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Case Study: Alomertex Factory for Textile and Ready Clothes

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Abstract: Textile industry is one of the most important and rapidly developing industrial sectors in Sudan. It has a high importance in terms of its environmental impact, since it consumes considerably amount of process water and produces highly polluted discharge water in large amounts. Textile mills in Sudan are required to control their discharge and therefore have started installing treatment plants. Performances of the treatment plants were evaluated by in situ inspections, and analysis of influent and effluent.
The objective of this study was investigation of the wastewater produced in ALOMERTEX factory, Analysis was done for samples of waste water to determine pH, COD (Chemical Oxygen Demand), BOD_5 (Biological Oxygen Demand), (Total dissolved solids) and TSS (Total suspended solids), results were presented in tables in the body of the paper, It is found that the waste water parameters in the effluent are off range of the standards, and the methods used for treatment were investigated.

Keywords*:* Textile Waste Treatment, Dying, wastewater.

I. Introduction

Textiles are among the basic needs of human being. The textile industries therefore have great economic significance by virtue of its contribution to overall industrial output and employment generation.
Textile dyeing industry consumes large quantities of water and produces large volumes of wastewater from different steps in the dyeing and finishing processes. Textile Printing and dyeing processes include pretreatment, dyeing, printing, finishing and other technologies. Pretreatment includes desizing, scouring, washing, and other processes [1]. Wastewater from printing and dyeing units is often rich in color, containing residues of reactive dyes and chemicals, such as biodegradable organic matter, suspended solids, toxic organic compounds (e.g. phenols), heavy metals, many aerosols, high chrome, high COD and BOD concentration as well as much more hard degradation materials. As a result, contaminated waste water is generated which can cause environmental problems unless properly treated before disposal [2].

Effluent from textile mills contains chromium, which has a cumulative effect and higher possibilities for entering into the food chain. Due to usage of dyes and chemicals, effluents are dark in color, which increases the turbidity of water body. High values of COD and BOD_5 has an adverse effect on the aquatic ecological system [3].

The discharge standards for the textile industry in Sudan are set by the Sudanese Standard and Metrology Organization (SSMO), which also controls and inspects the industrial wastewater discharges.

II. Material and Methods

Alomertex Factory:
ALOMERTEX factory for Textile and ready clothes is a large factory; occupying about (3000 m^2) area, located in Khartoum – Soba – industrial area .block 7. Factory contains the following processing units:
1. **Sewing Unit:** in this unit the fabric is processed into a garment.
2. **Trico Textile Unit:** in this unit the yarns are converted into fabrics.
3. **Water Treatment Unit:** it is a small RO unit where water is treated before entering dyeing unit.
4. **Dyeing and Printing Unit:** It is a large unit is about 2500 m^2 area, and consumes large amounts of water approximately (1700 m^3/day), and includes a small store for dyes and chemicals. Dyeing is a coloration process, by which coloring substance (dyes or pigments) is transferred from dye bath into fiber. The Dyeing process is done at 130°C and takes about one hour, and then the temperature is decreased gradually from 130 to 70 °C. The types of dying additives for different materials are as follows:

- **Polyester Dyeing Additives:** Acid SNA, SPM for polyester, EYSG (oil removal, washer and wetter) and Dyes.
- **Cotton Dyeing Additives:** SPM for cotton, EYSG (oil removal, washer and wetter), Dyes and Caustic soda.
  Generally dyes are added then the temperature is raised - but reactive dyes are added after the heating-followed by salt and caustic soda addition.
  Printing is a coloration process by which coloring substance (dyes or pigments) are applied on the surface of textile material in localized (selection or mark) area according to particular design.
  In the mill Air pollution includes particulates and gases. Of the particulates are the fur generated during the weaving and spinning process. And the gases are oxides of nitrogen, hydrocarbons emitted when the fuels are being burned, also sulphur dioxide and sulphates.
  The factory doesn't have wastewater treatment unit .wastewater is collected in one place and taken off side by tankers.

Experimental analysis of wastewater samples: samples of wastewater from the different processing units are taken and analyzed for BOD, COD, TDS, TSS and pH. Samples were taken from:

- The overall wastewater collection Tank.
- The wastewater of cotton dyeing machine
- The wastewater of polyester dyeing machine
- The wastewater of the dryer of fabrics containing 40% cotton, 60%polyester

Methodology:

The (APHA, 1998) [4] Standard Methods are applied for the analyses. The effluent is analyzed for BOD_5, COD, TSS, TDS and pH values.

III. Experimental Results and Discussion

The results of the analysis of the samples are shown in Table (1.1) and plotted in Figure (1.1):

Table (1.1): Analysis results of samples and a comparison with (SSMO) limits

Parameter	Dryer	Dyeing polyester	Dyeing cotton	Collection Tank	Standard
BOD	1870.3	1744.3	1342.3	1804.3	100
COD	4800	4800	5600	18000	250
TSS	1200	182	336	1300	200
TDS	544	413	1.92	2.21	1500
pH	5.91	6.2	8.3	6.63	7

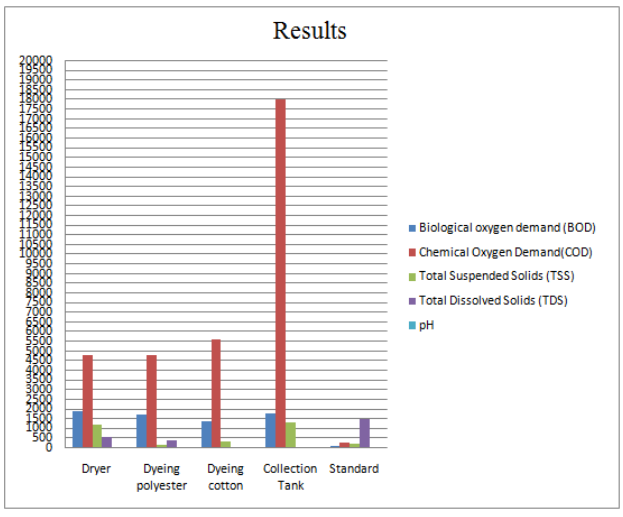

Figure (1.1): Results of samples analysis and a comparison with (SSMO) limits

Figure (1.1) shows:

- Samples taken from the overall wastewater collection tank when compared with (SSMO) limits for industrial effluents discharge show that (TDS) and pH values are in range of the standard values, however the (TSS), (BOD) and (COD) values are off range .

- Samples taken from the wastewater of cotton dyeing machine when compared with (SSMO) limits for industrial effluents discharge show that (TDS) and pH values are in range of the standard values, however the (BOD), (COD) and (TSS) values are off range.
- Samples taken from the wastewater of polyester dyeing machine when compared with (SSMO) limits for industrial effluents discharge show that (TDS), (TSS) and pH values are in range of the standard values; however (BOD) and (COD) values are off range.
- Sample taken from the wastewater of the dryer of fabrics containing 40% cotton, 60% polyester when compared with (SSMO) limits for industrial effluents discharge show that (TDS) values are in range of the standard values, however pH, (TSS), (BOD) and (COD) values are off range .
- COD is high in the overall wastewater collection tank; however this can be reduced by segregation of wastewaters.
- TSS in the water from the overall wastewater collection tank and dryer is high, therefore the water from the overall wastewater collection tank and dryer are to be combined and treated to reduce TSS.
- Using physiochemical treatment followed by biological treatment system is recommended.
  Textile dyeing wastewater is one of the most important sources of pollution. The type of this wastewater has the characteristics of higher value of color, TSS, BOD and COD, Complex composition, widely distributed and difficult degradation. If being directly discharged without being treated, it will bring serious harm to the ecological environment. Because of the dangers of dyeing wastewater, many countries have enacted strict emissions standards, but there is no uniform standard currently. Waste minimization is of great importance in decreasing pollution load and production costs.

IV. Conclusion

Certain pollutants in Textile wastewater are more important to target for pollution prevention than others, for this case studied it is found that the printing and dyeing processes needs more attention.

ALOMERTEX factory wastewaters are found to have the following characteristics; Total Dissolved Solids (TDS) levels are low in raw textile dyeing waste water; on the other hand Total Suspended Solids (TSS), Biological Oxygen Demand (BOD) and Chemical Oxygen Demand (COD) are high in all wastewater samples.

V. Recommendations

If the discharge is assessed according to (SSMO) criteria, additional treatment units would be required to meet the standards. Using physiochemical treatment followed by biological treatment system is recommended in this study.

Wet processing is an important pollution prevention target in printing and dying.As the improvement of the environmental protection laws and the raise of the awareness of environmental protection, the pollution of printing and dyeing enterprises have gained alot of attention and the treatment of dyeing wastewater has become a focus, on the other hand, clean production is also an important research, which can shift the focus from treatment to prevention.It will be beneficial to modify some processes in a way that it would be possible to use less salt for dyeing, to use chlorine instead of sulphate and to use HCl or CO_2 for neutralization. Use of environmentally friendly chemicals and processes that use less water is recommended.Recover usable materials such as caustic soda and salt from effluent and, minimize the generation of waste so that it can be safely stored without the need for discharge into the environment it can be reused also. It is necessary to carry out similar studies and to keep up with the technological development and to have educated operators to run the treatment facilities.

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