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Assessment of Environmental Impacts during Operational Phase of a Textile Industry

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Abstract - *Environmental pollution is global issue of the modern world. Tremendous industrialization is going on around the globe and in recent situation water and air are getting highly contaminated. The textile industry is often associated with environmental pollution problems and this industry is also considered as ecologically one of the most polluting industries in the world. About 14.5% GDP of India is from textile industry. India has specially emerged as a leading center for processing of synthetic fabric, specially suiting of mixed fiber i.e. cotton and synthetic in the polyester/viscose fabrics. An assessment of environmental impacts has been made for a textile industry RSWM Limited of Bhilwara, Rajasthan during its operation phase. In this study, the physico-chemical parameters of water namely temperature, pH, hardness, total dissolved Solid (TDS), biological oxygen demand (BOD), chemical oxygen demand (COD), ambient air quality parameters namely SPM, SO_2, NO_x and evaluation of noise levels, assessment of health and safety measures have been investigated for impacts on the workers of the industry. Zero discharge approach is examined in the said textile industry; which shows that significant environmental improvements are being made. It has been found that the industry is working according to the standards and norms defined by the Central Pollution Control Board of India.*

Key Words: **Environmental Impact Assessment, Textile Industry, Water Pollution, Air Pollution, Noise Pollution**

1. INTRODUCTION

Textile processing industry is characterized not only by the large volume of water required for various unit operations but also by the variety of chemicals used for various processes. There is a long sequence of wet processing stages requiring inputs of water, chemicals and energy and generating wastes at each stage. The other feature of this industry, which is a backbone of fashion garment, is large variation in demand of type, pattern and color combination of fabric resulting into significant fluctuations in waste generation volume and load. Textile processing generates many waste streams, including liquid, gaseous and solid wastes, some of which may be hazardous. The nature of the waste generated depends on the type of textile facility, the processes and technologies being operated and the types of fibres and chemicals used.

India's textile sector is one of the oldest industries in Indian economy. Even today, textile sector is one of the largest contributors to India's exports with approximately 11% of total exports. The textile industry has two broad segments. First, the unorganized sector consists of handloom, handicrafts and sericulture, which are operated on a small scale and through traditional tools and methods. The second is the organized sector consisting of spinning, apparel and garments segment which apply modern machinery and techniques such as economies of scale.

1.1 Waste Generated from Textile Industries

Textile industries generate all three kinds of waste i.e. liquid effluents, air emissions and solid wastes. However, liquid effluents are of utmost concern because of its high volume and pollution potential. Quantity and nature of waste generated depends on the fabric being processed, chemicals being used, technology being employed, operating practices etc. The important pollutants present in a typical textile waste effluent are colour, bio-chemical oxygen demand (BOD), chemical oxygen demand (COD), toxic heavy metals, residual chlorine, dissolved solids and non-biodegradable organics termed as refractory materials. The textile units may have utilities such as raw water treatment system, cooling towers, laboratory, workshop(s), fuel storage facilities, residential colony, administrative block, canteen etc. which generates utility wastewater and domestic wastewater. Main sources of air pollution are boilers(s), thermo pack and diesel generator(s) which generate gaseous pollutants such as suspended particulate matter (SPM), Sulphur dioxide gas, oxide of nitrogen gas etc. Textile industry is also a major source of hazardous waste generation. The sources of hazardous waste generation are effluent treatment plant sludge, used oil, empty containers of dyes and other chemicals etc.

1.2 Environmental Impact Assessment

Environmental Impact Assessment (EIA) is a tool used for decision making in projects, developments and programs. It may be defined as a formal process used to predict the environmental consequences of any development project. EIA tries to ensure that potential problems are foreseen and addressed at an early stage in the project's planning and design. EIA is also intended to identify the environmental, social and economic impacts of a proposed development prior to final decision making.

In essence, EIA is a process, a systematic process that examines the environmental consequences of development actions, in advance. The emphasis, compared with many other mechanisms for environmental protection, is on prevention.

2. STUDY LOCATION & PROFILE OF INDUSTRY

Textile is an important industry in Rajasthan, accounting for nearly 20% of the investment made in the State. Rajasthan contributes over 7.5% of India's production of cotton and blended yarn. Rajasthan has a leading position in spinning of polyester viscose yarn and synthetic suiting and processing. In total the production of textiles accounts 21.96 % in the State. Out of 862 spinning mills in India, 69 spinning mills are in Rajasthan. The major operations performed in a typical textile processing industry are de-sizing, scouring, mercerizing, bleaching, neutralizing, dyeing, printing and finishing. There are about 500 synthetic textile units in outskirts of Bhilwara on Chittorgarh, Gangapur and Mandal roads.

The LNJ Bhilwara Group is a well-diversified multi-product conglomerate with over 25,000 strong work forces, of which over 3,000 are highly qualified personnel in technical and managerial fields. The Group has diversified interests in Textiles, Graphite Electrodes, Hydro Power, and Sponge Iron & Telecommunication.

RSWM Limited is a LNJ Bhilwara Group company. In 1994, a melange yarn-manufacturing unit was started by RSWM Limited at Mandpam, Bhilwara. The Mandpam unit specializes in fashion-oriented yarn. The unit produces 100% cotton and cotton-blended Melange yarn, which is the blending of two or more different colours of dyed fibre plus grey fibre, on 44,592 spindles for spinning, producing 10000 MT/annum. The unit also has five cotton fibre dyeing machines capable of an output of 2500 MT/annum and 17 yarn dyeing machines with an output of 4000 MT/annum. The plant has state-of-the-art equipments from UK, Italy, Switzerland, Germany, USA and Japan to produce international quality melange yarn fibre & dyed yarn. The satellite image and actual photograph of RSWM Ltd. Bhilwara are shown below:

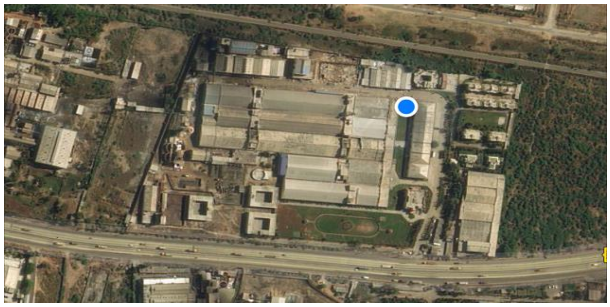


Figure 1: Satellite Image of RSWM Limited Bhilwara

Figure 2: RSWM Limited, Bhilwara

3. METHODOLOGY & INSTRUMENTATION

In the study, assessment of environmental impacts has been made by adopting the standards methods applicable for the analysis of water, air and noise parameters.

3.1 Water Quality Parameters

The water quality parameters have been analyzed at three important locations namely dyeing effluent, intermediate effluent treatment plant and reverse osmosis output. The important parameters included are temperature, pH, total dissolved solids, hardness, biochemical oxygen demand and chemical oxygen demand using instruments like thermometer, pH meter, TDS meter, BOD incubator, COD digester etc.

3.2 Ambient Air Quality Parameters

The ambient air quality parameters namely suspended particulate matter (SPM), SO_2 and NO_x have been analyzed at two locations of the industry i.e. main gate and near chimney using high volume air sampler, hot air oven, filters, impingers and spectrophotometer to assess the environmental impact.

3.3 Noise Level Measurement

The measurement of noise levels within the premises of textile industry has been carried out with the help of Quest 1900/2900 integrating sound level meter for a period of seven weeks during the study.

3.4 Health and Safety Measures

An assessment of health and safety measures was carried out with the help of questionnaire and personal interview with the workers of the industry. The health and safety measures were physically checked within the premises and satisfaction level of the employees was ascertained.

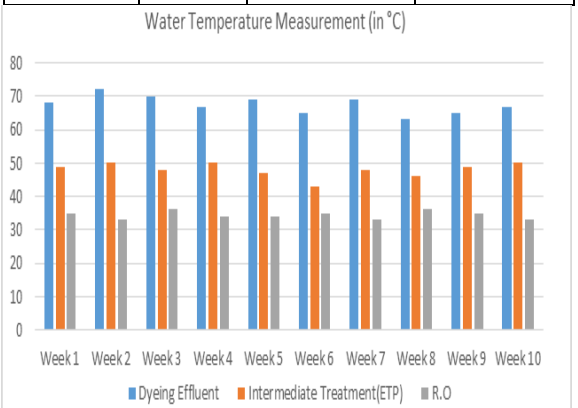
4. RESULTS & DISCUSSION

The following results have been obtained after assessment of water, air and noise parameters as well as health and safety measures.

4.1 Water Quality Parameters

Table - 1: Temperature Measurement

Sample collected during	Dyeing Effluent	Intermediate Treatment (ETP)	R.O.
Week 1	68°C	49°C	35°C
Week 2	72°C	50°C	33°C
Week 3	70°C	48°C	36°C
Week 4	67°C	50°C	34°C
Week 5	69°C	47°C	34°C
Week 6	65°C	43°C	35°C
Week 7	69°C	48°C	33°C
Week 8	63°C	46°C	36°C
Week 9	65°C	49°C	35°C
Week 10	67°C	50°C	33°C



Graph 1: Effect of time & process on Temperature of water

Table - 2: pH Measurement

Sample collected during	Dyeing Effluent	Intermediate Treatment (ETP)	R.O.
Week 1	8.7	8.1	6.9
Week 2	9.1	7.9	6.9
Week 3	8.9	8.2	7.0
Week 4	9.0	8.1	6.8
Week 5	9.3	7.7	7.0
Week 6	9.7	7.9	6.9
Week 7	8.8	7.9	6.6
Week 8	9.2	8.4	6.7
Week 9	8.7	8.1	6.9
Week 10	9.4	7.6	6.8

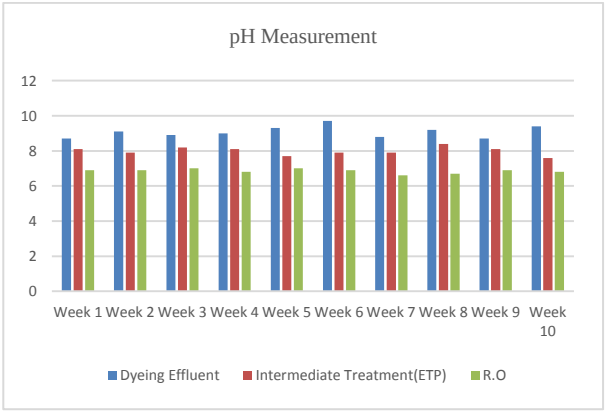
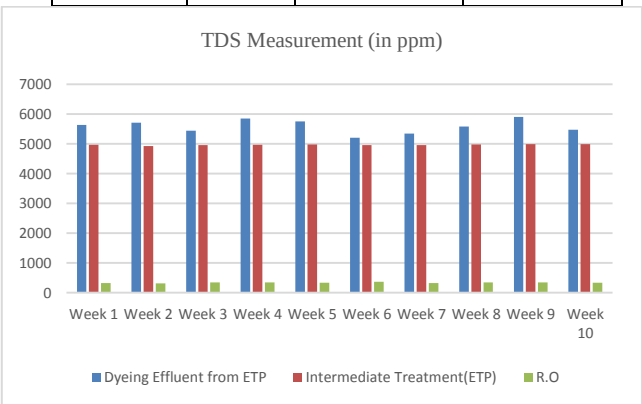


Figure 2: Effect of time and process on pH of water

Table - 3: TDS Measurement (in ppm)

Sample collected during	Dyeing Effluent	Intermediate Treatment (ETP)	R.O.
Week 1	5637	4967	328
Week 2	5710	4923	317
Week 3	5449	4958	345
Week 4	5853	4972	341
Week 5	5761	4979	338
Week 6	5209	4963	363
Week 7	5346	4964	328
Week 8	5587	4981	350
Week 9	5911	4992	342
Week 10	5472	4987	337

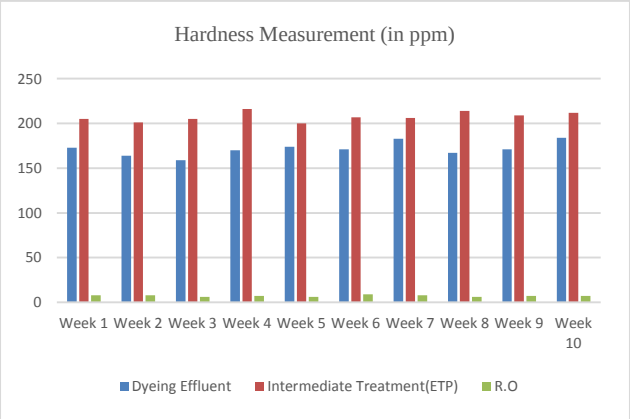


Graph 3: Effect of time and process on TDS of water

Table - 4: Hardness Measurement (in ppm)

Sample collected during	Dyeing Effluent	Intermediate Treatment (ETP)	R.O.
Week 1	173	205	8
Week 2	164	201	8

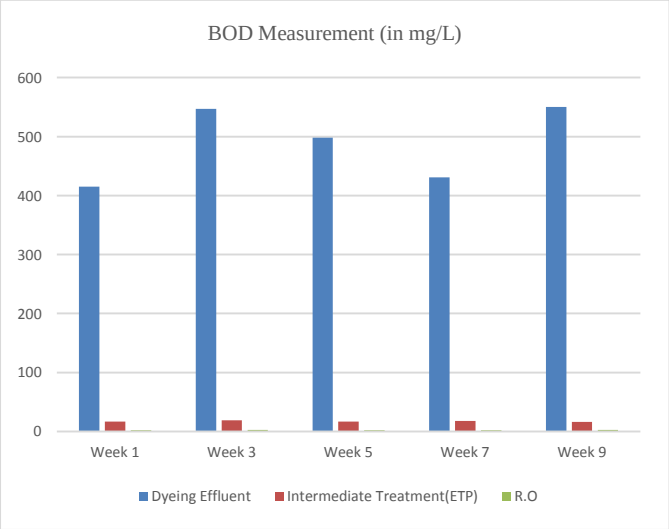
Week 3	159	205	6
Week 4	170	216	7
Week 5	174	200	6
Week 6	171	207	9
Week 7	183	206	8
Week 8	167	214	6
Week 9	171	209	7
Week 10	184	212	7



Graph 4: Effect of time and process on hardness of water

Table - 5: BOD Measurement (in ppm)

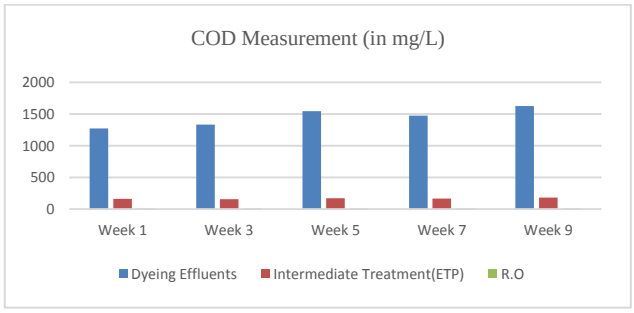
Sample collected during	Dyeing Effluent	Intermediate Treatment (ETP)	R.O.
Week 1	415	17	2.3
Week 3	547	19	2.7
Week 5	498	17	2.1
Week 7	431	18	2.2
Week 9	550	16	2.5



Graph 5: BOD values at different stages

Table - 6: COD Measurement (in ppm)

Sample collected during	Dyeing Effluent	Intermediate Treatment (ETP)	R.O.
Week 1	1274	163	11
Week 3	1334	158	11
Week 5	1545	172	10
Week 7	1476	167	12
Week 9	1627	184	11



Graph 6: COD values at different stages

4.2 Ambient Air Quality Measurement

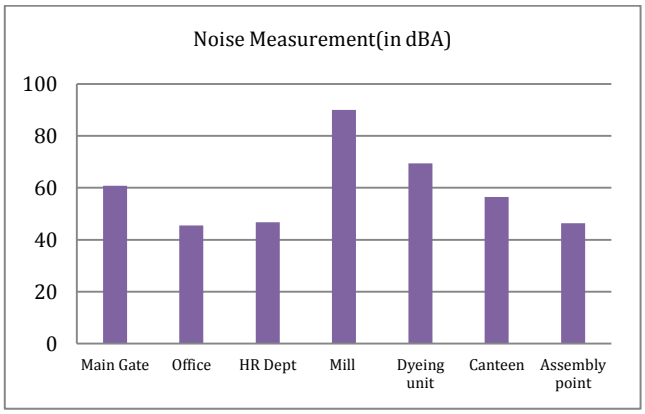
Table - 7: Ambient Air Quality Measurement

S. No.	Location	Parameters (in µg/ m^3)		
		SPM	SO_2	NO_x
1	Near Main Gate	305.36	26.25	38.39
2	Near Chimney	342.37	29.05	42.43

4.3 Noise Level Measurement

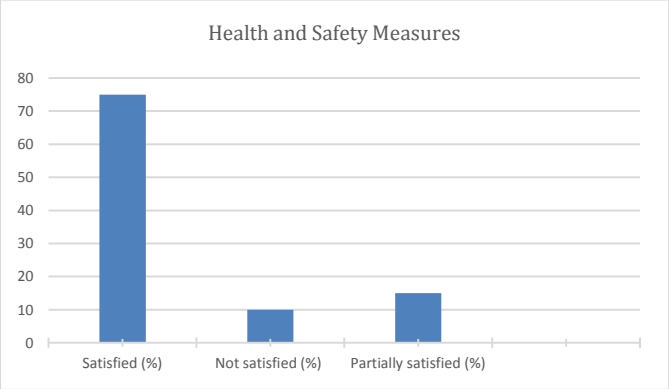
Table - 8: Noise Level Measurement (in dBA)

Location	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7
Main Gate	60	62	60	60	60	61	60
Office	45	46	45	46	45	47	45
HR Deptt.	48	46	47	49	46	45	47
Mill	90	89	90	91	90	89	90
Dyeing unit	68	70	67	69	71	70	71
Canteen	57	56	55	59	56	58	55
Assembly point	45	46	46	47	48	46	47



4.4 Health and Safety Measures

It has been observed that provisions of fire extinguishers, emergency kits including ladder, fire helmet, gloves, mask, hydrant box key and first aid box etc., smoke detectors, regular health checkup system for all workers and training programs for different health and safety consideration have been made in the company. The outcome of a questionnaire and personal interviews revealed the following analysis of the overall health and safety measures.



From the above results, it is clear that parameters evaluated in the textile industry whether they are related to water, air or noise quality, all of them are within the permissible limits as prescribed by the Central Pollution Control Board of India, as given in the table 9 below:

Table - 9: Central Pollution Control Board's Standard Limits for Textile Industry

S. No.	Parameters	Standard Limits
1	Temperature	5°C
2	pH	5.5 to 9.0
3	Hardness	600 mg/L
4	TDS	2000 mg/L
5	BOD	<30 mg/L
6	COD	<250 mg/L
7	SPM	500µg/m^3
8	SO_2	120 µg/m^3
9	NOx	120 µg/m^3
10	Noise	75dBA (Day), 70dBA (Night)

5. CONCLUSIONS

After carrying out an assessment of environmental impacts in the textile industry, very interesting outcomes have been observed. Some good practices have been observed in which zero discharge policy is a feather in the crown of the RSWM Ltd. In terms of impacts, we can conclude that:

- The industry is based on zero discharge principle, by using ETP and RO process, wherein the water is reutilized and recycled.
- The physic-chemical parameters of the recycled water e.g. temperature; pH, hardness, TDS, BOD and COD values are near about to fresh water.
- Harmful gases and substances are not found in the ambient air and SPM, SO_2 and NO_x values are within permissible limits.
- Noise level is permissible at most of the locations and tolerable at other places.
- All mitigate and non-mitigate measures regarding health and safety are being taken at work place. No hazardous impacts are being found.

In nutshell, it has been noticed that the textile industry does not have any major impacts which can lead to serious issues of environmental pollution or any other hazards. It has been noticed that the textile industry is significantly helping in improving the social status of the region.

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