

# Water and Air Effluents Treatment Handbook

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**Format:** paperback

**Code:** NI217

**Pages:** 576

**Price: Rs.1275US\$ 125**

**Publisher:** NIIR PROJECT CONSULTANCY SERVICES

Usually ships within **5** days

Water treatment describes those processes used to make water more acceptable for a desired end use. These can include use as drinking water, industrial processes, medical and many other uses. The goal of all water treatment process is to remove existing contaminants in the water, or reduce the concentration of such contaminants so the water becomes fit for its desired end use. Water quality analytical techniques are considered in the context of EEC directives on the quality of the aquatic control of all effluents is entering it. The principal methods of water analysis are reviewed and it indicated in view of destructive and hazardous role of pollution, it become necessary that the very nature of atmosphere, the various air effluent are present there to save the environment from the harmful effect. Effluent can be treated in different ways, it is classified as; preliminary treatment, primary treatment, secondary treatment and complete final treatment. Waste water obtained from industries is generally much more polluted than the domestic or even commercial waste water. Industrial wastewater cannot be always treated easily by the normal methods of treating domestic waste waters. Depending on the quantum, concentration, toxicity and presence of non biodegradable organics in an industrial wastewater, its treatment may consist of any one or more processes such as equalization, neutralization, physical treatment, chemical treatment and biological treatment. The atmosphere contains hundreds of air pollutants from natural or from anthropogenic sources. All such pollutants are called primary pollutants for example; sulphur oxides, carbon monoxide, nitrogen oxides, lead etc. Secondary pollutants are the chemical substances, which are produced from the chemical reactions of primary pollutants or due to their oxidation etc. A high growth in vehicle population brings in its wake urban air pollution problems unless timely appropriate steps to control vehicle emissions are under taken.

Some of the fundamentals of the book are quality and characteristics of effluents, collection of sewage samples for physical and, chemical testing, disposing of effluents, disposal of wastewaters in lakes and management of lake waters, disposal of sewage effluents on land for irrigation, classification of treatment processes, treatment of industrial effluents, methods of treating industrial wastewaters, strategies for management of industrial wastes, combined industrial municipal wastes, a process for upgrading paper mill effluent by water hyacinth, ventilation for controlling indoor air pollution, the environment and its pollution, disposal of environmentally hazardous radioactive effluents and biomedical wastes, air pollution, its control and monitoring, fuels from waste etc.

This book is an effort to put together the various options available to meet the water and air effluent available for the environmental protection. The book presents a concise but through an overview of state of technology for water and air effluent treatment. The water and air effluent treatments are organized into chapters by broad problem area, treatment of industrial effluent,

industrial waste management, etc. This will be helpful to technocrats, consultants, educators, architects, industry executive, students and others concerned with saving environment problem.

## 1. QUALITY AND CHARACTERISTICS OF EFFLUENTS

### IMPORTANCE OF STUDY

Decay or Decomposition of Sewage

### CHARACTERISTICS OF EFFLUENTS

Physical Characteristics of Sewage and Their Testing

Chemical Characteristics of Sewage and Their Testing

Total Solids, Suspended Solids and Settleable Solids

Population Equivalent

Relative Stability

Collection of Sewage Samples for Physical and,

Chemical Testing

Bacteriological Characteristics and Testing

## 2 DISPOSING OF EFFLUENTS

### DISPOSAL BY DILUTION

Conditions Favouring Disposal By Dilution

Standards of Dilution for Discharge of

Waste waters into Rivers

Dilution in Rivers and Self Purification of Natural Streams

Disposal of Wastewaters in Lakes and

Management of lake Waters

Disposal of Wastewater in Sea Water

### DISPOSAL ON LAND

Disposal of sewage effluents on land for for Irrigation

Quality Standards For Wastewater Effluents to be Discharged on Land For Irrigation

'Effluent Irrigation' and 'Sewage Farming'

-Difference Thereof

Methods of Applying Sewage Effluents to Farms

Sewage Sickness

Crops Grown in Sewage Farms and Their Hygienic Aspect

Dilution Method Vs. Land Disposal Method for

Disposal of Sewage

## 3. TREATMENT OF EFFLUENTS

Classification of Treatment Processes

### SCREENING

Types of Screens, Their Designs and Cleaning

Comminutors

Disposal of Screenings

### GRIT REMOVAL BASINS

Grit Chambers

Detritus Tanks

Design of Parabolic Grit Chamber provided-with-a-Par shall Flume

### TANKS FOR REMOVING OILS AND GREASE

Skimming Tanks

Vacuators

Disposal of Skimmings

Necessity and Use of Skimming Tanks in India

### SEDIMENTATION

General Introduction

Principle of Sedimentation

Theory of Sedimentation  
Sedimentation Tanks  
Disadvantages or Demerits of Coagulation in Sewage Treatment  
SECONDARY TREATMENT THROUGH BIOLOGICAL  
FILTRATION OF SEWAGE  
(Aerobic Attached Culture)  
Introduction to Sewage Filtration  
Contact Beds for Biological Filtration of Sewage  
Intermittent Sand Filters for Biological Filtration of Effluents  
Trickling Filters for Biological Filtration of Sewage  
Construction and Operation of Trickling Filters  
Recirculation of Treated Sewage and its Use in High Rate Trickling Filters  
Other Miscellaneous Types of Filter  
SECONDARY SEDIMENTATION  
Secondary Settling Tanks or Humus Tanks  
DIGESTION AND DISPOSAL OF PRIMARY AND  
SECONDARY SLUDGE  
Sludge and Its Moisture Content  
Sludge Digestion Process  
Stages in the Sludge Digestion Process  
Factors Affecting Sludge Digestion and Their Control  
Sludge Digestion Tank or Digestors  
(Aerobic Suspended Culture)  
Disposal of Digested Sludge  
Use of Lagoons for Disposal of Raw Sludge  
SECONDARY TREATMENT THROUGH ACTIVATED  
SLUDGE PROCESS  
(Aerobic Suspended Culture)  
Definition of Activated Sludge Process  
Various Operations and Units of an Activated Sludge Plant  
Bulking and Foaming Sludge in an Activated Sludge Treatment Plant  
DESIGN CONSIDERATIONS INVOLVED IN AN  
ACTIVATED SLUDGE PLANT  
Aeration Tank Loadings  
Sludge Volume Index (S.V.I.)  
Sludge Recycle and Rate of Return Sludge  
Wasting of Excess Sludge ( $Q_w$ )  
Modifications of the Basic Activated Sludge Process  
Size and Volume of the Aeration Tank  
Oxygen Requirement of the Aeration Tanks  
Advantages and disadvantages of an Activated Sludge Plant  
Activated Sludge Process Vs Trickling Filter Process and the Choice of One  
SECONDARY TREATMENT THROUGH ROTATING  
BIOLOGICAL CONTRACTORS  
(Aerobic Attached Culture)  
Rotating Biological Contractors (RBCs)  
AEROBIC STABILISATION UNITS  
(Aerobic Suspended Culture)  
Oxidation Ponds and Stabilisation Ponds  
Oxidation Ditches (Pasveer Type) or Extended Aeration Lagoons  
Mechanically Aerated Lagoons  
ANAEROBIC STABILISATION UNITS  
Anaerobic and Facultative Stabilisation Ponds

Septic Tanks  
Advantages  
Disadvantages  
Imhoff Tanks  
Clarigesters  
High Rate Anaerobic Systems  
CHLORINATION OF SEWAGE  
Disinfection of Sewage by Using Chlorine  
Design of Inlet Chamber  
Design of Screen Chamber  
Design of Grit Chamber  
Design of Aeration Tanks  
Design of Secondary Clarifier  
Return Sludge Pump House:  
Design of Sludge Drying Beds  
4. TREATMENT OF INDUSTRIAL EFFLUENTS  
Introduction  
Methods of Treating Industrial Wastewaters  
Thermal Pollution  
5. INDUSTRIAL WASTE WATER EFFLUENTS  
Introduction  
TERMINOLOGY  
TREATMENT LEVELS  
Primary Treatment  
Secondary Treatment  
LAGOONS AND SEPTIC TANKS  
TYPES OF INDUSTRIAL WASTES  
Strategies for Management of Industrial Wastes  
QUANTITY OF INDUSTRIAL WASTES  
METALS AND METAL PRODUCTS  
Geographical Aspects of the Industry  
Technological Control Methods for Steel Mill Wastes  
CHEMICAL AND ALLIED PRODUCTS  
PAPER AND ALLIED PRODUCTS  
PETROLEUM & COAL PRODUCTS  
Petroleum  
Coal  
FOOD & KINDRED PRODUCTS  
Cannery Wastes  
Frozen Foods  
Dairy Products  
Meat  
Bakery Products  
Poultry  
MACHINERY AND TRANSPORTATION EQUIPMENT  
STONE, CLAY & GLASS PRODUCTS  
RUBBER AND PLASTICS  
LUMBER AND WOOD PRODUCTS  
TEXTILE MILL PRODUCTS  
Cotton  
Synthetics  
COMBINED INDUSTRIAL-MUNICIPAL WASTES  
COST ASPECTS OF POLLUTION CONTROL IN THE

## PULP AND PAPER INDUSTRY

### 6. RECLAMATION OF TEXTILES EFFLUENTS

Experimental Procedure

Results and Discussion

Conclusion

### 7. A PROCESS FOR UPGRADING PAPER MILL

#### EFFLUENT BY WATER HYACINTH

Experimental Procedure and Results

Phase I

Phase II

Phase III

Discussion

Conclusion

Salient Features

### 8. DISPOSAL OF SOLID EFFLUENTS AND REUSE

Definition, Classification, Quantity and Composition of Refuse

Collection, Removal and Carriage of Refuse

Disposal of Refuse

Advantages

Disadvantages

Merits

Demerits and Limitations

### 9. VENTILATION FOR CONTROLLING INDOOR

#### AIR POLLUTION

Sources, Effects and Status of Indoor Air Pollution

Definition of Ventilation

Effects of Occupancy of a Space

Purpose of Ventilation

Extent of Ventilation Required and Ventilation Standards

Systems of Ventilation

Advantages

Disadvantages

### 10. THE ENVIRONMENT AND ITS POLLUTION

Biosphere and Environment

Physical and Biological Environment

Ecosystem and Ecological Balance of Nature

Impact of Man on Biosphere

Pollution and Conservation of Environment

Status of Administrative Control on Environment in India

Status of Water Pollution--Monitoring and Control in India

Status of Air Pollution--Monitoring and Control in India.

### 11. DISPOSAL OF ENVIRONMENTALLY HAZARDOUS RADIOACTIVE EFFLUENTS AND

#### BIOMEDICAL WASTES

##### RADIOACTIVE WASTES

Radioactive Elements and Radioactive Radiations

Impacts of Radioactivity on Life and Environment

Disposal of Radioactive Wastes

##### BIO-MEDICAL WASTES

Biomedical Wastes and Their Hazards on Health and Environment

Legal Laws on Management of Medical Wastes in India

#### COLLECTION AND TREATMENT OF BIOMEDICAL WASTES

Colour Coding of Biomedical Wastes and Their Collection in Different Coloured Bins or Bags

Collection of Sharp Wastes

Labeling for Identification of Bio-medical Wastes

Storage of Bio-medical Waste

Transportation of Bio-medical Wastes to the Treatment and Disposal Site

Treatment and Disposal of Biomedical Wastes

## 12. AIR POLLUTION, ITS CONTROL AND MONITORING

Air Pollutants, Their Effects, and Sources of Origin

Dispersion of Air Pollutants into the Atmosphere

### AIR POLLUTION CONTROL

The Natural Self-Cleansing Properties of the Environment

Dilution Method for Controlling Air Pollution from Stationary Sources (Factories)

Controlling Air Pollution from Stationary Sources by Installing Engineering Devices

Controlling Air Pollution from Automobiles

## 13. VEHICULAR AIR POLLUTION AND MEASURES FOR ITS CONTROL

Types of Vehicle Emissions

Emission Characteristics of Indian Vehicles

Vehicle Emission Control Technology and Fuel Efficiency

Inspection and Maintenance

Conclusions

## 14. FUELS FROM WASTE

Characteristics of Wastes for Fuels

Wastes as Fuel

Wood-Waste Combustion Systems

Municipal-Waste Combustion

Other Wastes as Fuel

Conversion Systems Applied to Wastes

Conclusions

## About NIIR

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Fri, 02 May 2025 08:47:39 +0000