Textile Waste Water – A Threat to Jodhpur

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***Abstract* – Textile industries use many dyes, chemicals, and other materials to impart desired quality to the fabrics. Textile waste waters include large amount of dyes and chemical substances that make it an environmental challenge not only as liquid waste but also in its chemical composition. Main pollution from textile industries comes from dyeing and finishing processes. These processes require an input of large number of dyestuffs which generally are complex organic compounds. Water is required to apply dyes and complete the process. In this process, much of it is not included in the final product and is wasted creating a disposal problem. Dye bath wastewater generated by textile mills thus are often rated as the most polluting among all industrial sectors. The pollution load is characterized by high color content, suspended solids, salts, nutrients and toxic substances such as heavy metals and chlorinated organic compounds. Many textile mills in the state currently discharge their wastewater to local wastewater treatment plants with minimum treatment such as pH neutralization. This process removes much of the residual dye color leaving behind other pollutants.**

Jodhpur, being a textile hub, produces tons of textile material like cloth prints; wall prints etc. every month and which are exported to various corners of the globe. These textile industries are boom to the revenue addition in Rajasthan state hence provide large amount of taxes. But when we talk about green chemistry, these textile industries are unfriendly industries to the environment. These industries produce a large amount of colored water waste which are heavily polluted and are containing very harmful chemicals. Therefore wastewater from textile industries has to be treated before being discharged into the environment or nearest water bodies. In this study, a brief description of the process to treat these effluents from textiles to decrease their harmful effect is presented. Some of available cheap alternatives (adsorbents) could be applied at the source before discharging it to nearest water body.

Keywords: Textile industries, wastewater, bio-adsorbent, metal ions

I. INTRODUCTION

Development of industries is a reflection of a country's progress. It contributes in the in the increasing revenue and employment opportunities of the country. Among the plethora of developing industries in India, textile dying and printing industry is one of most ancient industry which not only has developed but also attained a respectable position in world today. Jodhpur, a city in India, it contains the biggest bloc of textile dyeing and printing industries. About 250 textile industries which exist in and around Jodhpur make it a textile hub in world. In these industries various chemicals such as dyes, acids, alkalis, salt etc. are being used and at the same time considerable amount of water is also being used in different processes. All these chemicals are not contained in the final product prepared and cause disposal problems along with large volumes of wastewater. This wastewaters contains various salts of heavy meals along with other chemicals, and if not treated properly degrade the water quality in the water scarce region of Jodhpur. Highly toxic textile effluents not only adversely affect humans in its surrounding but also pose a big threat to the biological life in its vicinity.

When improperly disposed off, they imperil human health and the environment. Effluents from textile industries are complex mixtures of chemicals varying in quantity and quality. These industries generate waste mixed with waste waters from the production processes, which leads to change in both biological and chemical parameters of the receiving water bodies. [1]

The key environmental issues associated with textile industry are treatment and disposal of aqueous effluent. As in the case of many textile industries in Jodhpur region, the treated effluents are being discharged through drainage channels into the Jojari stream which subsequently affects the water quality of the stream. Also the stream has converted in a disposable block of textile industries. Depending on the dosage and exposure period, the effluents could be poisonous to plants, aquatic life and humans. Jodhpur being a large textile hub of India is going to face a large environmental crisis in future if this problem is not seriously taken today.

II. METAL IONS FOUND IN TEXTILE WASTEWATER

In industries such as textile, rubber, paper, plastic, cosmetics, etc. during processing a variety of chemicals are employed, depending on the nature of the raw material and product. These chemicals may vary from enzymes to detergents, dyes to soda or acids to salts, in their suspended form or aqueous form. Industrial processes generate wastewater containing heavy metal contaminants. Since most of heavy metals are non-degradable into non-toxic end products, their concentrations must be reduced to acceptable levels before discharging them into environment. Water pollution caused by industrial effluent discharges has become a worrisome phenomenon due to its impact on environmental health and safety. These compounds are of metal ions such as copper, cadmium, lead, iron, nitrate, sulphate, nickel, zinc, and chromium ions in aqueous as well as solid forms.[2] These compounds contaminate the surface water, thereby making it unfit for irrigation and drinking. Since farmers are using water from Jojari River for agricultural purposes and the residents of the town are using both the surface and underground waters from the same area as potable water, it was quite unsafe for this discharge into this water body. The ecological and human health safety of continual discharge of this treated textile effluents into this river are undoubtedly under threat. The metal ions present in the wastewater are very harmful for humans and environment including plants and animals.

III. HARMFUL EFFECTS OF METAL ION PRESENT IN TEXTILE WASTEWATER

The presence of Fe^{2+}, Ca^{2+}, Mg^{2+}, Cl^{-} and SO_4^{2-} wastewater from the metallurgical, cement and steel industries changes the nature of the water into which they are discharged, affecting its staining characteristics, hardness and salinity. Various oxidizing and reducing agents, such as the ammonia, nitrite, nitrate and sulphate discharged from the fertilizer, textile and dyeing industries, alter the chemical balance of the wastewater and cause problems with rapid oxygen depletion, etc. This not only decreases the nutritional value of the water but also causes foul odors and microbial growth. The discharge of acids and alkaline materials from the textile, coal-fuelled and chemical industries disrupts the ph buffer system of the natural water, reducing its potential to kill harmful micro-organisms.

IV. HARMFUL EFFECTS OF METAL IONS PRESENT IN TEXTILEWASTEWATER

From the numerous reports of industries in and around Jodhpur region, it was found that there are different kinds of metal ions such as cadmium, chromium, zinc, copper etc are found in wastewater disposed from textile in Jojari River which causes much harmful and ill effect on humans as well as plants and animals and environment too.

There are some major ions and their related problems.-

A. Cadmium-

Cadmium was found to range from 0.045 to 0.129 mg/L in and around Jodhpur area.

- On plants:

Decreased growth rate and negative effects on embryonic development are some of the negative physiological effects on organism, shown by cadmium.

- On Humans:

Cadmium is primarily toxic to the kidney, especially to the proximal tabular cells, the main site of accumulation.

Bone demineralization and bone damage can also be caused by Cadmium.

Lungs get damaged by breathing very high levels of cadmium.

- On environment:

Cadmium does not break down in the environment but can change forms.

Cadmium binds strongly to soil particles.

Cadmium can easily dissolve in water.

B. Chromium –

Chromium was found to range from 0.163 to 0.927 mg/L.Title and Author Details

- On Plants and animals:

Growth of roots, stems and leaves along with germination process is altered due to high concentration of Chromium in water which is harmful for plant growth. Chromium is very poisonous for living organism as it blocks the respiratory organ or part of the living creature and disables it to breathe

- On Humans:

the respiratory tract is the major target organ for chromium toxicity, for acute and chronic inhalation exposures.

Kidney damage, liver failure, blood cell damage happens due to its oxidation property.

Pneumonia, asthma, skin ulcers and bronchitis are other problems caused by chromium.

C. Zinc –

Zinc was found to range from 0.15 to 0.186 mg/L.

- On plants:

High zinc content in water is non toxic to plants.

- On Humans:

High concentration of zinc in water is most harmful to aquatic animals during early life stages thus affect humans through food chain.

D. Copper

Copper is a common environmental metal and it was found to range between 0.24 to 0.795 mg/L

- On plants:

Copper is toxic to plant roots. Causes root deformation, disruption of root cuticle and root hair proliferation.

- On Humans:
  In high concentrations, it can cause anemia, liver and kidney damage, stomach and intentional irritation.
  Problems like gastrointestinal and distress are experienced

V. TREATMENT OF METAL IONS PRESENT IN TEXTILE WASTEWATER-

Treatment of textile wastewater is very necessary part of textile production. Here are some of various ways to treat the metal ions present in textile wastewater Biological treatment, electrochemical technique, ozonation, ultra filtration, AOP, electro coagulation.

A. *BIOLOGICAL TREATMENT*

The various chemicals such as biocides and stain repellents used for brightening, sequestering, ant creasing, sizing, softening, and wetting of the yarn or fabric are also present in wastewater. Therefore, the textile wastewater needs environmental friendly, effective treatment process. [3]

B. *ELECTRO CHEMICAL TECHNIIQUE*

In electro oxidation, the main reagent that is used here is electron (clean reagent) where it removes the organic matter in textile wastewater without generating any secondary pollutants and also there is no need for adding extra reagent. [4]

C .OZONATION

Ozone has been used for successfully for removal of color from textile wastewater streams in plants around the world as well as in other industrial wastewater processes. In wastewater treatment, ozone is often used in conjunction with biological treatment systems such as activated sludge. Organic dyes are mostly refractory due to their large molecular size and they can be poorly removed by adsorption on activated sludge. In some cases ozone has been used before the biological process, but mainly after biological treatment. If the wastewater is hardly biodegradable or toxic to activated sludge pretreatment is an option.

D.ULTRA FILTERATION:

The traditional biological waste water treatment process has been used widely but it still could not yield a satisfied treatment performance. Therefore we have to know the feasibility for application of utrafilteration as a clean technology for treatment and reclamation of dye house waste water. The operating Trans membrane pressure is varied in a range from 2.0 to 3.5 bars to obtain the optimum Tran's membrane pressure.

E.ADVANCED OXIDATION PROCESS (AOP's):

The goal of any AOPs design is to generate and use hydroxyl free radical (HO·) as strong oxidant to destroy compound that cannot be oxidized by conventional oxidant. [5]

F.ELECTROCOAGULATION:

Electro coagulation is based on the in situ formation of the coagulant as the sacrificial anode corrodes due to an applied current, while the simultaneous evolution of hydrogen at the cathode allows for pollutant removal by flotation. This technique combines three main interdependent processes, operating synergistically to remove pollutants: electrochemistry, coagulation and hydrodynamic. [6]

VI. CONCLUSION

From the above stats and methods, we came to a conclusion that in order to unified the dignity and prosperity of textile in Jodhpur, the wastewater has to be treated before it is disposed off in the Jojari River. Jodhpur is a textile hub and also a very big exporter of cloth and textile product worldwide. With the help of above steps and precautions, we can make our industries more safe, better, powerful and proper.

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