A

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CHAPTER-1

INTRODUCTION

Textile industry

Textile industry is one of the most important and rapidly developing industrial sectors. It has a high importance in terms of its environmental impact, since it consumes considerably high amounts of processed water and produces highly polluted discharge water in large amounts. Textile mills are required to control their discharge and therefore have started installing treatment plants in the name or environmental protection. For the treatment of textile industry wastewater, biological treatment, chemical treatment and combinations of these are used. Plants utilizing biological treatment rather than chemical processes claim that their prcfcrcncc is due to Icss cxccss production, lower operational costs and better COD removal in biological treatment.

In the textile industry, many different processes are used and almost all of them generate wastewater. The effluents resulting from these processes differ greatly in composition, due to differences in processes, used fabrics and machinery. Textile wastewater is usually treated as a mixed stream. For water and chemicals reuse purposes however, it is preferable to keep process streams apart and treat them separately. Characterization of textile industry effluents is of great importance for the separate treatment of process streams.

STATUS ABOUT TEXTILE INDUSTRIES IN INDIA

The textile industry occup1es 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 20% of the total exports. being the largest foreign exchange eamer, accounting for more than 5 per cent of GDP and providing direct employment to 38 million people, primarily the weaker sections, it is the second most important sector only after agriculture.

The No. I exporter of textiles, China, has a share of more than 10 per cent followed by Korea with 8.1 per cent; India's hovers at 3.5-4 per cent. In clothing exports, China holds a share of 18.5 per cent followed by Italy (6.7 per cent) and India (3 per cent). India's share may look small but in monetary terms it is large has a unique position as a self-reliant industry, form the production of raw materials to the delivery of finished products, with substantial value-addition at each stage of processing; it is a major Contribution to the country's economy. The industry is composed of handlooms, power looms and mills. While the mill sector is well-organized and modern, the same cannot be said of the power loom and handloom segments. The mill sector has managed to grab a reasonable share of the world export market. Although the development of textile sector was earlier taking place in terms of general policies, in recognition of the importance of this sector, for the first time a separate Policy Statement was made in l985 in regard to development of textile sector. The textile policy of 2000 aims at achieving the target of textile and apparel exports of US $ 50 billion by 2010 of which the share of garments will be US $ 25 billion. The man markets for Indian textiles and apparels are USA, UAE, UK, Germany, France, Italy, Russia, Canada, Bangladesh and Japan.

The main objectives of the textile policy 2000 is to provide cloth of acceptable quality at reasonable prices for the vast majority of the population of the country, to increasingly contribute to the provision of sustainable employment and the economic growth of the nation; and to compete with confidence for an increasing share of the global market.

RECENT TRENDS

The mood in the Indian textile industry given the phase-out of the quote regime of the Multi- Fibre Arrangement (MFA) is upbeat with new investment flowing in and increased orders, for the industry as a result of which capacities are fully booked up to April 2005. As a result of various initiatives taken by the government, there has been new investment of Rs.500 billion in the textile industry in the last five years. Nine textile majors invested Rs.26 billion and plan to invest another RS.64 billion. Further, India's cotton production increased by 57% over the last five years; and 3 million additional spindles and 30,000 shuttles-less looms were installed.

The industry expects investment of Rs. 1,400 billion in this sector in the post-MFA phase. A Vision 2010 for textiles formulated by the government after intensive interaction with the industry and Export Promotion Councils to capitalise on the upbeat mood aims to increase India's share in world's textile trade from the current 4% to 8% by 2010 and to achieve export value of US% 50 billion by 2010 Vision 2010 for textiles envisages growth in Indian textile economy from the current US $37 billion to $ 85 billion by 2010; creation of 12 million new jobs in the textile sector; and modernization and consolidation for creating a globally competitive textile industry.

The textile industry is undergoing a major reorientation towards non- clothing applications of textiles, known as technical textiles, which are growing roughly at twice rate of textiles for clothing applications and now account for more than half of total textile production. The processes

involved in producing technical textiles require expensive equipments and skilled workers are, for the moment, concentrated in developed countries.

Technical textiles have many applications including bed sheets; filtration and abrasive materials; furniture and healthcare upholstery; thermal protection and blood-absorbing materials; seatbelts; adhesive tape, and multiple other specialized products and applications.

SEGMENT ANALYSIS

India's textile industry compnses mostly small-scale, non- integrated spinning, weaving, finishing, and apparel-making enterprises. The following details depicts the overall value chain and the number and type of units within the industry.

SPINNING MILLS

With an installed capacity of 40 million spindles, India accounts for about 21 per cent of the world's spindle capacity. In 2008, India's spinning sector consisted of about 1,161 small-scale independent firms and 1,566 larger scale independent units. Independent spinning mills account for about 75 percent of capacity and 92 per cent of production.

KNIT/WEAVING/ KNITTING UNTIS

India's weaving and knitting sector is highly fragrpented, small-scale and labor-intensive. The woven fabric production industry can be divided into three sector:

I. Power loom,

2. Handloom and

3. Mill sector.

In 2011 it consisted of about 3.9 million handloorns, J .8 million power looms, and 0.1 million looms in the organised sector. The decentralisd power loom sector accounts for 95 per cent of the total cloth production. The knitted fabric forms 18 per cent of the total fabric production.

PROCESSING UNITS

The processing industry_ is largely decentralized and marked by hand processing units and independent processing units. Composite mill sectors are · very few falling into the organized category. Overall, ·about 2,300 processors are operating in India, including about 2, 100 independent units and · 200 units that are integrated with · spinning, weaving or knitting units.

GARMENTS MANUFACTURING UNITS

Small-scale fabricators dominate garment manufacturing. Most garment manufacturing units' fare reasonably well on the technology count. The bulk of apparel is produced by about 77,000 small-scale units classified as domestic manufacturers, manufacturer exporters, and fabricators (subcontractors). The fragmented structure of the industry provides the advantage of a large pool of skilled workers in different areas of textile manufacturing, and also gives scope for entry of organized integrated textile manufacturers. Small scale units in different sectors can also be leveraged as a supply base for sourcing materials at low cost. Apart from these advantages, the industry has also been experiencing consistent growth across different sectors, making it one of the key potential sectors in India.

TEXTILE DYES

Dyes are generally synthetic colorants used widely for coloration of different types of textile fibers and also in various other industries like tanneries paper and pulp, varnishes, food processing etc. Dyes are organic aromatic amines having wide variety of organic frame work with specifically incorporated functional group of metallic ions on the surface of the substrate. Currently, more than 9000 chemically distinct types of dyes are produced throughout the world belonging .to different application and chemical classes. A large amount of dye produced is utilized in the textile industry.

Dyes are extensively used in the textile industry. The colour which dues impart to water bodies is very undesirable to the water user for aesthetic reasons. Due to high concentration of organics in the effluents and higher stability of modern synthetic dyes, their discharges into rivers are harmful to aquatic life. The textile dyeing and printing industry have been recognized as one of the most polluting industries in India, which contribute towards the pollution of the water environment. Textile dyeing and printing industries are one of the most highly polluting industries. The textile dyeing and printing industries effluent contain high COD and colour it was observed that, the pollution potential of the printing industries is negligible as compare to that of textile dyeing.

Many types of dye are used in textile industries such as direct, reactive, acid and basic dyes. Most of these dyes represent acute problems to the ecological system as they considered toxic and have carcinogenic properties, which make the water inhibitory to aquatic life. Due to their chemical structure, dyes possess a high potential to resist fading on exposure to light and water. The main sources of wastewater generated by the textile industry originate from washing and bleaching of natural fibres and from dyeing and finishing steps. Given the great variety of fibres, dyes and process aids, these processes generate wastewater of great chemical complexity and diversity, which are not adequately treated in conventional wastewater treatment plant. Pollution of water resources is thus high, as their location is mostly on the banks of Small River.

PRODUCTION OF DYES IN INDIA

Dye production in India is estimated to be around 64,000 tonnes, which is about 6.6% of the world production. There are around 700 varieties of dyes and dye intenncdiatcs produced in India, mainly direct dyes, acid dyes, reactive dyes and pigments. Most of these dyes have not been characterized regarding their chemical nature, purity, possible toxicity or their impact on health and the environment. Yet, they are wide1y used by texti1e, leather, food and even the food industry. The textile industry in India alone consumes up to 80% of the total dyestuffs produced.

In Rajasthan state particularly, textile mills represent an important economic sector of all dyes produced across the world, 11 % goes out as effluents, 2% from manufacturing and as such as 9% from colouring. The effluents from dyeing and textile industries contain chemicals with intense colours and the release of these effluents to receiving streams may be objectionable for various aesthetic reasons. Besides a number of dyes used by these textile industries are not degradable. Further, these coloured dye wastes contain compounds that are difficult to treat biologically due to their resistance against biodegradation.

Since large quantities of dyes are used, such pollut1on due to yes may occur on a sipurity or possible mutagenicity or toxicity. This study was thus planned to investigate the mutagenic potential of the dyes available in markets of Sanganer.

TEXTILE WASTE WATER CHARACTERISTICS

Composite textile wastewater is characterized mainly by measurements of biochemical oxygen demand (BOD), chemical oxygen demand (COD), suspended solids (SS) and dissolved solids (DS). Typical characteristics of textile industry wastewater are presented in Table 1. Results in Table I show. A large extent of variation from plant-to-plant and sample-to-sample. As presented in Table 1, COD values of composite wastewater is extremely high compare to other parameter. In most cases BOD/COD ratio of the composite textile waste water is around 0.25 that implies that the waste water contains large amount of non-degradable organic matter.

Table 1. Composite textile industry wastewater characteristics

Parameters	Values
pH	7.0-9.0
Biological Oxygen Demand (mg/L)	80-6,000
Chemical Oxygen Demand (mg/L)	150-12,000
Total Suspended Solids (mg/L)	15-8,000
Total Dissolved Solids (mg/L)	2,900-3,100
Chloride (mg/L)	1000-1600
Total Nitrogen(mg/L)	70-80
Colour (Pt-Co)	50-2500

Chapter -2

OBJECTIVES

OBJECTIVES

Earlier studies have indicated that the soil water and underground water quality of Jaipur has been continuously deteriorating hence, the present study has been under taken to -

1. To assess and analyze the present water quality of Amanishah Nallah.

2. To identify the causes behind the deteriorating water quality.

3. To suggest remedial measures for improvement of water quality.

Chapter-3
REVIEW OF LITERATURE

REVIEW OF LITERATURE:

Textile wastewater includes a large variety of dyes and chemicals additions that make the environmental challenge for textile industry not only as liquid waste but also in its chemical composition (Venceslau et al., 1994).

Main pollution in textile wastewater came from dyeing and finishing processes. These processes require the input of a wide range of chemicals and dyestuffs, which generally are organic compounds of complex structure. Because all of them are not contained in the final product, became waste and caused disposal problems. Major pollutants in textile wastewaters are high suspended solids, chemical oxygen demand, heat, colour, acidity, and other soluble substances (Dae-Hee et al., 1999).

Dyes and heavy metals have been considered to be the possible source of genotoxic activity in dyeing and textile effluents. Several dyes have been investigated and found to be carcinogenic (Prival et al., 1984).

Many of the dyes used by textile industries are known carcinogens (ICPEMC i.e. International Commission for Protect ion against Environment Mutagens and Carcinogens, 1982) and teratogens (Beck, 1983).

Yoshida and Miyakawa (1973) reported that occupational exposure to benzidine dyes might have possibly resulted in bladder cancer amongst kimono painters in Japan. Triple primary cancers involving kidney, urinary bladder and liver in a dye worker have also been reported (Morikawa et al., 1997).

The removal of colour from textile industry and manufacturing industry wastewaters represents a major environment concern. In addition, only 47% of 87 of dyestuff are biodegradable (Pagga and Brown, 1986).

It has been documented that residual colour is usually due to insoluble dyes which have low biodegrability as reactive blue 21, direct blue 80 and vat violet with COD/BOD ratio of 59.0, 17.7 and 10.8, respectively (Marmagne and Coste, 1996).

Conventional oxidation treatment has 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 generated hydroxyl free radicals by different techniques.

Colour is the first contaminant to be recognized in the dyeing effluents and has to be removed before discharging into the water stream. Aesthetic merit, gas solubility and water transparencies are affected by the presence of dyes even in small amount. The removal of colour from wastewater has been rated to be relatively more important than the removal of soluble . colourless organic substances, which usually contribute the major fraction of biochemical oxygen demand (Rajamohan and Karthikeyan, 2004).

Large amounts of chemically different dyes are employed for various industrial applications including textile dyeing (Adebayo et al., 2010). Among' the total dyestuff consumption, it has been reported that textile industry accounts for 67% of the total dyestuff market (Rajamohan, et al., 2004).

AOPS processes are combination of ozone (03), hydrogen peroxide (H2O2) and UV irradiation, which showed the greatest promise to treat textile waste water. These oxidants effectively decolorized dyes, however did not remove COD completely (Ahmetet al., 2003; Lidia et al., 2001; Stanislaw et al., 2001; Tzitzi et al., 1994).

Evaporation method was employed for determination of BOD was determined by DO meter while COD by COD apparatus directly (Greenberg et al., 1992).

Chloride and sulphate contents were determined by titrimetric and turbidity method, respectively (Rump & Krist, 1992). pH of effluents affects physico-chemical properties of water which in turn adversely affects aquatic life, plants and humans. This also changes soil permeability which results in polluting underground resources of water (Rump & Krist, 1992).

Dissolved solids may be obtained by difference between total solids and suspended solids in the sample of the effluent (Ugoji and Aboaba, 2004).

Major pollutants in textile wastewater are high suspended solids, chemical oxygen demand, heat, colour, acidity and other soluble substances (Venceslau et al., 1999; World Bank, 2007).

Textile operations are extremely water and energy intensive textile effluents contain high concentration of salts, total suspended solids, colour, Chemical Oxygen Demand (COD), nutrients (nitrogen and Phosphorous compounds, such as surfactants heavy metal, andchlorinated organic compound (Correia ct al., 1994).

The heavy metals contained in these effluents (either in the form of effluents or adsorbed in the suspended solids) have been found to be carcinogenic (Tamburlini et al., 2002). Keeping in view the significance of water pollution the present study has been undertaken to check the contribution of textile effluents in water pollution.

Ecological and toxicological problems due to the discharge or wastewaters fron1 Sanganer textile industries in local drainage (Amani Shah Nallah) have been one of_ the most important water pollution problems in this area. Studies have clearly indicated that the industrial effluents, which are directly discharged into the Amani Shah Ka Nallah, drainage contain highly mutagenic compounds. These compounds are also contaminating the surface and even underground water, thereby, making it unfit for irrigation and drinking (Mathuret al., 2005). High concentrations of heavy metals like Cu, Cd, Zn, Pb, Ni, etc. have also been reported in this area (Khan, 1995).

Phenolic compounds were determined by photometric method (Greenberg et al., 1992).Other resources of water pollution include industrial (chemical, organic and thermal wastes), pesticides and fertilizers (Melvin. 2006).

Environmental pollution caused by textile waste water results in adverse effects on flora, fauna and the general health of the residents of surrounding industrial area. Usually the textile effluents contain highly toxic dyes, alts, acids, alkalis and · bleaching agents. Heavy metals like cadmium, copper, zinc, chromium and iron are also found in the dye effluents (Mathur et al., 2005).

The pollution of natural waters with textile waste effluents has become a serious problem in India, as industrial growth and development have been on a very large scale. It is also reported that textile and dyeing industry in the world pose a major environmental threat because of the large amounts of water and dyes involved in the manufacturing process (Abd El Rahim et. al., 2008).

Pollution of water bodies is a phenomenon of concern in the developing nations of the world (Awomeso et al., 2010). They may contain higher amounts of metals especially chromium, copper and cadmium. The presence of poisonous chemicals in industrial effluent may pose health threat to humans and animals as well as result in contamination of water quality (Novick, R., 1999).

In addition to having detrimental aesthetic effect on lakes (odour and appearance), some algae are toxic to cattle, spoil the taste of water, plug filtration units and increase the requirements for chemicals in the water treatment (Metcalf and Edy, 1991).

The first type of waste water treatment equipment is the metal recovery ion exchange system. This system was designed to remove metals within the waste water (McGraw Hill, 1982).

The impacts on the environment by textile industry have been recognized for some time, both in terms of the discharge of pollutants and of the consumption of water and energy (Lacasse and Baumann, 2006).

Chapter-4

STUDY AREA

LOCATION OF RAJASTAN

Rajasthan is situated in the north western part of India. It covers 342,239 square kilometers, is the largest state of the Republic of India in terms of area. Rajasthan lies between latitudes 23 degree 3'and 30 degrees 12', north and longitudes 69 degree 30' and 78 degree 17', east. The southern part of Rajasthan is about 225 km from the Gulf of Kutch and about 4oo km from the Arabian Sea. Rajasthan is bounded by Pakistan in the west and north-west; by the State of Punjab in the north; by Haryana in the north-east; by Uttar Pradesh in the east, by Madhya Pradesh in the south- east and Gujarat in the south-west. It is the land of Great Indian Thar Desert 60%, surrounded by beautiful Aravalli hills Range, a land of Forts, and a land of ancient civilization in the banks of Sarasvati river. It is one of the most beautiful states of India which attracts very large number of domestic and foreign tourists.

Forest Area: 9.32% (of total state area)

State Tree - Khejri

State Flower - Rohida

State Bird: Godawan or Great Indian Bustard

State Animal - Chinkara (an antelope)

Rajasthan is divided into 33 districts and seven divisions:

- Ajmer Division: Ajmer, Bhilwara, Nagaur, Tonk.
- Bharatpur Division : Bharatpur, Dholpur, Karauli,

Sawai Madhopur.

- Bikaner division: Churu Ganganagar, Hanumangarh

• Jaipur Division: Alwar, Jhunjhunu, Sikar, Dausa.

- Jodhpur Division : Banner, Jaisalmer, Jalore, Jodhpur District , Pali, Sirohi

• Kota Division : Baran, Bundi, Jhalawar, Kota

• Udaipur Division : Banswara District, _Chittorgarh District,

Pratapgarh District, Dungarpur District, Udaipur, Rajsamand.

Climate

The climate of Rajasthan greatly varies throughout the state. The climate of Rajasthan can be divided into four seasons: Summers, Monsoon, Post-Monsoon and winter

Summer season: -which extends from April to June, is the hottest season, with temperatures ranging, from 32-degree C to 45-degree C. In western Rajasthan the temp may rise to 48-degree C, particularly in May and June. At this time, Rajasthan's only hill station, Mt Abu registers the lowest temperatures. In the desert regions, the temperature drops at night. Prevailing winds are from the west and sometimes carry dust storms

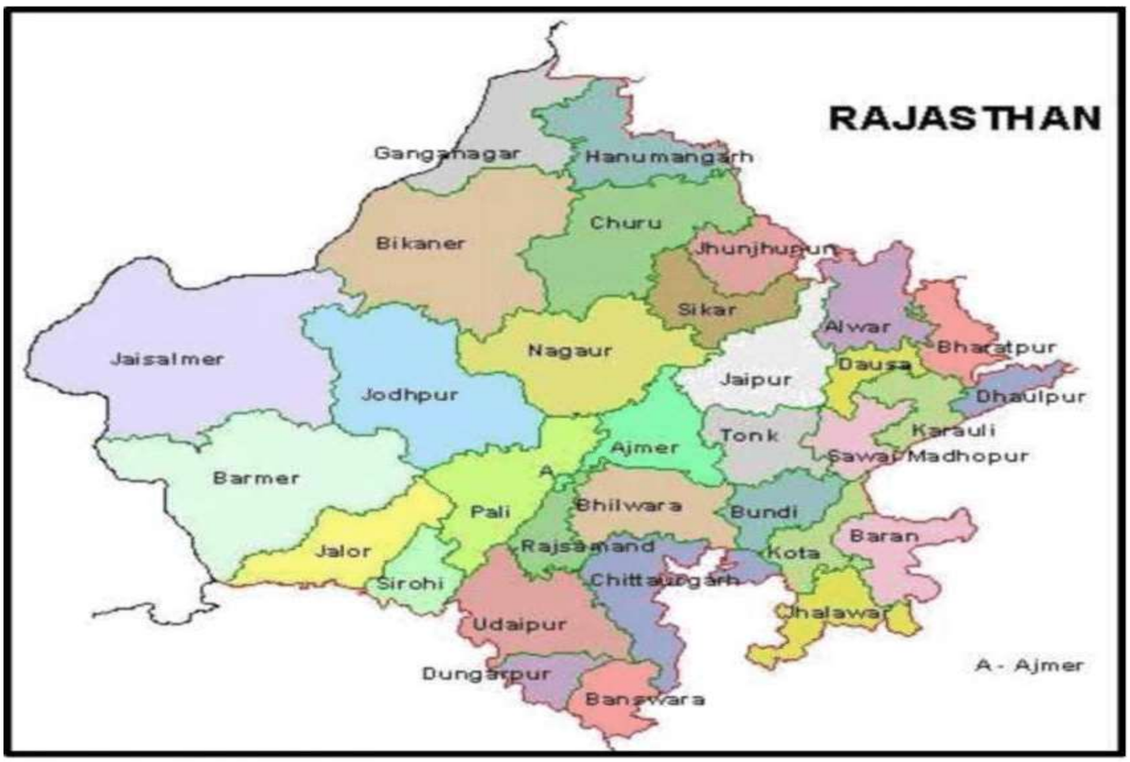
Monsoon season: extends from July to September, temp drops, but humidity increases, even when there is slight drop in the temp (35 degrees to 40-degree C). 90% of rains occur during this period.

The **Post-monsoon** period is from October to November. The average maximum temperature is 33-degree C to 38-degree C, and the minimum is between 18-degree C and 20-degree C.

Winter season: - from December to March. There is a marked variation in maximum and minimum temperatures and regional variations across the state.

January is the coolest month of the year. And temp may drop to 0-degree C in some cities of Rajasthan, like Churu. There is slight precipitation in the north and north-eastern region of the state, and light Winds, predominantly from the north and northeast. At this time, relative humidity ranges from 50% to 60% in the morning, and 25% to 35% in the afternoon.

LOCATION OF JAIPUR



Jaipur is the headquarters of the Jaipur district which is situated in the eastern part of Rajasthan. It is located at 26°55'N 75°49'E / 26.92°N 75.82°E I 26.92; 75.82. It has an average elevation of 431 meters The major rivers passing through the

Jaipur district are Banas and Banganga. Ground water resources to the extent of about 28.65 million cubic meters are available in the district. Although serious drought is rare, poor water management and exploitation of groundwater with extensive tube-well systems threatens agriculture in some areas.

SOCIO ECONOMIC FACTORS

POPULATION

As of 2011 India census, Jaipur Municipal Corporation area had a population of 37,22,575. The Jaipur District had a population of 66,51 ,071 with 35.10% increase in population since 1991. While 50.63% people lived in rural areas, 49.36% lived in urban areas. The overall literacy rate for the district was 69.80%. 82.80% males and 55 .52% females were literate. The sex ratio was 897 (females per 1000 males).

The major religion is Hinduism. Muslims and Jains also form a sizable chunk of the population.

Table 2: Population of Jaipur Different Years

JAIPUR POPULATION		
Census	**Population**	**% ±**
1981	**1,015,200**	**-**
1991	**1,518,200**	**49.5%**
2001	**2,322,575**	**53.0%**
2011	**3,701,256**	**59.4%**

INDUSTRIAL AREA

Number of large and medium scale running units is 48and 19,544 small scale in this city. The areas under study were major industrial areas and their flanJ<ing spots, almost in all parts of Jaipur city and adjacent areas, a large number of Industries have come up during last two decades.

No. of Industrial Area: 19, which includes: Bagru, Bassi, Bais Godam, Bindayaka, Dudu, Hirawala, Jetpura, Jhotwara, kaladera, kanakpura, Kartarpura, Malviya Nagar, Phulera, Renwal, Sanganeer, Shahpura, Sitapura, Sudarshanpur and Vishwakarma.

INTRODUCTION OF SANGANER INDUSTRIAL AREA

Sanganer is fa1nouse for its textile hand printing work. Mainly Chhipas community is engaged in dyeing and printing of textile as Small scale industry. Sanganer is very famous for a special type of printing known as 'Sanganer Printing'. This type of printing requires water based process for color fixation and it creates water pollution. The chhipas either wash clothes at their wells in the city or bring the cloth on wells dug on bank of An1anishah Nallah. The Amanishah Nallah gets polluted due to discharge of trade effluent into it and due to inflowing domestic waste water of Jaipur City. The agony is that there is no common effluent treatment plant installed in Sangager. There are estimated to be around 500block and screen p1inting units in Sanganer.

Sanganer town, district Jaipur (Rajasthan, India), if famous worldwide for its dyeing and printing industries. There are about 400 industries involved in textile printing processes, which, discharge effluents into nearby ponds and drains, without any treatment. These effluents contain highly toxic dyes, bleaching. agents, salts, acids, and alkalis. Heavy metals like cadmium, copper, zinc, chromium, and iron are also found in the dye effluents.

Textile workers are exposed to such waters with no control over the length and frequency of exposure.

Further as the untreated effluents are discharged into the environment, they can cause severe contamination of surface and underground water, Environmental pollution caused by such textile effluents results in adverse effects on flora, fauna, and the general health of not only the textile workers, but also the residents of Sanganer ssssstown. Therefore, to assess the possible genotoxic health risk and environmental genotoxicity due to the textile industry effluents, this study was carried out using the Ames Sahnonella/111icro son1e mutagen city assay. The results clearly indicate the effluents and the surface water of Amani Shah Drainage have high mutagenic activity. Further, the drainage water and the dry bed of the drainage (during summer months) are not fit for agricultural or other recreational purposes. A low level of mutagen city in the underground water of Sanganer again emphasizes the grave pollution problem existing in a tea. Multiple post hoc comparison tests (LSD, Tukey's) were used for comparison of sample sit, dose, and length of exposure, Quadratic Model was found to adequately fit the observed data.

LOCATION, LAND, AREA AND POPULATION

Sanganer town is situated nearly 16 km away from the main city of Jaipur. It lies between 26°49' N latitude and 75°76' to 75°51' E longitude. The total area of sanganer is about 635.5 sq. km in which urban area is 12.9 sq.km and rural area is 622.6 sq.km. The population range of sangane1: industrial area is between 10,000 and 20,000.

·CLIMATOLOGY

Climate is semi-arid type of Sanganer industrial area. The area has a lot dry in summer and bracing cold season. The cold season is from December to February and the summer season from March to June.

1. RAINFALL

About 90-95<1/o of the rainfall occurs during the monsoon period.

2. TEMPERATURE

Temperature range is variable. In summer temp. is very high 111 Sanganer.

3. HUMIDITY

The weather is generally dry accept during the monsoon, Relative humidity as less as 38.77% during the hot season and as high as 74.8% during monsoon have been observed.

INTRODUCTION TO AMANISHAH NALLAH

The untreated waste mainly from textile industries are discharged in Amanishah Nallah. The area across Amanishah Nallah have agricultureal field. It was observed during the survey that waste water from Amanishah Nallah is directly utilized by the farmers for agricultureal area across the Amanishah Nallah in sanganer town The Amanishah Nallah gets polluted due to discharge of trade effluent into it and due to inflowing domestic waste water of Jaipur city. The agony is that there is no common effluent treatment plant installed in Sanganer.

Chapter-5

MATERIALS AND METHODS

MATERIALS & METHODS

For the present investigation the samples were collected from Amani Shah Nallah. These samples were collected during different periods of the year from October, November and December 2022. Water samples were collected in different glass bottles. Physicochemical parameters were estimated using APHA Methods.

SAMPLE COLLECTION FROM AMANISHAH NALLAH

Three samples for the Study were collected different distances from Amanishah Nallah in Sanganer, Jaipur during October, November and December 2022.

PARAMETERS SELECTED

Following parameters were selected to achieve the determined aim.

1. Colour
2. pH
3. Electrical Conductivity
4. Total Solids
5. Chloride
6. Calcium Hardness
7. Magnesium Hardness
8. Total Hardness
9. DO (Dissolved Oxygen)
10. BOD (Biological Oxygen Demand)

1. **COLOUR**

Colour was estimated by visual method.

2. **pH**

pH is the negative log IO of the Hydrogen ion concentration in solution. pH of water samples was analyzed by digital pH meter (Model No. 161 E).

REAGENTS

Standard buffer solution of pH 4.00, 7.00 and 9.00 buffer tablets were dissolved in distilled water and diluted to I 00ml.

PROCEDURE

Standardize the instrument with electrode immersed m a buffer solution. Electrode was removed from buffer rinsed and blotted and then immersed in a second buffer, for the sample analysis, electrode was placed in the sample and the reading was noted on the meter.

3. **ELECTRICAL CONDUCTIVTY**

Electrical Conductivity of the sample was determined with the help of digital conductivity meter.

4. **TOTAL SOLIDS**

Total solid is the measure of all kinds of solids i.e. suspended, dissolved and volatile solids. Total Solids can be determined as the residue left after evaporation at 103° to 105° C of the unfiltered sample. It consists of two parts: Total Suspended Solids (TSS) and Total Dissolved Solids (TDS).

APPARATUS

1. Evaporating dishes: Dishes of 100 ml capacity made up of either porcelain or platinum.

2. Desiccators, provided with a desiccant containing a colour indicator of moisture ($CuSO_4.5H_2O$).

3. Drying oven or hot air oven, for operation at 103° to 105° C.

4. Analytical balance. capable of weighing to 0.1 mg.

PROCEDURE

1. Take an evaporating dish or clean beaker (400ml capacity) of suitable size and dry at I 03° to 105° C for 1 hr. Store and cool the dish in desiccators until needed. Weigh immediately before use.

Note the initial weight (W_i) in mg.

2. Put 250-300ml unfiltered well mixed sample in it.

3. Put in hot air oven at I03°C to 105° C for 2hr up to dryness.

4. Cool in desiccators and take the final weight (W_f) in mg.

5. Repeat cycle of drying, cooling, desiccating and weighing until a constant weight is obtained, or weight change is less than 4% of previous weight or 0.5mg, whichever is less. When weighing dried sample, be alert to change in weight due to air exposure and sample degradation, Duplicate determination should be within 5% of the average.

CALCULATION

Total Solids mg/L = $(W_f - W_i) \times 1000$ /Volume of Sample(ml)

5. CHLORIDE

Silver nitrate reacts with chloride to form very slightly soluble white precipitate of AgCl. At the end point when all the chlorides get precipitated free silver ions react with chromate to form silver chromate of reddish brown colour. High content of chloride gives salty taste to water.

REAGENTS

1. $AgNO_3$ (0.02 N) - 3.4 g of dried $AgNO_3$ (A.R.) was dissolved in distilled water to make I litre of solution and kept in a dark bottle.

2. Potassium Chromate (5%) -5 g of K_2CrO_4 was dissolved in 100ml of distilled water.

PROCEDURE

50ml of sample was taken in a conical flask and 2 ml of K_2CrO_4 solution was added. This solution was titrated against 0.2 N silver nitrate solution until a persistent brick red end point appeared.

Chloride (mg/l) = (ml x N) of $AgNO_3$ x 1000 x 35.5 /ml of sample

6. CALCIUM HARDENESS

EDTA is having a higher affinity towards calcium, the former complex is broken down and a new complex is formed. However, EDTA has a property to combine with calcium.

REAGENTS

1. **EDTA SOLLUTION (0.01 M)**: - 3.723 g of disodium salt of EDTA was dissolved in distilled water to prepare 1 litre of solution and stored in polyethylene bottle.

2. **Sodium Hydroxide (1 N)**: - 40 g of NaOH was dissolved in distilled water and diluted to 1 litre.

3. **Murexide indicator** - 0.2 of Ammonium purported was added to 100 g of NaCl (A.R.) and grinded.

PROCEDURE

50 ml of sample was taken in a conical flask and 2 ml of NaOH solution was added. Then one pinch of murexide indicator was added. The solution turned pink. Solution was titrated against EDT A until the pink colour changed to purple.

Calcium (mg/l) = X x 400.8 / ml of sample

Where, X = Volume of EDTA used

7. **MAGNESIUM HARDENESS**

Calcium and magnesium form a complex of wine red colour with Eriochrome Black T at pH 10.0. The EDTA has got a stronger affinity for Ca^{2+} and Mg^{2+} the former complex is broken down and a new complex of blue colour is formed. The value of Mg^{2+} can be obtained by subtracting the value of calcium from the total of Ca^{2+} + Mg^{+2}

(a) Mg^{+2} ,mg/L = (Y-X) x 400.8/ Volume of sample x l.645

Where Y = EDTA used in Hardness determination

X = EDTA used in Calcium determination for the same volume of

the sample.)

(b.) Mg^{+2}, mg/L = Total hardness (mg/1 $CaCO_3$) - Calcium hardness (as mg/L $CaCO_3$) X 0.244

Where, Calcium hardness (as mg/L $CaCO_3$) = Ca, mg/L x 2.497 (APHA, A WW A and WPCF, 1985)

8. <u>TOTAL HARDENESS</u>

Hardness is generally caused by the calcium and magnesium ions present in water. Calcium and magnesium form a complex of wine red colour. with Eriochrome Black T at pH of 10.0 ± 0.1. The EDTA has got a stronger affinity towards Ca^{+2} and Mg^{+2} and therefore by addition of EDTA, the former complex is broken down and a new complex of blue colour is formed.

REAGENTS

1. **EDTA solution (0.01 M)**: - 3.723 g of disodium salt of EDTA was dissolved in distilled water to prepare 1 litre of solution and stored in polyethylene bottle.

2. **Buffer solution** –

(a) 16.9 g Ammonium chloride (NH_4Cl) was dissolved in 143 ml of concentrated ammonium hydroxide

(b) 1.179 g of disodium EDTA and 0.780 g of $MgS0_4.7H_2O$. were dissolved in 50 ml distilled water. Both (a &b) solutions were mixed and diluted to 250 ml with distilled water.

3. **Eriochrome Black T (Solochrome Black T) indicator** - 0.40 g of Eriochrome Black T was mixed with 100 g NaCl (A. R.) and grinded.

4. **Sodium sulphide solution** - 5.0 g of $Na_2S.9H_20$ or 3.7 g $Na_2S.5H_20$ was dissolved in 100 ml of distilled water. Bottle was tightly closed to prevent oxidation.

PROCEDURE

50ml. of water sample was taken in a conical flask and 1 ml of buffer solution and a pinch of Eriochrome Black 'I' indicator was added, the solution turned wine red. The solution was titrated against EDTA solution until the wine red colour changes of blue at the end point.

Hardness as (mg/l) $CaCO_3$ = ml of EDTA use x 100 / ml of sample

9. DISSOVED OXYGEN (D.O)

Dissolve oxygen is one of the best indicators of the health of water ecosystem oxygen enters water by direct absorption from the atmosphere or by plant photosynthesis. The oxygen is used by plants and animals for respiration and by the aerobic bacteria which consume oxygen during the Process of decomposition. Dissolved oxygen level changes according to the time of day, the weather and the temperature.

PRINCIPLE

Living organisms need oxygen to maintain their metabolic processes. Dissolved oxygen (DO) is important is precipitation and dissolution of organic substances in water. The solubility of oxygen in water depends upon its temperature. Analysis of DO (Dissolved Oxygen) is a key test in sanitary engineering practice. Therefore, it necessary to know D.O.

Dissolved Oxygen levels to assess quality of raw water and to keep a check on stream pollution. In a dissolved state in water oxygen in not reactive in the molecular form. Therefore, to make it reactive, $Mn(OH)_2$ (Manganese Hydroxide) is used. It is obtained from $MnSO_4$ in the presence of an alkali as follows-

$$2NaOH+MnSO_4 > Mn(OH)_2 +Na_2SO_4$$

OR

$$2KOH+MnSO_4 \ Mn(OH)_2+K_2SO_4$$

This Mn(OH)2 combines with oxygen (O2) and forms a brown precipitate of Manganic oxide MnO (OH)2 as follows-

$$2Mn(OH)_2 +O_2 \rightarrow 2MnO\ (OH)_2 \text{ (Brown ppt.)}$$

Thus, precipitate of manganic oxide reacts with H,SO4 and produces nascent oxygen (O).

Since, nascent oxygen is highly reactive, it dissociates iodine from KI in the presence of H2SO4.

$$MnO(HO)_2 + H_2SO_4 \rightarrow MnSO_4 +2HO+(0)$$

$$2KI+(0) + HSO_4 \rightarrow K_2SO_4 +MnSO_4+I_2$$

OR

$$MnO(OH)_2 + 2H_2SO_4 +KI \rightarrow K_2SO_4+ MnSO_4+ I_2 +3H_2O$$

Iodine turns starch blue; this it can be estimated that equivalent quantity of starch turned blue will indicate the amount of iodine. Iodine reacts with sodium thiosulphate, which does not give blue colour with starch.

Therefore,

$2Na_2S_20_3 + 12 \rightarrow 2NaI + Na_2S_40_6$

NOTE: Many times it has been observed that few ions, e.g. NO_2^- SO_3 which remains present in water, can free iodine from KI just like that of nascent oxygen [O]. Their presence is always. a hurdle in the estimation of real amount of dissolved oxygen. Therefore, to remove this problem, sodium azide (NaN_3) is added in solution before adding H_2SO_4.

$2NaN_3 + H_2SO_4 \rightarrow 2HN_3 + NaSO_4$

$HNO_2 + HN_3 \rightarrow N_2O + N_2 + H_2O$

Apparatus and Glassware - Burette stand, measuring cylinder (100ml),

beaker, titration flask, reagent bottles, etc.

Reagents required

I. Manganous Sulphate - dissolve 48 gm of tetra hydrate manganous sulphate and dilute to 100ml, filter if necessary.

2. Alkali Iodide (Azide reagent)- Dissolve 500 gm NaOH and 150 gm KI and dilute to 1000ml. Add 10 gm NaN_3 dissolved in 40 1111 distilled water.

3. Concentrated. H_2SO_4 .

4. Starch Indicator-Prepare paste or solution of 0.5 gm starch powder in distilled water. Pour this solution in l00m boiling. Allow to boil for minutes. Cool and then use.

CALCULATION

D.O of Water Sample = (8 x 1000 x N x V /Volume of sample) x mg/L

Where,

N = Normality of Titrant.

V = Volume of Titrant.

10. BIOLOGICAL OXYGEN DEMAND (BOD).

BOD (Biological Oxygen Demand) test is used to measure the concentration of biodegradable organic matter present in u sample of water. It can be used to the quality of the water and its degree of pollution by biodegradable organic matter. It is used in water quality management and assessment.

PRINCIPLE

The Biological oxygen demand (BOD) is a way of expressing the amount of oxygen compounds in sewage as measured by the volume of oxygen required by micro-organism (bacteria) to metabolize it under aerobic conditions. It is good index of organic pollution. If the amount of organic matter is sewage is more; the more oxygen will be utilized by bacteria to degrade it. Dumping sewage that contains high BOD increases the concentration of soluble organic compounds in the aquatic body where it discharges. Digestion of these organic compounds in natural ecosystems such as lakes, river can deplete available oxygen and result in asphyxiation (death) of fish.

The BOD of a water sample is generally measured by incubating the sample 20°C for five days in the dark under aerobic conditions. In tropical and subtropical belts, where the temperature and rate of metabolic activities are higher, the incubation should preferably be done at 27°C for 3 days, Since, nitrification consumes oxygen ·significantly; therefore, resulting in over estimation of BOD must be checked of alkyl thiourea.

In the water samples where more than 70% of initial oxygen is consumed. It is necessary to oxygenate/or dilute the sample with BOD free water to avoid oxygen stress.

REAGENTS REQUIRED

1. Alkylthio urea solution (0.5%)

2. Phosphate buffer solution (pH 7.2)

3. Sulphuric acid (1N): - 4ml of cone. H2SO4 added to 100ml of BOD

free distilled water.

4. Sodium hydroxide (l N): - 4gm of NaOH dissolved 1n 100ml of

distilled water.

PROCEDURE

1. Adjust the water sample to neutralize using IN alkali solution.

2. Fill the Water Sample in 6 BOD bottles without thout bubbling.

3. Add l ml of alkylthiourea to each bottle.

4. Determine dissolves oxygen content in three of the 6 BOD bottles

   by the titration method.

5. Take the mean of the three reading (D2).

6. Incubate thaw rest of the BOD bottles a 27°C in a BOD incubator for 5 days.
7. Estimate the oxygen concentration in the all the three incubated samples.
8. Take the mean of three reading (D2).

CALCULATION

BOD of water sample= D_1-D_2 mg/L

Where,

D_1 = Initial D.O in sample.

D_2 = D.O after 5 days in incubation.

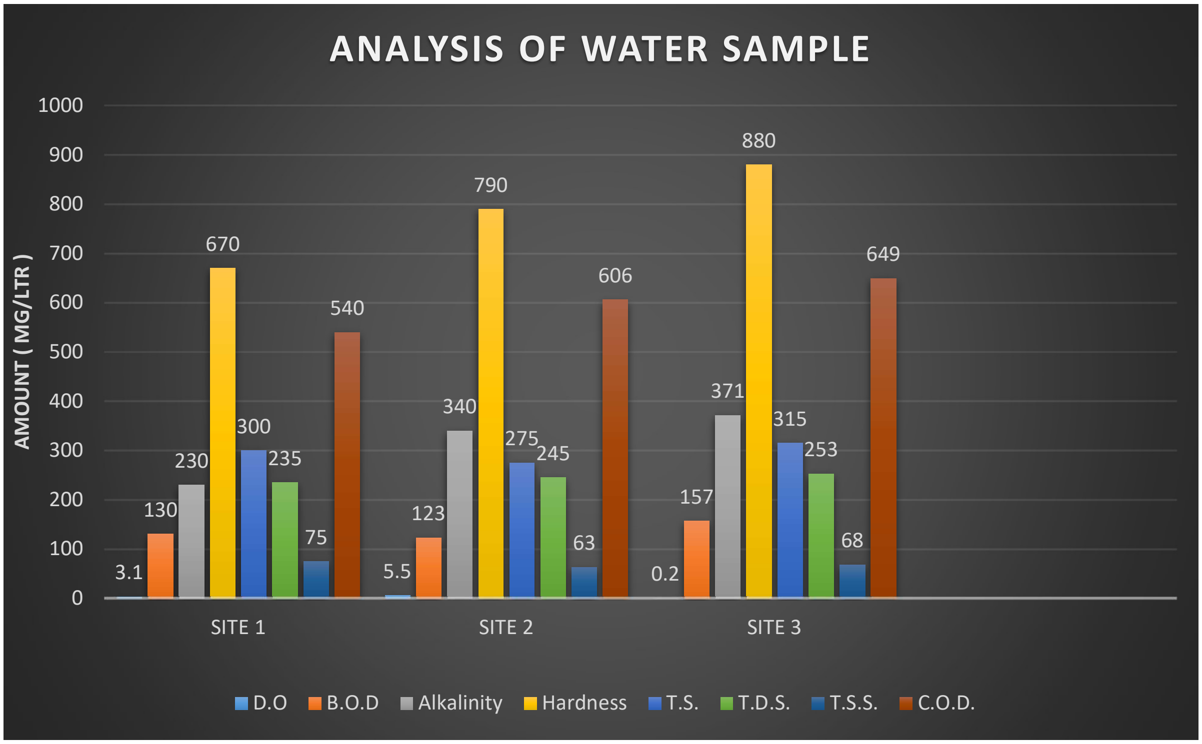
Chapter-6

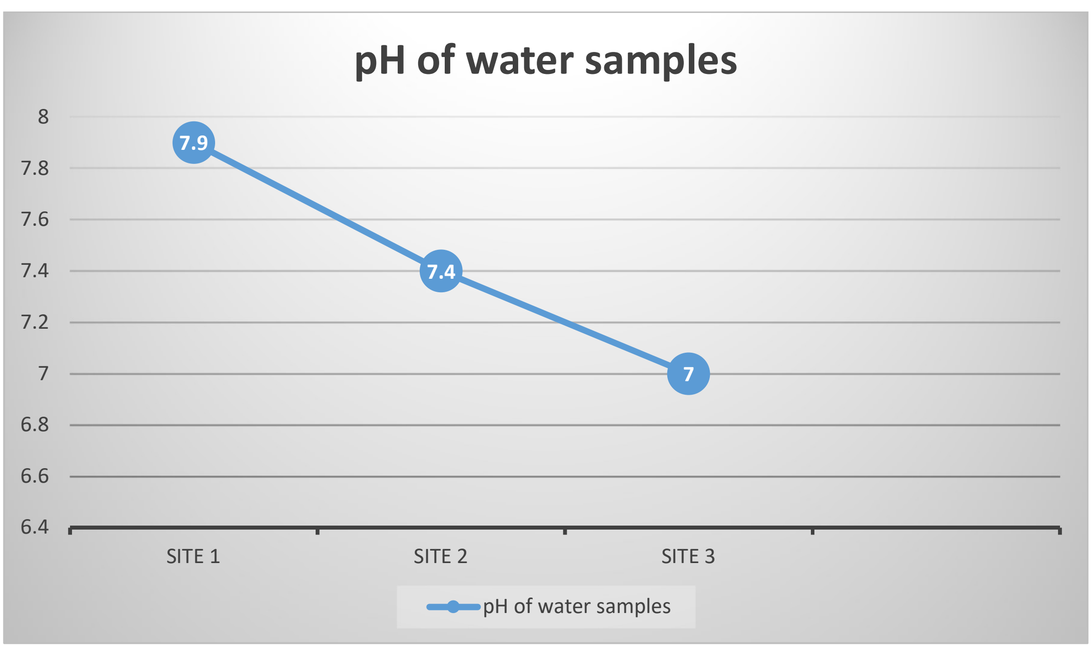
OBSERVATIONS

Table – 3 Analysis of water sample from Sanganer Textile Industry .

Sr. No.	Parameter	Site 1	Site2	Site3
1.	pH	7.90	7.40	7.30
2.	E.C mho/cm	33.6	48.3	78.7
3.	D.O. mg/ltr	3.1	5.5	0.2
4.	B.O.D. mg/ltr	130	123	157
5.	Alkalinity mg/ltr	230	340	371
6.	Hardness mg/ltr	670	790	880
7.	T.S. mg/ltr	300	275	315
8.	T.D.S. mg/ltr	235	245	253
9.	T.S.S. mg/ltr	75	63	68
10.	C.O.D mg/ltr	540	606	649

GRAPHICAL REPRESENTATION OF VARIOUS OBSERVATIONS





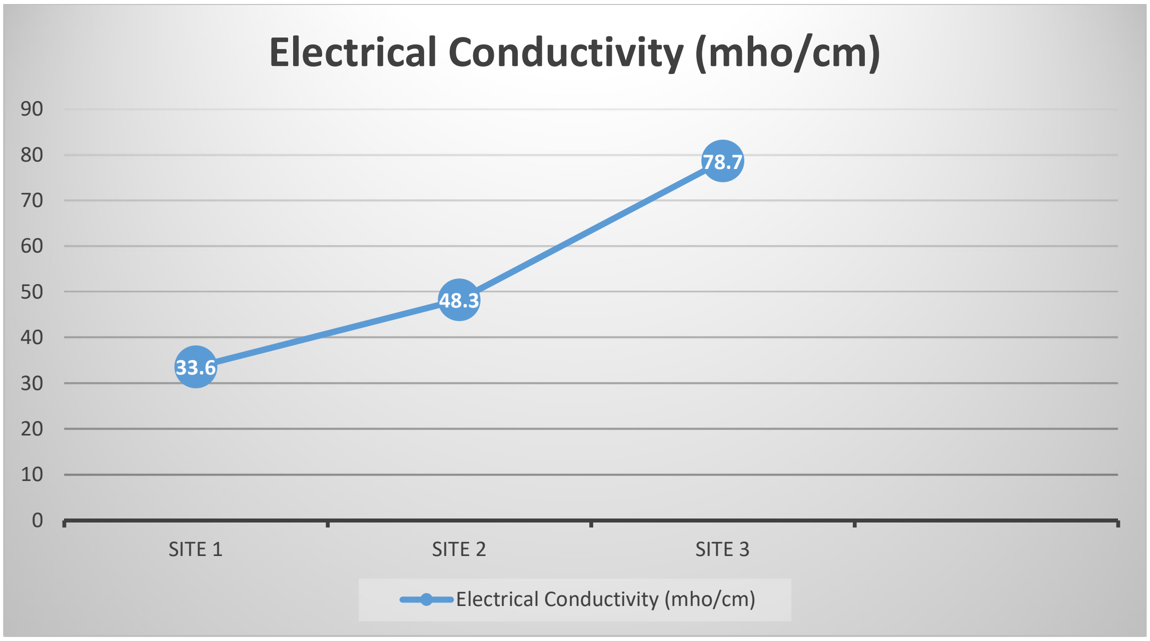

Electrical Conductivity (mho/cm)
90
80
70
60
50
40
30
20
10
0
33.6
48.3
78.7
SITE 1
SITE 2
SITE 3
Electrical Conductivity (mho/cm)

Table – 4 Analysis of Water Sample from Amani Shah nallah (Sanganer)

	pH	EC	TS	Cl	BOD	Ca	Mg	TH
pH	1.000							
EC	0.949							
TS	0.957	0.817	1.000					
CL	0.986	0.989	0.895	1.000				
BOD	0.999	0.839	0.994	1000				
Ca	0.762	0.519	0.917	0.642	0.551	1.000		
Mg	0.970	0.997	0.858	0.997	0.999	0.580	1.00	
TH	0.966	0.998	pH 0.851	0.996	1.000	0.569	1.000	1.000

Chapter-7

RESULTS AND DISCUSSIONS

Table 1: Physicochemical parameter of different site of sample collection in sanganer textile industry area.

Result: -

In our study we found that physiochemical parameter was showed that textile water contains high value of certain parameter which is main reason of toxicity.

.

pH: - Among all these samples s-1 has higher value which sows its basic nature and this sample contain more basic dyes (Table- 1).

DO: - among all these sample has low DO value which shows that this waste water was completely lack of organism (Table- 1).

BOD and COD:- most of sample contain higher value of BOD and COD. Among all these sample S-3 sample has higher value of COD (Table- 1).

TDS and TS:- Among these samples S-3 contain higher value of TS and TDS which shows its hardness (Table- 1).

Discussion

Sanganer textile industry is the life line of garment sector. There is various industries in this area and acidic and basic dyes are used in these industries. In our study we reported that waste water of Sanganer textile industries discharged from nala and other waste water resources as a result of which water contamination occur in land and surrounding area of Sanganer.

Effect of textile waste water on human health

These acidic and basic dyes contain aromatic and amine compound such as 4-aminobiphenyl, benzidine, these conpound are carcinogens as per research study in 1992 initially ascertained that occupational exposure to some aromatic amines, particularly benzidine, 2-naphthylamine, and 4- aminobiphenyl, dramatically elevates bladder cancer risk. In one German dye plant, 100% of workers, although Azo dye extractability from fabrics · is generally low, as is the probability of health detriment from Azo dye poisoning, the severity of cancer has demanded the dramatic response of ET AD, the EU and other organizations

.

-Consumption through water can reach much higher levels of exposure with higher absorption rates, and is theoretically 111ore dangerous. No epidemiological studies regarding possible carcinogenic effects of Azo dyes in humans are available.

EU restricted aromatic amines have also been linked to splenic sarcomas and hepatocarcinomas. 1,4-diamino benezene is an aromatic amine whose parent azo dyes can cause skin irritation, contact dermatitis, chemosis, lacrimation, exopthamlmose, pennanent blindness, rhabdomyolysis, acute tubular necrosis supervene, vomiting gastritis, hypertension, vertigo and, upon ingestion, oedema of the face, neck, pharynx, tongue and larynx along with respiratory distress. Aromatic amines can be mobilised by water or sweat, which aids their absorption through the skin and other exposed areas, such as the mouth.

Absorption by ingestion is faster and so potentiaily more dangerous, as more dye can be absorbed in a smaIIer time frame. Water soluble Azo dyes become dangerous when metabolised by liver enzymes.

Azo dye release in industrial effluent can also have an impact on human health. Though the drinking water was treated in a plant 6km downstream of -the discharge site, testing confirmed the presence of carcinogenic aro1natic amines. When laboratory rodents consumed industrial effluent at 1-10% concentration, an increase in pre-tumour lesions of the colon was observed.

Effect of textile waste water on environment

Research studies shows that effect of textile waste water on environment depending on exposure time and dye concentration, dyes can have acute and/or -chronic effects on exposed organisms and presence of very small quantities of dyes in water (less than 1 ppm) is highly visible due to their brilliance. As per scientific report it has been assumed that greatest environmental concern with dyes is their absorption and reflection of sunlight entering the water. Light absorption diminishes photosynthetic activity of algae and seriously influence on the food chain, dyes can remain in the environment for an extended period of time, because of high thermal and photo stability. For instance, the half-life of hydrolysed Reactive Blue 19 IS about 46 .years at pH , 7 and 25 oc.

Many dyes and their breakdown products are carcinogenic, mutagenic and/or toxic to life. Dyes are mostly introduced into the environment through industrial effluents.

There are various scientific studies which showed that of their harmful effects. Triple primary cancers involving kidney, urinary bladder and liver of dye workers have been reported. Most of the dyes, used in the textile industry are known only by their trade name, while their chemical nature and biological hazards are not known. Mathur et. al. 2001 studied the mutagenicity of textile dyes (known only by their trade name, used in Pali, identified as one of the most polluted cities in India) and the effluents containing these dyes, and the influence on the health of textile dyeing workers and the environment. The dyes were used in their crude form and no following purification was attempted, because they wanted to test the potential danger that dyes represent in actual use. The results clearly indicated that most of the used dyes are highly mutagenic.

Brown et. al, published an article, to show it is possible to predict the toxicity of new azo dyes. The systematic backtracking of the flows of wastewater from textile-finishing companies led to the identification of textile dyes as a cause of strongly mutagenic effects. The textile dyes used in the textile-finishing companies in the European Union were examined for mutagenicity. According to the obtained results the dyes that proved to be mutagenic have been replaced with less harmful substances.

The degradation product of dyes could be carcinogenic. The formation of Decolouration of Textile Wastewaters 177 carcinogenic aromatic amine o-tolidine from the dye Direct Blue 14 by skin bacteria has been established.

Public perception of water quality is greatly influenced by the colour. So, the removal of colour from wastewater is often more important than the removal of the soluble colourless organic substances.

Removal of the dyes from the textile wastewater is often very costly, but a stringent environmental legislation has stimulated the textile sector in developing wastewater treatment plants.

Textile dyes can cause allergies such as contact dermatitis and respiratory diseases, allergic reaction in eyes, skin irritation, and irritation to mucous membrane and the upper respiratory tract. Reactive dyes form covalent bonds with cellulose, woollen and PA fibres. It is assumed that in the same way reactive dyes can bond with -NH2 and -SH group of proteins in living organisms. A lot of investigations of respiratory diseases in workers dealing with reactive dyes have been made. Certain reactive dyes have caused respiratory sensitization of workers occupationally exposed to them.

Our study showed physioche1nical and biological impact of waste water containing dyes of textile industries. We suggested that these industries should treat their waste water with good and efficient technique before discharge 10 nalas and other waterbodies.

Chapter-8

RECOMMENDATIONS

RECOMMENDATIONS

Since the present situation of water quality is grim hence each type of waste water problem should be solved only by taking into consideration the following factors:

1. Local conditions.

2. Dyestuff and chemical use.

3. Amount and composition of the waste water.

4. Local drainage condition.

5. Region.

6. Main Sewage Channel.

7. Sewage characteristics etc.

Our aim should be to adopt technologies g1v1ng mm1mum or zero environmental pollution.

The quality of life depends on the ability to manage available water in the greater interest of the people. Water depletion of good quality water and environmental pollution has given tremendous importance to the water management. Joints efforts are needed by water technologists and textile industry expert to reduce water consumption in the industry.

While the user industries should try to optimize water consumption, water technologists should adopt an integrated approach to treat and recycle water in the industry.

Our motto is to save living species and its surrounding environment. Thus we must stop using chemicals and dyes, which produce harmful effect to the biotic and Abiotic factors in our ecosystems. Reducing of waste at the source is the preferred strategy instead of the traditional method of "end of pipe waste treatment”. Apart from problematic chemicals and dyes, the main pollutant is, of course, water. So, the new technologies, which aim to reduce or eliminate water, are to be conceived.

Chapter-9

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