TREATMENT OF TEXTILE PROCESSING EFFLUENTS

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Treatment of Textile Processing Effluents

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DEDICATED
TO THE
LOTUS FEET
OF
LORD MURUGA
AND
TO MY PARENTS
C.K.NATARAJ AND ARUNAGIRI AMMAL
The biggest problem that every textile processor has to encounter is the treatment of their effluents. But many processors find it very difficult to treat their effluents mainly because of their poor understanding of the character of their effluents. This book is written with the intention to provide the textile processor, a clear picture of the effluents emerging from their industry, and to have a suitable treatment system that works efficiently and economically. The textile industry has to adopt new technologies according to the changing scenario both in processing and treatment of effluents. In recent times a number of effluent treatment technologies have been developed. They are dealt exhaustively in this book. Unlike in the past, today’s treatment programs encompass several new concepts such as reduction of pollution load, recovery of dyes and chemicals, waste water recovery etc., This book describes all these new concepts elaborately under separate chapters.

This book is divided into three parts. Part-I exclusively deals with the characteristics and treatment of processing effluents. Separate chapters are devoted for Cotton, Synthetic and Woollen Textiles. An exclusive chapter is apportioned to offer ways and means to reduce pollution load. The chapters, “Recovery and Reuse of Sizes, Dyes and Other Chemicals” and “Recovery and Reuse of Waste Water” are incorporated to enable the processor to recover valuable materials from the effluents and possible methods of reusing them and also waste water. Methods for the minimum use of water are also described in the chapter “Conservation and Reuse of Water”.

PREFACE
Part-II is devoted exclusively to describe treatment methods. Elaborate discussions have been made on primary, secondary and tertiary treatments in Chapters 13, 14, and 15. The latest treatment methods are described under the Chapter “Advanced Methods for the Treatment of Textile Processing Waste Water”. “Ozone Treatment” and “Activated Carbon Adsorption” are also discussed elaborately as separate chapters. An exclusive chapter is devoted to “Membrane Technology” owing to its effective applications in the treatment of effluents.

Part-III, Analysis of Textile Processing Effluents provides analytical procedures for the determination of various parameters. Starting from the general physico-chemical measurements, analytical procedures for the measurement of organic pollution (including BOD and COD), determination of non-metallics and metallic constituents are described in detail. The procedures are described in step by step for easy follow up.

Needless to say that this book would be of immense use to textile processors, textile chemists, textile consultants, and to all others who engaged in textile processing and to consultants, engineers and chemists and firms engaged in water and waste water treatment. Academic and Research Institutions and University faculties offering courses on Textile Technology, Textile Processing, Textile Chemistry, Environmental Sciences, Chemistry and Ecology would find this as an invaluable reference book.

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- N.MANIVASAKAM
This book is divided into the following parts

**Part-I.** Treatment of Textile Processing Effluents

**Part-II.** Treatment Methods

**Part-III.** Analysis of Textile Processing Effluents
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PART - I

TREATMENT OF TEX TILE PROCESSING EFFLUENTS
Chapter - 1

INTRODUCTION

Among the industries that generate larger volumes of effluents, textile processing industry is noteworthy. Besides higher quantities, the effluents are also very complex in nature and therefore several treatment procedures need to be adopted to render them innocuous. Textile processing is carried out on fibres to remove the natural and acquired impurities and to obtain the desired properties, shade, design and finish and to impart desirable qualities of sight, touch and durability to fabric.

The major types of fibres are: 1) Cotton 2) Synthetic and 3) Wool. This apart, certain other fibres and blends of the above fibres are also processed. Cotton and synthetic fibres are generally woven or knitted into cloth before applying any finishing operation, while wool is generally scoured and dyed before being woven (or knitted) into cloth. Each fibre undergoes a number of wet processes before being converted into the final product.

As regards cotton and synthetic fibres, the major processes involved are 1) Sizing (Slashing) 2) Desizing 3) Scouring 4) Bleaching 5) Mercerizing 6) Dyeing/Printing and 7) Finishing. With regard to wool, the wool fibres are first scoured, dyed and then woven (or knitted) into fabric and then subjected to various finishing operations. Whether it is cotton, synthetic or wool, regardless of the fibre, each wet process
ultimately results in the generation of huge quantities of effluents. A wide variety of chemicals including dyes, acids, alkalis, salts, detergents, soaps, wetting agents, accelerators, oxidizing and reducing agents and developers are used in these processes. Only a small portion of these chemicals is utilised, while the remaining major portion finds its way into the effluents. That is why the effluents are complex in character and need several stages of treatment for purification.

Irrespective of the fibre processed, the effluents arising from the processes are intensely colored, contain appreciable concentration of suspended impurities and a high concentration of dissolved solids. The BOD and COD of these effluents are also high. Owing to such high pollution load, treatment and disposal of these effluents are ever a serious problem.

The textile processing effluents cause a very serious damage to environment if let out untreated. Before going to the details of treatment it is imperative to know the harmful effects of these effluents when discharged into water courses or on to land.

**Effects on water courses**

When the effluents let out into water courses, the water resources are polluted heavily and the water becomes unfit for further domestic industrial, agricultural and other uses. Some of the components of the effluents and their effects are discussed briefly in the following paragraphs.

1. **Color:** The effluents contain dyes in higher concentrations which impart color to the receiving streams and they persist for longer distances. Photosynthesis of
phytoplankton is affected seriously by these colors.

2. **Suspended Impurities**: The colloidal and suspended impurities produce turbidity in the receiving waters. The turbidity together with color causes an unsightly appearance.

3. **Detergents**: The detergents and soaps present in the effluents cause serious foaming problems in the receiving waters.

4. **pH value**: The high alkalinity of the effluent renders the receiving waters alkaline and upset the eco system. The extreme pH values (either alkaline or acidic) are deleterious to aquatic life and the water becomes unsuitable for other purposes too.

5. **Oils and Grease**: Various oils, especially mineral oils in the effluents interfere with the oxygenation of streams as they form blanket on the surface and prevents the entry of oxygen at air/water interface.

6. **Nitrates and Phosphates**: The effluents contain substantial quantities of nitrates and phosphates and therefore may cause eutrophication problems in receiving water.

7. **Oxygen Depleting Substances**: Substances present in the textile effluents (such as starch, dextrin, sulfide, nitrite etc.,) exert an oxygen demand. The stream will then be devoid of oxygen and the aquatic life are affected adversely.

8. **Dissolved Mineral matter**: The dissolved inorganic matter
To protect the environment from such adverse effects, it is the prime duty of the processing units to treat the effluents to safe levels prescribed by river authorities and/or pollution control boards. The disposal of these effluents without any impact on environment has become an integral activity of the industry and much attention has to be bestowed upon the methods of treatment in order to select the most efficient and economical one both in capital expenditure and in running costs.

The excess content of sodium and boron of the textile wastes are deleterious to crops. The high sodium alkalinity combined with the salinity impair the growth of plants. Texture of the soil is affected by suspended impurities and sodium, and penetration of the roots is also prevented.

Effects on Land

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6 Treatment of Textile Processing Effluents

(mostly sodium salts), increases the salinity of water and consequently it becomes unfit for irrigation and other domestic purposes.

9. Carrier Chemicals: Certain carrier chemicals used in dyeing such as phenols cause disagreeable tastes and odors in receiving waters.

10. Toxic Substances: Chromium, sulfide, chlorine and aniline dyes present in the textile wastes are toxic to fish and microbial organisms which carryout purification. Thus the self purification of the water body is affected.
As stated above, depending on the fibre processed and methods of processing, chemicals used in the processes also vary. Accordingly effluent treatment methods also vary. For a better understanding, each fibre sector is discussed as separate chapter as indicated below.

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