iJRASET
International Journal For Research in
Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 9 **Issue:** VII **Month of publication:** July 2021

DOI: https://doi.org/10.22214/ijraset.2021.36404

International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.429
Volume 9 Issue VII July 2021- Available at www.ijraset.com

Perspective Analysis of River Pollution Induced by Textile Industry Effluents

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Abstract: Based on field analysis and selection, 3 textile industries were selected in the eastern part of Solapur city Characterization research. Collect and characterize textile wastewater from these selected industries The main parameters of the pollution index, namely BOD, COD, TDS, sulfur, sulfate, chloride, hardness, Alkalinity, calcium and magnesium. The effluent is dark and has an alkaline pH. We found that the BOD and COD values Higher than the Central Pollution Control Committee of the Government of India and the BOD: COD ratio A value between 0.2 and 0.35 indicates that the effluent contains a large amount of non-biodegradable substances. This The concentration of total dissolved solids was found to be greater than 5000 mg / L. The effluent also contains High concentrations of sulfate, sulfur, chloride, calcium and magnesium, they are causing the wastewater has a higher hardness. The results show that the researched textile industry Wastewater whose pollution index parameters are significantly higher than the standards set by the central Pollution Control Committee. Based on these characteristics, insufficient water output is recommended. It is directly discharged into the environment without treatment.
Keywords: Textile effluent, Pollution load, Characterization, Standards.

I. INTRODUCTION

The textile industry, as a part of manufacturing sector has been one of the important sectors to contribute towards country's economy. It contributes 14% to the industrial production, 3% to the gross domestic production, 8% to the total excise revenue collection, 17% to the country's export earnings and most importantly it provides direct employment to over 35 million people in India (The Manufacturing Plan, 2015; Textile and Jute Industry, 2015). Today textile industry has been globalized and to sustain in the global market overall growth of the Indian textile sector becomes factor of utmost importance. However, the growth should not be in the expense of environmental degradation. The environmental sustainability will need to be factored into India's textile manufacturing growth plans. The growth of textile sectors is enabled and facilitated by increasing use of material leading to manifold impacts on the environment (The Manufacturing Plan, 2015). The environmental degradation by way of pollution of land, air, and water occurs during the procurement and use of natural resources, industrial processes and activities, and the product use and disposal. So, the objective of this study is to investigate the impact of Indian textile industry on the environment and human health.

The degradation of surface and groundwater quality due to industrial and urban waste has been recognized for a long time (Olayinka 2004). The rivers and stream are the common recipients of industrial effluent all over the world. The deterioration in water quality has an adverse effect on human beings as well as aquatic ecosystem directly or indirectly. The current practice of any industrial unit is to discharge wastewater into local environment without any treatment. The untreated or partially treated effluent on entering a water body either gets dissolved or lie suspended on river bed, thereby causing the pollution of water body. Industries are tempted to assume that they cannot avoid large volumes of wastewater produced during major industrial operations and therefore, they become lax in pollution prevention. One essential step in water pollution is precise assessment of pollution status of every individual unit and its potential for improvement. Thus, the first step in a pollution prevention strategy CSE Study: Evaluation of Water Pollution due to Textile Industries in Solapur, Maharashtra for water resource is a thorough audit and characterization of wastewater from industrial operations (Wood 1992). The textile industry is classified into three main categories

A. Cellulose fibres (cotton, rayon, linen, ramie, hemp and lyocell),
B. Protein fibres (wool, angora, mohair, cashmere and silk)
C. Synthetic fibres (Polyester, nylon, spandex, acetate, acrylic, Ingeo and polypropylene)

.

In this context, Solapur city is known for its textile, dyeing and printing work. This city lies between 17.6599° N latitude and 75.9064° E longitude. The textile dyeing and printing units situated at Solapur have been discharging effluents in the river Sina. Water quality of river Sina is severely Polluted. At present more than 10 industries are carrying out dyeing and printing of cotton and synthetic clothes on large scale.

The present study, therefore, has been taken up to assess the chemical characteristics of the industrial wastewater discharged in the surrounding area of industrial estate Solapur, and the extent of pollution load in the wastewater discharged in Sina river.

Table 1 Shows the location and distribution of industrial units in Solapur region

SR. NO	NAME OF INDUSTRY	NO. OF UNITS
1	Merrow Textile Industries Pvt. Ltd	450
2	Regency Export Ltd.	400
3	Somani Evergreen KNITS Ltd.	500

II. LITRATURE REVIEW

In [1]: Garrett, B., Shorofsky, B., & Radcliffe, R. In the Thar Desert in Rajasthan, India, the textile industry has been forced to reevaluate its water-intensive practices following mounting public pressure and legal proceedings against the industry. The main cause of public concern is the depletion of regional groundwater resources and the deterioration of the water quality of the Rooney River basin. A recent ruling by the Rajasthan High Court calls for a zero discharge policy for wastewater flowing into the river basin. This decision has allowed industrialists to find economically viable solutions to maintain the vitality of the industry by recycling water. The Pollution Control Commission also makes efforts to keep up with law enforcement requirements. Although some community leaders advocate the diversification of industrial activities in the region, the fact is that the textile industry will continue to be the short-term lifeblood of the regional economy, and partial closures caused by court decisions continue to inhibit progress. On the other hand, the ruling provides an opportunity for substantial improvements in management, supervision and monitoring. Through our research, our goal is to evaluate the effectiveness of the proposed treatment options to implement a closed-loop water treatment system for textile mills and to recommend feasible alternatives, especially near Jasol Village. Due to its robust and relatively small-scale community organization, Jasol is the perfect testing ground for innovative textile wastewater treatment. We hope that our recommendations can be successfully tested and applied in Jasol, and then replicated throughout Rajasthan and India. This article presents the full range of environmental, socio-economic and political problems in the textile industry, in the hope of finding a powerful solution to current environmental problems

In [2] R.O. YUSUFF & J.A. SONIBARE "CHARACTERIZATION OF TEXTILE INDUSTRIES' EFFLUENTS IN KADUNA, NIGERIA AND POLLUTION IMPLICATIONS." Wastewater from five major textile industries in Kaduna, Nigeria, was characterized as the proposed central wastewater treatment plant. Seven measurement parameters exceeded the limits set by the Federal Ministry of Environment. The color intensity of all samples (Mills 1-5) exceeded it by an average of about 350 times, while COD, TSS, NH3, BOD5 and S2 were 24, 13, 8, 7 and 3 times, respectively. TDS was detected in all samples and only exceeded the limit in Mill 2. Nitrate, oil and fat were detected in Mill 1 and 2 and were within limits. The detection rate of Al, Mn and Zn is 80% and within the limit, while the detection rate of Fe is 60%. The Cu detection rate is 80%, and the upper limit is about 3 times on average. This research focuses on the impact of these wastewaters from the urban textile industry on pollution; important because of the risks of human exposure to them. Industrial pollution is one of the problems Nigeria is facing today. Various industries across the country are vigorously carrying out various efforts to control industrial pollution to ensure that Nigerians live in a disease-free environment. Wastewater produced by industry is one of the sources of pollution. The air, soil, and water polluted by industrial wastewater are associated with a high disease burden (WHO, 2002), which may be part of the reason why the country\u2019s current life expectancy is shorter than that of developed countries (WHO, 2003). country.

In [3] B. Ramesh Babu, A.K. Parande, S. Raghu, and T. Prem Kumar(2007) "Cotton Textile Processing: Waste Generation and Effluent Treatment"

This review looks at cotton textile processing and methods for treating wastewater from the textile industry. Several countries, including India, have introduced strict green standards for the textile industry. More stringent control measures are expected in the future, so control measures should be implemented to minimize sewage problems. Industrial textile processing includes pretreatment, dyeing, printing and finishing operations. These production processes not only consume a lot of energy and water, but also generate a large amount of waste. This manuscript combines a discussion of waste generated by textile processes such as desizing, mercerizing, bleaching, dyeing, finishing, and printing, as well as a discussion of advanced wastewater treatment methods such as electro-oxidation, biological treatment, photochemistry, and membrane processes. The textile printing and dyeing industry consumes a lot of water and produces a lot of waste water in different stages of the dyeing and finishing process. Wastewater from printing and dyeing units is usually rich in color, contains reactive dyes and chemical residues, and needs to be properly treated before being discharged into the environment.

The toxic effects of dyes and other organic compounds and acidic and alkaline pollutants in industrial facilities on the public have been widely accepted. Increasing public attention to environmental issues has led to the closure of some small industries

In [4] Freeman Ntuli, Member, IAENG, Daniel Ikhu-Omoregbe, Pardon K. Kuipa, Edison Muzenda and Mohamed Belaid. "The physical and chemical properties of wastewater from wet finishing operations of textiles for denim and other textile fabrics were evaluated. The effluent is characterized by its organic and inorganic pollutant load and its suitability for biodegradation. The main parameters of the pollution index are chemical oxygen demand (COD), biochemical oxygen demand (BOD), total dissolved solids (TDS), suspended solids (SS), color and heavy metal levels. . The effluent is very cloudy and colored, and the average organic and inorganic loads are 1766 kg COD.day1 and 964 kg TDS.day1, respectively. The overall mean COD, TDS, and SS levels of the effluent are 5849 mgl1, 3193 mgl1, and 521 mgl1, respectively. The levels of Cu, Fe and Cr (VI) are less than 4 mgL1. Analysis of the BOD curve shows that the initial delay time of microbial activity is 12 days, indicating the presence of non-persistent toxic substances that affect microbial activity.

After the initial lag, an average BOD rate constant (KL) value of 0.55 days 1 was obtained, which is higher than the acceptable sewer discharge limit of 0.17 days 1. The range of the BOD5 ratio: COD is 0.20.5, indicating that the effluent contains a large amount of non-biodegradable organic matter. COD and TDS levels are higher than generally accepted levels for municipal sewer discharge. Although the concentration of these pollutants is not much higher than the acceptable limit, due to the large emissions, a high pollutant mass load is obtained. Based on its general characteristics, it is considered that unpretreated sewage is not suitable for discharge into municipal sewers. Therefore, pretreatment steps including coagulation and flocculation and carbon adsorption are recommended.

In [4] NEETIKA MATHUR & ASHWANI KUMAR. Sanganer is famous for the textile printing and dyeing industry. Water pollution caused by the textile industry is mainly wastewater discharged from wet processing operations such as bleaching, printing and dyeing, printing and dyeing. In this study, the physical and chemical characteristics of soil samples contaminated by textile wastewater in the Sangan area were analyzed.

The standard method was found to be very different. Soil samples are dark in color, smelly and alkaline (pH 8.8), contain trace metal ions, and their concentration values \u200b\u200bdo not meet the standard. The pH of the sample is essentially alkaline (8.08.8). The conductivity value range is 0.190.81 mmhos \/ cm. The% organic content and% organic carbon content are between 0.31 0.41% and 0.18 0.24%, respectively. Wastewater from the textile industry is the main source of pollution, which will affect the flora and fauna in the aforementioned environment. Therefore, it is necessary to treat textile wastewater before it is discharged into the environment.

III.STUDY AREA

Solapur, often referred as the "Manchester of India" has been traditionally renowned for its textile industries (especially for its varied designs and quality of chaddars and towels) with the first industry being established as early 1877. consist of 4 MIDC Chincholi, Tembhurni, Kurduwadi, & Akkalkot. We selected Chincholi MIDC for the study of Industrial Effluent Disposed in River. Area of chincholi MIDC is 6 Square KM. Chincholi MIDC consist of industries like Merrow Textile Industries Pvt. Ltd. Regency Export Ltd. Somani Evergreen KNITS ltd There are 3 Industrial areas in and around the city namely Chincholi, Akkalkot and Hotagi MIDC. For industrials effluents, there are 2 CETPs6 for Akkalkot MIDC and Chincholi MIDC. Both these CETPs are discharging treated wastewater in Shelgi nallah.

The Sina, one of the large left-bank feeders of the Bhima, rises 22 km west of Torna in Ahmednagar district and runs south east through Ahmadnagar and Solapur district to fall into the Bhima near Kudul about 25 km. south of Solapur, on the Maharashtra and Karnataka boundary. Of its entire length of 180 km, the river has a length of 177 km within the district. About 7 km north of Mohol, the river receives the Bhogavati River on its left bank. Another small tributary on the left bank is the Gorda nadi joining the Sina east of Madha. The Sina is about 100–200 metres broad and has steep banks. The bed is generally sandy but occasionally rocky. While upstream of Mohol, the river flows through a narrow valley, downstream it opens out widely to merge into the broad valley of Bhima

Water quality of River Sina is assessed at one location. It is observed that Dissolved Oxygen range between 3.4 – 7.7 mg/1 putting together data of three years (2016-2018) which is not meeting the criteria limit of at least 4 mg/l. The Bio-chemical Oxygen

Demand (BOD) varies between 4.2 – 8.5 mg/1 for similar years which is exceeding the desired level of 3 mg/1. The Chemical Oxygen Demand (COD) values ranged between 8.0-42.0 mg/l indicating low level of industrial pollution. The Faecal and Total Coliform numbers respectively for the years referred are in the range of 8-310 MPN/100ml and 25-1600 MPN/100ml indicating significant contribution of untreated sewage

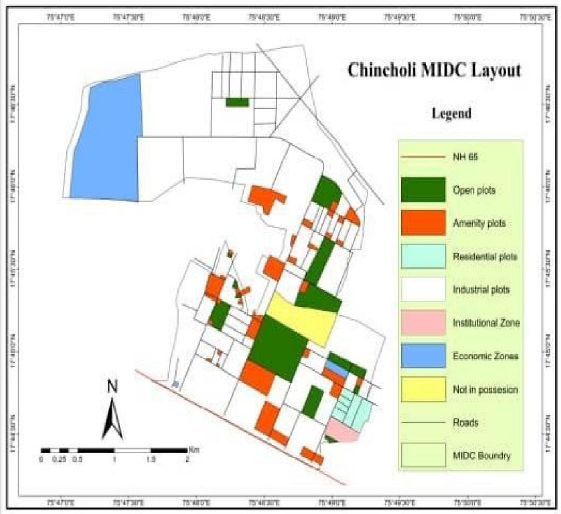
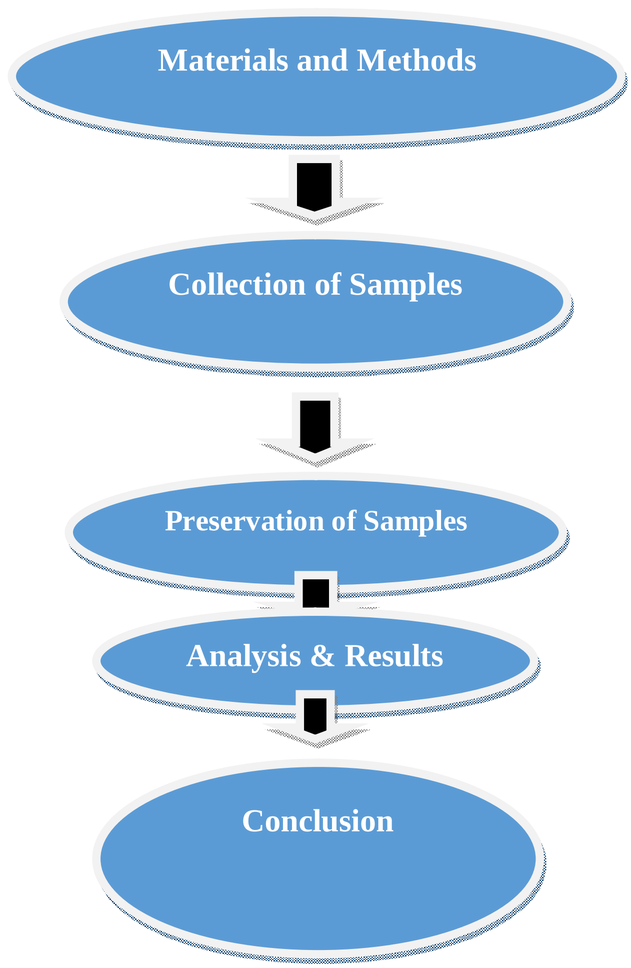


Fig.2.9. Chincholi MIDC layout (Source: MIDC Architecture and Town Planning Dept. Solapur).

Figure 1 Stretch of Sina River

Figure.1 LAYOUT OF CHINCHOLI MIDC SOLAPUR DISTRICT
Figure.2 PATH CARRIED BY SINA RIVER

IV. METHODOLOGY



A. Material Used

1) *Sampling:* A total of three water samples were collected from different places in Mohol. Appropriate preservatives were added during the sampling and brought to the laboratory for analysis.
2) *Equipment's:* 2 teams M6 Series Solar Atomic Absorption Spectrometer (Thermo) (AAS) \uf076 UV-Vis Spectrophotometer (Agilent Carry 100 model) \uf076 Microwave Assisted Digestion System, Milestone, Start D \uf076 Nansen Water Bath, Whatman Type Filter Paper, Hanna Instrument, salinity meter, atom absorption spectrophotometer.
3) *Chemicals:* All acids and reagents used for analysis (nitric acid, hydrochloric acid, sodium hydroxide, etc.) are of analytical quality and are purchased from Merck. Ultrapure water comes from the Elga USF Maxima Ultrapure analytical grade deionized water system
4) *Glassware:* Different glassware is used. Borosil glass beakers, volumetric flasks, Erlenmeyer flasks, funnels, pipettes, mirrors and rods were obtained. The volumetric flask and pipette used are calibrated. All glassware is cleaned with detergent first, then with 10% nitric acid, and rinsed thoroughly with distilled water before use. All glassware used in the phenol evaluation was cleaned with detergent, then rinsed thoroughly with tap water, and then rinsed with distilled water. Thereafter, the glassware was washed with chloroform and dried before use.
5) *Standard:* Standards of zinc, nickel and chromium were purchased from Merck.

B. Sampling Of Effluent

1) *Sampling:* Sampling is a process used to select a small portion of water or wastewater to determine the characteristics of the entire batch of water or wastewater." Analyze the sewage collected over a period of time to represent the average performance
2) *Purpose of Sampling:* Obtain reliable data on the characterization and quantification of any type of waste, wastewater, sea water, etc. Sampling techniques for industrial wastewater research and analysis must ensure that representative samples are obtained, because the analysis data will ultimately serve as the basis for the design of treatment facilities. To understand the complete change, you can sample by hour, day, week, month, year, and season.
3) *Sampling Type:* There are 3 sampling methods sampling:

a) *Grab Sampling:* Use standard procedures to collect samples at any time of the day. The random sample only shows the main situation at the time of sampling and cannot represent the average situation, so it should not be used as a processing basis. The sampling point of the random sample can be in the pipeline away from the flow measurement device or the pump.
b) *Composite Sampling:* When the composition of the waste changes with time or flow, the composite sample can provide more measured flow data. The composite sample can be collected manually or using an autosampler depending on flow rate or time. This is used when there is preferably a recording device. It applies to processes that flow and change.
c) *Continuous Sampling:* In this type of sampling, the samples are not proportional, but are collected at a constant rate. Suitable for instrument measurement. For continuous sampling, the sampler must be installed in different parts to find different changes at different stages.

C. Collection & Preservation Of Samples

Complete and unequivocal preservation of samples, whether domestic wastewater, industrial wastes, or natural waters, is a practical impossibility. Regardless of the sample nature, complete stability for every constituent never can be achieved. At best, preservation techniques only retard chemical and biological changes that inevitably continue after sample collection

1) *Sample Storage Before Analysis*

a) *Nature Of Sample Changes:* The nature of the sample change: Certain assays are more likely to be affected by sample storage prior to analysis than others. Some cations are lost due to adsorption or ion exchange on the walls of the glass container. These include aluminum, cadmium, chromium, copper, iron, lead, manganese, silver, and zinc. It is best to collect them in separate clean bottles and acidify them with nitric acid to a pH below 2.0 to minimize the time the container is walking Precipitation and adsorption. The temperature changes rapidly: the pH value can change significantly in a few minutes: dissolved gases (oxygen, carbon dioxide) can be lost. Because changes in basic water quality characteristics can occur so rapidly, temperature, pH, and dissolved gases are determined on-site immediately after sampling. Changes in pH alkalinity and carbon dioxide balance can cause calcium carbonate precipitation, lowering the calcium carbonate precipitation value and lowering the calcium value and total hardness. Iron and manganese dissolve easily in their highest oxidation states: these cations can therefore precipitate or dissolve from the sediment, depending on the redox potential of the sample. Microbial activity can be the cause of changes in ammonia nitrite content, reduction of phenol and BOD concentration, or reduction of sulfate to sulfide. The remaining chlorine is reduced to chloride. Sulfite, ferrous iron, iodide and cyanide are lost due to oxidation. Color odor and turbidity may increase Ì or the quality of sodium silicate may change Ì and boron may be leached from the glass container. Hexavalent chromium can be reduced to chromium ions. Biological changes in the sample can change the oxidation state of certain components. Soluble components can be converted into organic binding materials in the cell structure*, or cell lysis may result in the release of cellular materials in solution.The well-known nitrogen and phosphorus cycles are examples of biological effects on sample composition. Zero removal is important for the preservation of samples containing volatile organic compounds. Collect the sample in a fully filled container to avoid loss of volatiles. This is achieved by filling carefully so that the top of the meniscus is higher than the edge of the bottle. Be careful not to dilute the preservative by overfilling. The serum vial with septum cap is especially suitable for the part of the sample that can be analyzed through the stopper with a syringe, but the effect of the reduction of headspace pressure must be considered. The well-known nitrogen and phosphorus cycles are examples of biological influences on sample composition. Zero head-space is important in preservation of samples with volatile organic compounds. Avoid loss of volatile by collecting sample in a completely filled container‹ achieve this by carefully filling so that top of meniscus is above the top of the bottle rim.

2) *Time Interval Between Collection And Analysis:* Generally speaking, the shorter the time between collecting a sample and analyzing the sample, the more reliable the analysis result is. Some components and physical values \u200b\u200bneed to be analyzed immediately on site. For composite samples, the usual practice is to use the time at the end of the composite collection as the sample collection time. It is not possible to determine exactly how much time can be allowed between the sample and the analysis; it depends on the characteristics of the sample, the analysis to be performed and the storage conditions. By keeping the sample in the dark and low temperature (<4\u00b0C but above the freezing point), the changes caused by the growth of microorganisms can be greatly retarded. When the time interval between sample collection and analysis is long enough to cause a change in the concentration or physical state of the component to be tested, follow the prescribed storage practices.

b) Preservation of Sample: Protection technology: In order to minimize the possibility of volatilization or biodegradation between sampling and analysis, keep the sample as cold as possible without freezing. It is best to pack the samples in crushed ice or cube ice or commercial ice substitutes before shipment. Avoid using dry ice, as it will freeze the sample and cause the glass container to crack. Dry ice can also affect the pH changes in the sample. The composite sample is kept ice-cold during the composite process or in a refrigeration system at 4℃. Analyze the samples as soon as possible after arriving in the laboratory. If analysis is not possible immediately, it is recommended to store most samples at 4\u00b0C. Use chemical preservatives only when it is shown that they will not interfere with the ongoing analysis. When using them, first add them to the sample bottle so that all sample parts are saved immediately after collection. No method of preservation is completely satisfactory: the preservative is chosen based on the measurement to be performed. Since the storage method of one assay may interfere with another assay, samples for multiple assays may need to be stored separately. All storage methods may not be suitable for suspended solids. Since formaldehyde affects many chemical analyses, do not use it as a preservative. Preservation methods are relatively limited, usually aimed at delaying biological effects, delaying the hydrolysis of compounds and complexes, and reducing the volatility of ingredients. Storage methods are limited to pH control, adding chemicals, using amber and opaque bottles, refrigerating, filtering and freezing. The above discussion is by no means exhaustive or complete. Obviously, it is impossible to prescribe absolute rules to avoid all possible changes. Other suggestions will be found in the discussion of individual determinations, but to a large extent, the reliability of analytical determinations depends on the experience and good judgment of the person collecting the sample

V. RESULT AND DISCUSSION

Analyse physicochemical and biological parameters according to the methods described in the Standard Methods for Water and Wastewater Inspection. pH is measured by potentiometric method, biochemical oxygen demand (BOD) is measured by dilution method at 20℃ for 5 days, chemical oxygen demand (COD) is measured by closed reflux method, and total dissolved solids (TDS) is measured by gravimetric method. The titration method is used to determine sulfide, the turbidimetric method is used to determine sulfate, and the silver method is used to determine chloride. Determine the total hardness, alkalinity, calcium and magnesium by titration.

Following are tests which are carried on Surface water, Drinking water, Effluent samples :
Following Methods were carried out while study of Industrial Effluent.

1) Ph
2) Dissolved Oxygen
3) Biochemical Oxygen Demand
4) Chemical Oxygen Demand
5) Total Dissolved Solids
6) Total Suspended Solids
7) Total solids
8) Sulphate content
9) Sulphide content
10) Iron oxide
11) Sodium
12) Clorine
13) Chloride

Sr. no	Sample code	Sample name	pH	DO (ppm)	TS (ppm)	TDS	TSS	Electric Conductivity	COD	CHLORIDE	Sulphide	Sulphate	Phenolic Compound
	SURFACE WATER	ISI-IS:2296-1982	6 - 8.5	4-6	-	500, 2100	--	1	---	250	---	400,1000	0.002,0.005
1	1	d/s river 30km (Solapur)	8.9	0.15	7586	6650	936	10	1330	2090	16.1	440	ND
2	2	Sina River (u/s) 40km	8.8	0.19	9674	8600	1074	12.8	718	2182	1.3	605	ND
3	3	d/s Sina river 15km	9.2	0.25	9794	8740	1054	13	648	2322	9.1	650	ND
	DRINKING WATER	IS-10500-2004(AMENDED)	6.5 - 8.5	----	----	500	---	------	----	250	0.05	200	0.001
4	1	Drinking g/w near CETP 1	7.2	3.3	1050	1040	10	1.6	230	227	ND	45.2	ND
5	2	Open well 30km (Solapur)	8.3	1.21	7736	6880	856	10.2	938	1857	0.3	480	ND
6	3	Open well Mohol	6.8	0.24	7382	6540	842	10	358	2898	24.1	627	ND
	TEXTILE EFFLUENT	CPCB STANDARDS	5.5 -9	-----	-----	-----	100	-------	250	-----	2	-----	1
7	1	CETP 1 OUTLET	10.6	0.58	9674	7200	2474	10.8	2604	1625	ND	1185	ND
8	2	CETP 2 OUTLET	11.3	0.05	11136	7850	3286	11.8	2153	789	48.7	802	0.5
9	3	CETP 3 OUTLET	12.2	0.95	16620	8780	7840	13.2	2826	1904	8.5	857	0.2

VI. CONCLUSION

A. Out of the total three surface water samples, 80 % (two) are not fit to be used under any class of surface water (ISI-IS: 2296-1982) on the basis of the higher values obtained for their pH, DO, TDS, electric conductivity, COD, chloride, sulphide and sulphate analysis.

B. Sample code 1 (drinking g/w near CETP 1) is inferred to be fit for drinking on the basis of the results obtained for its pH, TDS, EC, chloride, sulphide, sulphate, phenolic compounds and heavy metal analysis. However, sample code 2 (Open well 30 Km, Solapur) and 3 (Open well Mohol village) were not found to be fit for drinking.

C. Among all the textile effluent samples analyzed, approximately, 80 % of the samples were found to be highly polluted as per the results obtained for their pH, DO, TDS, COD, chloride, sulphide and sulphate analysis. These results were compared with the standards of CPCB for textile effluents.

D. Phenolic compounds were detected in sample code 2 (CETP 2 outlet), 3 (CETP 3 outlet), and their values were within the range of the standard limit.

VII. ACKNOWLEDGMENT

On the very outset of this report, I would like to extent any sincere and heartfelt obligation towards all the personages who have helped me in this endeavor, without their active guidance, help, cooperation and encouragement. I would have made headway in the project.

We are thankful to the JSPM's Imperial College of Engineering and Research Wagholi, Pune. Our Principal Dr. R. S. Deshpande, our HOD of Civil Engineering Dr. N. V. Khadke, our guide prof. S.J. Mohite other teaching staff.

We are grateful to all the following authorities, Departments, personnel for their kind contribution in the project work.

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