat a wide of industrial and agricultural wastes.	- Seasonal turnover results in uncontrolled odours.
- No preliminary treatment is required other than, possibly a grit chamber and screening.	- Seasonally poor performance
- They can withstand both organic and hydraulic shock loads.	- Algae present in the effluent represent a high suspended solids and BOD loading on the receiving streams.
- Sludge accumulation does not present any problem.	- Poor maintenance may result in high weed growth,brush, trees and other vegetation providing nesting places for animals.
- Algae present in effluent can be used as a valuable by-product if a cheap method for their harvesting is evolved.	
- They can easily be designed so that the degree of treatment is readily altered.	

1.2 BASICS OF STABILIZATION PONDS

Waste stabilization ponds are large shallow basins enclosed by earthen embankments, in which raw sewage is treated by entirely natural processes involving both algae and bacteria . Since these processes are unaided by man, the rate of oxidation is rather slow and as a result, long hydraulic retention times are employed .

With regard to the nature of biological activity that takes place within the ponds, they can be classified into anaerobic, facultative and aerobic. Table (1.2) shows the main differences between the three types together with the design criteria of each .

The removal of organic matter from oxidation ponds is brought about through the metabolism of two major groups of microbes :-

1) Heterotrophic microbes (bacteria) which oxidise organic matter for energy.

2) Photosynthetic microbes (algae) which fix carbon dioxide for cellular carbon and derive their energy from sunlight .

Under normal conditions, these two groups compliment each other because algae produce oxygen as an end-product which benefits the growth of aerobic and facultative