Waughter

AKTION CONSULTANCY

Volume 3 : Edition 7 –Wastewater Treatment Design : Textile Industry *Aug 01, 2023*

Dear Water Warriors,

Textile Industry is providing one of the most basic needs of people and it holds importance of maintaining sustained growth for improving quality of life.

Textile production processes are water-intensive and release harmful chemicals, dyes, acids and starches into the water. It is necessary to minimize their undesirable impact on the environment.

It's important for these factories to have an effective wastewater effluent treatment plan.

This issue of '**Waughter**', we discuss the wastewater treatment in textile industry.

Nidhi Jain
Civil Engineer

In this edition we cover up the different wastewater treatment practises for textile industry along with some major challenges.

Introduction

The textile industry occupies a unique place in our country. One of the earliest to come into existence in India, it accounts for 14% of the total Industrial production, contributes to nearly 30% of the total exports and is the second largest employment generator after agriculture.

It has a unique position as a self-reliant industry, from the production of raw materials to the delivery of finished products, with substantial value-addition at each stage of processing.

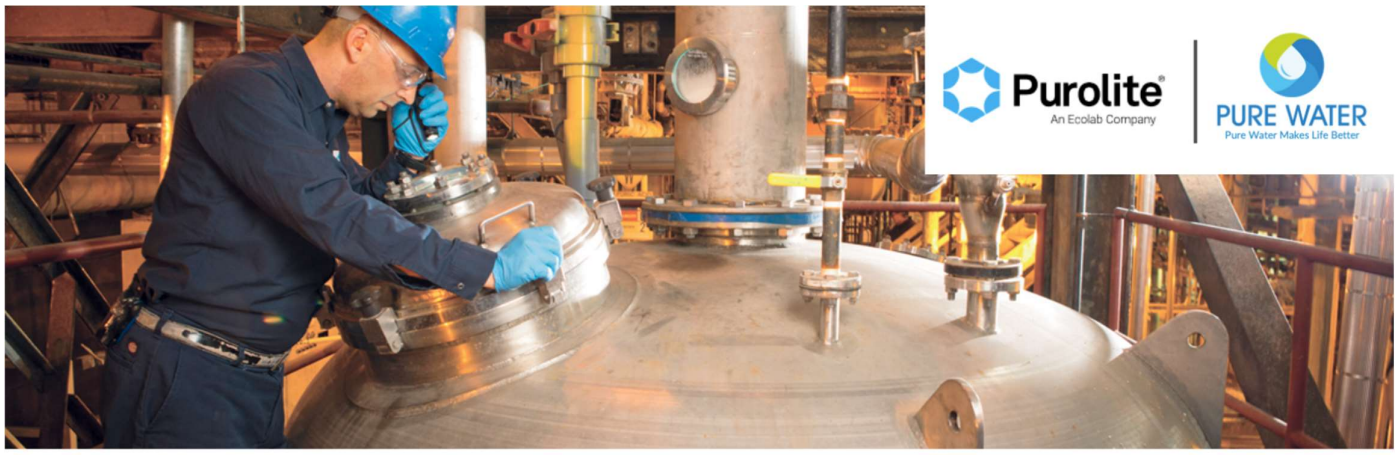
The textile industry consumes large amounts of water and chemicals for dyeing and finishing processes.

Introduction to Textile Process

Textile process starts with the gathering of natural fibres or man-made synthetic.

Then, after spinning process, continues with the processing into textile flat structures, fabrics, in the form of woven fabrics, knit fabric, nonwovens fabric, etc.

The fabrics are treated in finishing processes, including dyeing and printing processes, coating, mechanical finishing. These processes provide new properties to the fabric before the clothing stage.



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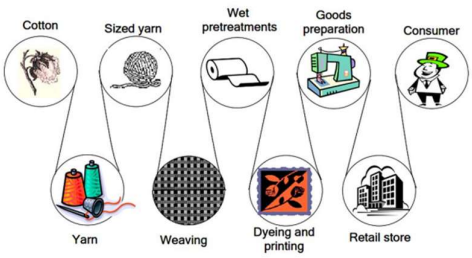
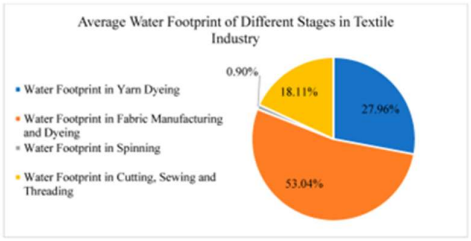
Industrial process and water footprints



Textile manufacturing is a series of processes that are involved in the conversion of fiber into yarn and then yarn into fabric. The fabrics are then printed or dyed, or fabricated into cloth which is converted into useful goods like household items, cloths, upholstery and various industrial products.

Attached image is showing various processes involved in textile manufacturing industry from raw material to finished product.



Water footprint assessment is important for textile products. The textile industry uses massive amounts of water in the production of goods. Untreated effluent generated by textile industries is one of the major sources of water pollution. As shown in diagram more than 50% water consumption comes from manufacturing and dyeing section.

Major Pollutant & Treatment map

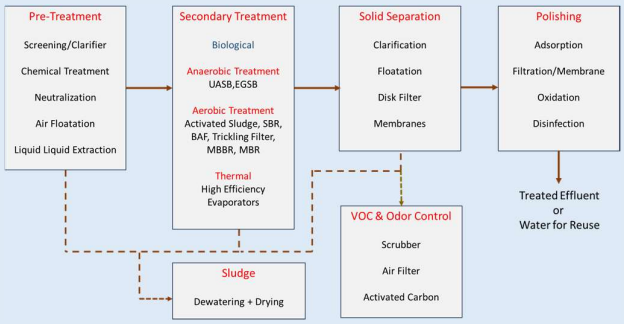
Textile production is estimated to be responsible for about 20% of global clean water pollution from dyeing and finishing products.

Major pollutant that is released from process to wastewater treatment section are :

pH : Due to use of chemicals in dyeing and bleaching. Usually, we receive alkaline effluent.

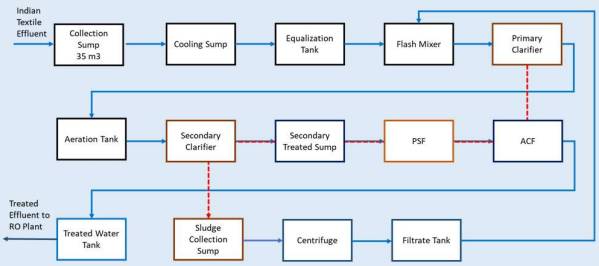
Temperature : Effluent temperature is quite high.
Other than PH and temperature textile process releases cellulosic fibers, COD, BOD, TSS, TDS, FOG and inorganic salts.

Process	Effluent Composition	Nature
Sizing	Starch, Waxes, Carboxymrthyl Cellulose, PVA, wetting Agents	High in BOD,COD
Desizing	Starch,CMC,PVA,fats, Waxes,Pectins	High in BOD,COD,SS, TDS
Bleaching	Sodium Hypo,Cl_2, NaOH,Acids,Surfactants, $NaSiO_3$	High Alkalinity, High SS
Mercerizing	Sodium Hypo, Cotton Wax	High pH, Low BOD, High TDS
Dyeing	Dyestuff Urea, Reducing & Oxidising Agents, Detergents, Acetic Acid, Wetting Agents	Strongly colored, High BOD, Low SS, Heavy Metals
Printing	Pastes, Urea, Starches, Gums, Oils, Binders, Acids, Alkali etc.	Strongly colored, Low BOD, SS, Alkaline, Oily Appearance



An integrated waste treatment system usually consists of three phases: primary treatment, secondary treatment, and advanced treatment.

Primary treatment involves the removal of suspended and settleable solids by screening, flotation, and sedimentation. Secondary treatment involves the biological decomposition of the organic matter, largely dissolved, that remains in the flow stream after treatment by primary processes.



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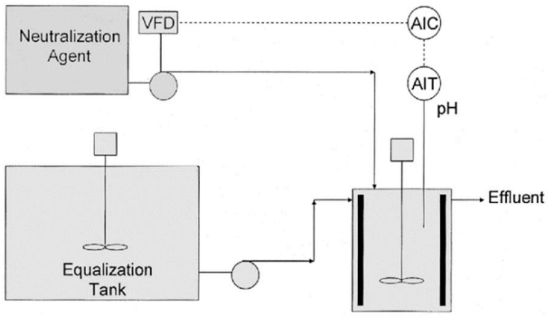
Importance of Neutralization

A high volume of wastewater generated from continuous operation like printing, finishing and preparatory dyeing is one of the biggest problems for the textile processing units. The effluent from textile processing industries is generally high in pH and dissolved solids.

The alkaline wastewater from preparatory process and wash water from continuous dyeing and preparations processes are most common large volume wastewater generation process.

The textile industry uses neutralization process to control the pH of wastewater so that it does not have impact over subsequent Primary & Biological treatment.



Temperature Difference : Issue ?

Temperature is a critical parameter to monitor for any biological wastewater treatment-based system. Like humans and many other living organisms, bacteria in wastewater treatment systems function best within a certain temperature range – typically between 20 – 35 ^{0}C.

The good thing about temperatures at the low end of this range is that bacteria can still function, they just do so much more slowly. Due to high temperature, there are some of the major signs of high temperature-related bacterial stress.

Like Deflocculation and High Effluent TSS, High Effluent BOD, Filament Die-Off and High/Low DO issue.

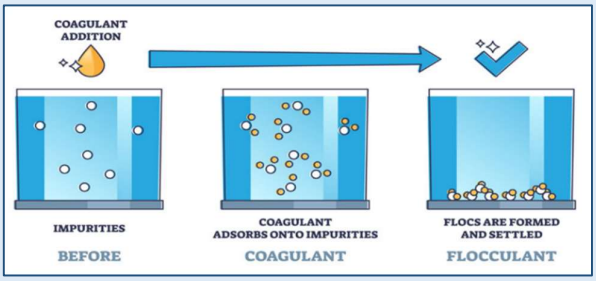
Colorchem : Role & Need

Due to the variety of organic and inorganic compounds used in both the dyeing as well as in other operations, influences the resulting wastewater's characteristics.

Coloured wastewaters which discharged to recipient waters, reduces the light transmission in water medium, and thus adversely affect the photosynthetic activity. Also, accumulation of dyes in some aquatic organisms, increases the risk of toxic and carcinogenic products occurrence.

Colorchem chemicals are used to remove and decrease colour in effluent with proper dosage in flash mixer.

Coagulation & Flocculation ?



The coagulation and flocculation process is the widely used unit operation, due to its low cost and comparatively easy operation.

Chemical coagulants cause formation of a sludge phase that can be separated by density difference. Major used coagulant are Spent PAC, Alum, ferric chloride & ferric sulphate.

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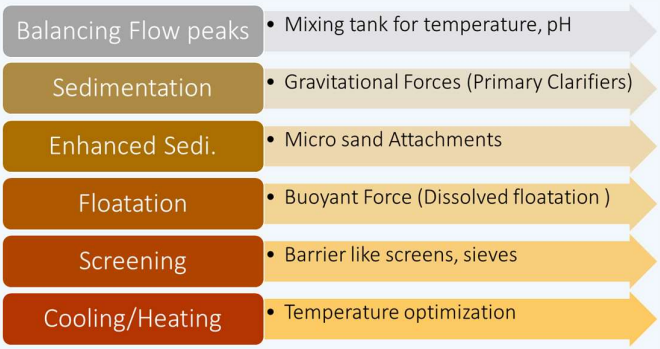
Need of Biological Treatment

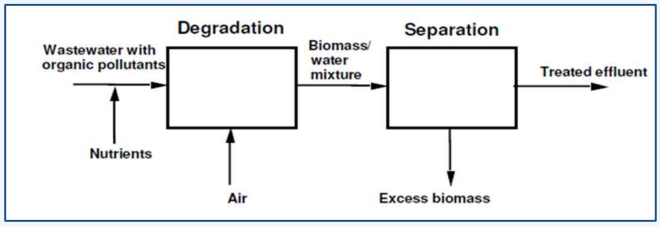
It is found that biological wastewater treatment possesses high degree of efficiency with minimum operating cost (5 to 6 times less) compared to other methods. Average reduction efficiency of BOD, COD, TSS is found 84%, 59.1%, and 81.7% respectively by biological treatment.

None of the methods except biological method can satisfy discharge standard. Combined physio-chemical and biological method is considered as the most efficient method.

Before treating effluent biologically, primary treatment needs to be implemented to get effective result from biological treatment.



A time-honoured example of an aerobic biological treatment method is the activated sludge process, which is widely used for the secondary treatment.



Biological treatment is the most economic and eco-friendly process due to least running cost; no hazardous chemicals are required, and very low non-toxic sludge are produced. Also, the use of microorganisms to remove contaminants from wastewater is highly effective and widespread.

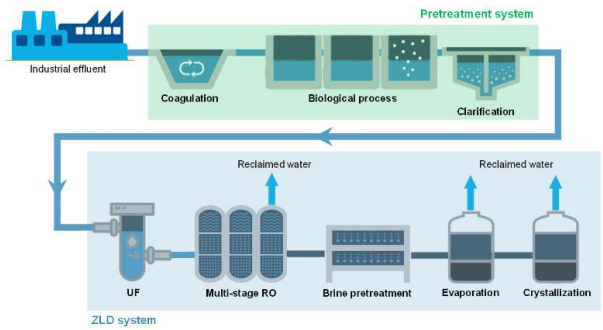
Post treated Treatment : UF, RO & ZLD

The membrane-based separation Techniques such as ultrafiltration (UF) and reverse osmosis (RO) have been used to treat a variety of industrial wastewater.

When treating wastewater by traditional methods such as aerobic the ratio of biochemical oxygen demand BOD to COD must be >0.38.

In recent years, post treated treatment with RO & ZLD desalination has attracted increased interest by the textile industry as an auspicious strategy for wastewater management.

This is mainly due to its ability to enhance water usage efficiency, while reducing brine discharges and water and disposal-related environmental impacts.



Above shown is the brief representation of UF, RO & ZLD schematic of post treatment of secondary treated water.

Treated RO water can be further used in recycling process for Boiler and cooling tower feed.

Other than avoiding addition of makeup water RO treated water has several advantages in textile industry as mentioned below :

- Higher cycles of concentration results in reduced fuel costs for boilers and cooling towers.
- Improved steam purity and quality for increased corrugator speed of boiler.
- More efficient operations and increased throughput results in higher profit.

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Challenges faced in Textile Industry

Textile industry wastewater has become a growing concern in recent years because it has been characterized by a high load of organic dyes, suspended and dissolved solids, alkaline pH, and low biodegradability.

Textile industry is a major contribution to the country's economy. Amidst all the optimism and favourable trends (backed by timely governmental initiatives), there are certain points of concern which can serve as roadblocks in the growth path of the textile sector.

More than 5% of the total volume of landfills worldwide are textile wastes. According to a recent survey, textile manufacturing was found to be the second-largest pollution-generator (after the oil industry).

A wide range of ionic chemicals, acids, industrial enzymes, and alkaline solutions are used in the day-to-day operations of the textile industry.

During the burning or singeing process different types of gases also get mixed in the ambient air. Many of these chemicals can pose serious health hazards (e.g., cancer risks).

The Indian textile industry is a source of employment for over 4.6 crore people – and their health cannot be compromised with.

Other than generation of heavy waste one more issue is there that is Inadequate Attention Paid to Technology Upgradation and Regular R&D.

While the Indian textile sector is growing steadily, there is regional unevenness in this growth.

This is also something that needs to be gradually rectified.

जल जीवन जननी !!

Our World is Waughter

The technical knowledge share attempt of Aktion Consultancy and the contents in the magazine shall be qualified by Sanjeev Srivastava our Technology Lead.

Our next edition focuses on: "Common Effluent Treatment Plants - CETPs"

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