Textile Effluent –An Introduction

Lecture-1

Textile effluent and its management

Every country is aiming at Common Effluent Treatment Plants for the development of zero discharge solution for the bleaching and dyeing units. The total effluent treatment capacity is designed based on the Mill size, based on the effluents generated in these mills.

Selection of technology and design for the engineering for the CETP are Pipeline for effluent conveyance, Pre-treatment works, Reverse Osmosis plant, Evaporator plant, and Recovered water distribution system and many more advanced technologies.

Textile Effluents and its management

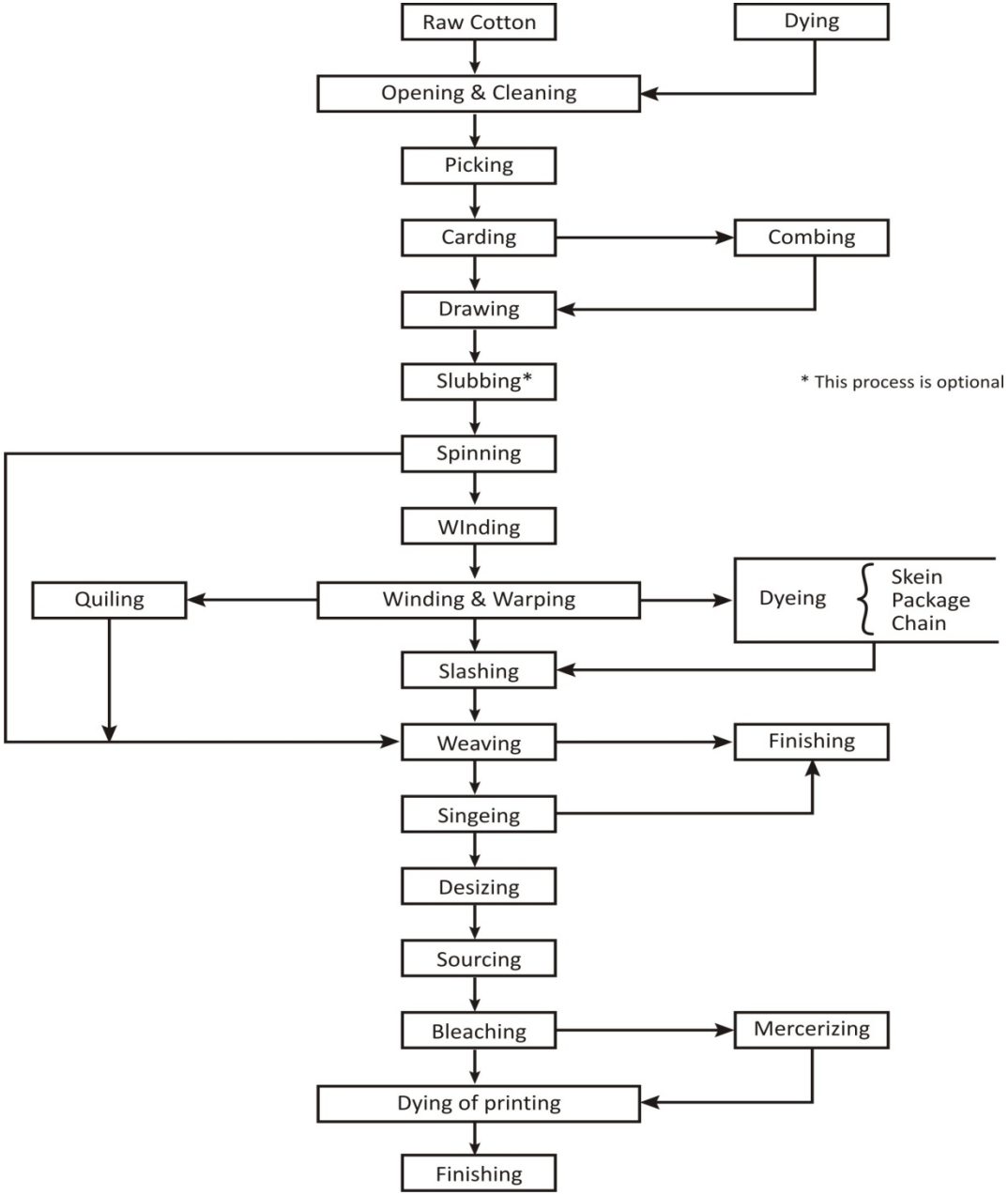
- As textile industry is one of the largest industries in the world and different fibres such as cotton, silk, wool as well as synthetic fibres are all pre-treated, processed, coloured and after treated using large amounts of water and a variety of chemicals, there is a need to understand the chemistry of the textile effluents very well.

- The textile waste characteristic needs to be understood clearly.

- Different methods and aspects of Textile Effluents and its management to save the environment from polluting the same needs to be understood.

- Major pollutants in textile wastewaters are high suspended solids, chemical oxygen demand, heat, colour, acidity, and other soluble substances whose chemistry will be emphasised.

Stages of Textile Processing



List of harmful Chemicals used in Textile Industry

Detergents mainly nonyl-phenol ethoylates- generates toxic metabolites which is poisonous to fish

Stain remover: Carry solvents like CCl_4 can cause ozone depletion

Oxalic acid used for rust stain removal: are toxic to aquatic organisms and also boots COD

Sequestering agents: Polyphosphates like Trisodium polyphosphate and **sodium hexametaphosphate:** are banned chemicals

Printing gums: preservatives like pentachlorophenol can cause dermititis, liver and kidney damage are all banned chemicals

Fixing agent: Formaldehyde and Benzidine are banned internationally

Bleaching: Chlorine bleaching caused itiching and is harmful

Dyeing : Azo dyes which release amines are banned because they are known carcinogens

Textile Waste Characteristics

- The pollutant features of textile wastes differ widely among various Organic substances such as dyes, starches and detergents in effluent undergo chemical and biological changes which consume dissolved oxygen from the receiving stream and destroy aquatic life.

- Such organics should be removed to prevent septic conditions and avoid rendering the stream water unsuitable for municipal, industrial, agricultural and residential uses.

Textile Wastewater Problem

- Treatment of wastewater – will definitely reduce the waste, prevent and make positive effects on its further uses
- Strong rinse waters from dye operations may be used to make up new dyebaths, while weak rinses may be recycled through in-plant water treatment units.
- The savings in material in the first case may be enough to pay for the cost of treatment of the later case

Chemicals used in Textile Industry

Synthetic organic dyes, bleaches and detergents Some chemicals are biodegradable-starch, however others such as dyes are non-biodegradable Thus the effluents could have lower dissolved oxygen concentrations which means higher BOD and COD

Solids in textile wastewater come from fibrous substrate and process chemicals, this disturbs the aquatic life by showing oxygen transfer and reducing light penetration

Inorganic chemicals

- High concentrations of soluble inorganic salts may make the discharge water stream unsuitable for industrial and municipal use
- Metals such as chromium and zinc are toxic to aquatic life and should be removed before discharge
- Certain carrier chemicals used in dyeing , such as phenol may add bad taste and odor as well.

Treatment of Textile Effluents

- Typically textile effluent would involve the following steps—
- Reactive dye concentrates can be treated in a conventional anaerobic digester
- Exposure to the biomass to achieve de-colorization and tolerance of the micro organisms to concentrations of the dye
- Additional carbon source(eg. glucose) is necessary to maintain the microbial metabolic state
- The presence of Nitrate in the system inhibits de-colorization
- Adsorption of the dye to the biomass also causes de-colorization
- The degradation products of the dye after anaerobic digestion may be isolated and identified

Treatment of Wastewater

After every effort that can be made to reduce waste strength and volume, there still remains the problem of disposing the final remains of polluted waste into any water stream, thus the waste may be treated in various methods either singly or in combination and the best combination of methods differs from plant to plant.

The various types of treatment practices are as follows:

- Segregation
- Lagooning and storage
- Screening
- Mechanical Filtration
- Pre-aeration and Post- aeration
- Neutralization
- Chemical precipitation
- Chemical Oxidation
- Biological Oxidation

Major Environmental concern

- The removal of colour from textile industry and dyestuff manufacturing industry wastewaters represents a major environmental concern.
- Conventional oxidation treatment have found difficulty to oxidize dyestuffs and complex structure of organic compounds at low concentration or if they are especially refractory to the oxidants.
- To ease the stated problems advanced oxidation processes (AOPS) have been developed to generate hydroxyl free radicals by different techniques.
- AOPS processes are combination of ozone (O_3), hydrogen peroxide (H_2O_2) and UV irradiation, which showed the greatest promise to treat textile wastewater.

Currently what is practiced in textile industry

The textile dyeing industry is under considerable pressure to reduce the color of process waters directly discharged to municipal water treatment facilities. Two common approaches are practiced:

1. The Electrochemical treatment by anodic oxidation using anodes with catalytic coatings to oxidise the dye wastes
2. Ion- exchange zeolite treatment with different cations such as Fe(II), Fe(III), Cu(II), Clinoptilolate, a natural zeolite have been found to be quite effective.

Since the catalytic Fe(II) sites are bound to the zeolite structure, no sludges are formed and the cations released to the solution during organometallic dye degradation were found to be absorbed by the zeolite