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Textile Effluents Changes Physiochemical Parameters of Water in Barnala Region: Threat for Human Lives

Yogita Sharma[1], Kamalpreet Kaur[2] and Vinesh Kumar[3]

[1]*Guru Kashi University, Bathinda*
[2]*Department of Chemistry, Guru Kashi University, Bathinda*
[3]*Dehradun, Uttarakhand*
E-mail: [1]drsharmayogita@gmail.com

Abstract—*Textile is the foremost part of industrial sectors in India and is the major source of water and soil pollution. More than 80% people are depending on agricultural sectors for their livelihood in India. This study investigates the impacts of textile pollution on human lives and water in Barnala (Malwa) region, Punjab A total of 105 water samples from three different industrial sites(Site I,Site II and Site III)were collected from the study area and analyzed to determine concentration of physiochemical parameters of water. Analysis revealed that values of the parameters of three sites such as,pH,Electrical Conductivity, COD (mg/L), BOD (mg/L), TDS (mg/L) and TSSis maximum in Site III.values are negatively deviated from the standard values set by the Department of Environment (DOE)for textile effluents.. Major sources of water over these industrial regions such asdrain water, surface water, tap water, ground water and canals, have been severely polluted by textile and other pollutants as well as causing serious impact on health and environment. Government should strictly implement the existing environmental and industrial laws in textile effluent management.*

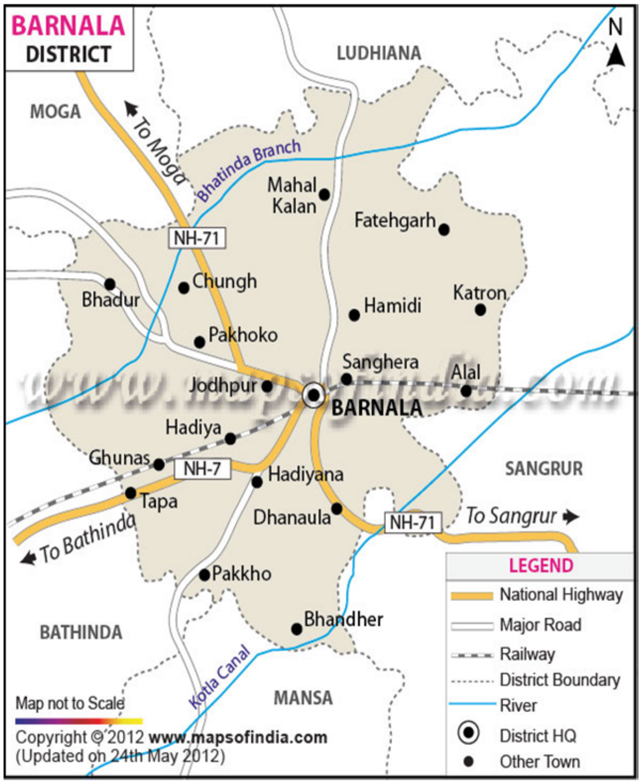
Keywords*: Physiochemical parameters, Textile effluents,Human lives, Water.*

1. INTRODUCTION

Industries are essential for economic development of any country. Textile industries have significant contribution in uplifting India's economic status. But these industries have negative implications for environment. Normally in production process, textile industry uses huge amount of water and after the production finishes, contaminated waters are releasedto the sewers or drains without pretreatment (Kant, 2012;Chindahet al., 2004).Discharging the contaminated water without pretreatment may directlycause environmental degradation. Direct discharge of contaminated water indisputably declines the soil productivity and negatively affectsthe level of crop production in the surrounding agricultural lands (Islam et al., 2006). The risky factors are mainly elated with the wet processes scouring, mercerizing, bleaching, dyeing and finishing. The dye baths take account ofhighlevel of BOD, COD, color, toxicity, surfactants, turbidity, and at the same time may enclose heavy metals (Wynne et al., 2001). Microbial activity slows down and biological treatment system also fails due to the existence of heavy metals and other dye compounds (Wynne et al., 2001). Textile effluents contain high BOD due to fiber residues and suspended solids (Yusuf et al., 2004; AEPA, 1998). These can contaminate water with oils, grease, and waxes while some may contain heavy metals such as chromium, copper, zinc and mercury (EPA, 1974). Copper is toxic to aquatic plants at concentrations below 1.0 mg/l where concentrations near this level can be toxic to some fish (Sawyer et al.1978).

In modern economies, various types of activities including agriculture, industry and transportation, produce a large amount of wastes and new types of pollutants. Soil, air and water have traditionally been used as sites for the disposal of all these wastes. Moreover, in India, technologies of waste water treatment plants are abysmally poor (DOE, 2008). For this reason, great changes take place in soil macro and micro nutrients status whichneg-atively impact agricultural production. Textile industries generate a large amount of effluents, sewage sludge and solid waste materials everyday those are being directly discharged into the surrounding channels, agricultural fields, irrigation channels and surface water which finally enter into the river systems. This study aimed to determine the physiochemical parameters of water such as BOD(Biochemical Oxygen Demand),COD(Chemical Oxygen Demand),TDS(Total Dissolved Solids) and TSS(Total Suspended Solids) of water close to textile industries at Barnala Region to compare the results with the standard level (DOE standard for water parameters)for humanperspectives.

Map of Barnala District



2. MATERIALS AND METHODS

Yarn Factory (Site I),Gatta Factory (Site II) and Trident Factory (Site III) the textile industrial hub, are situated in the Barnala Region District Barnala.

A total of 105 samples were collected (15 samples for each parameter from three different sites) from the study areafollowingstandard procedures. Analysis was done in the Environ Tech Laboratories (NABL Accredited laboratory) Department of Science and technology,India. S.A.S Nagar (Mohali),Punjab. For testing of water parameters, samples were collected with two-liters white plastic kegs, which have been thoroughly washed with nitric acidandthen rinsed several times with distilled water. Analysis was carried out as per the standard methods (APHA, 1989).

3. RESULTS AND DISCUSSION

Table 1. Analytical results of selected water samples (W1, W2…W5) of textile effluents with DOE standard for industrial effluents.

Parameters		W1	W2	W3	W4	W5	DOE Standards
PH	Site I	7.4	7.2	7.2	7.9	7.1	6.5 - 8
	Site II	8.8	7.4	7.2	8.5	7.1	
	Site III	9.5	7.8	7.5	9.3	7.1	
EC	Site I	5861	5856	5860	5860	5850	250 µs/ cm
	Site II	1633	1610	1610	1632	1620	
	Site III	7234	7221	7221	7232	7222	
Turbidity	Site I	58	45	43	53	41	
	Site II	12	9	9	11	9	
	Site III	66	62	61	65	61	
BOD	Site I	70	55	55	65	55	150 mg/L
	Site II	43	40	40	42	35	
	Site III	310	305	308	309	300	
COD	Site I	212	206	207	209	206	200mg/L
	Site II	98	72	70	90	70	
	Site III	1020	1012	1012	1016	1010	
TDS	Site I	4099	4089	4096	4098	4088	2100mg/L
	Site II	977	970	969	976	968	
	Site III	15060	15047	15048	15059	15048	
TSS	Site I	2574	2562	2560	2571	2558	
	Site II	67	42	43	60	43	
	Site III	4037	4021	4023	4036	4020	

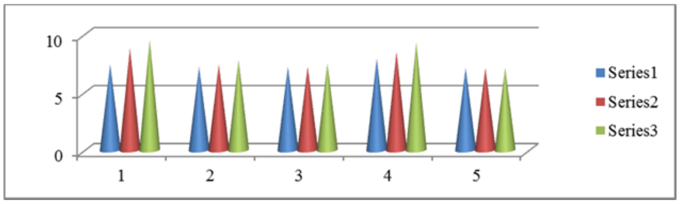
The analytical results of textile effluents are given in the Table1. Obtained values of the parameters deviated from the permissible limits recommended by DOE for pH, EC, Turbidity, COD, BOD, TDS.and TSS

Table 2: Analysis of Mean and Standard deviation of all the parameters from three different sites

Parameters	Site I[Mean±S.D]	Site II[Mean±S.D]	Site III[Mean±S.D]
pH	7.46±0.40	7.8±0.79	8.24±1.08
EC	5860±8.45	1625±6.85	7226±6.64
Turbidity	48±7.21	10±1.41	63±2.34

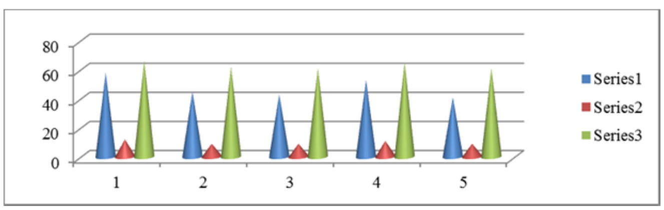
BOD	60±7.07	40±3.08	306.4±4.03
COD	208±2.54	80±13.11	1014±4
TDS	4094±5.14	972±4.18	15052±6.30
TSS	2565±7.07	51±11.68	4027±7.84

pH



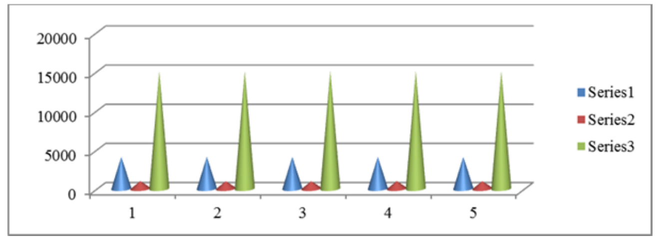
The concentration of hydrogen-ion is a major sign for measurement of quality of natural and wastewater (Bharati and Shinkar, 2013).The higher value of pH of the textile effluent indicates the alkalinity conditions which have an adverse effect on the soil permeability ,soil micro flora (Robinson et al., 2002) and ultimately which results in the distruption of the human lives. Our body needs to maintain an optimum acid-base balance, or pH level, to ensure the various processes within your body occur without problems, according to the University of Maryland Medical Center. When the body's pH level becomes high, the condition is known as alkalosis. When the body's pH level becomes low, the condition is called acidosis. Both alkalosis and acidosis can have dangerous consequences if untreated. Arrhythmia, Coma, Low Potassium Levels, Impaired Organ Function, Respiratory Failure, Seizures, Shock or Death .All such problems lead due to higher values of pH.Max value of pH is found to be highest in Site III.

Turbidity



Excessive turbidity, or cloudiness, in drinking water is aesthetically unappealing, and may also represent a health concern. Turbidity can provide food and shelter for pathogens. If not removed, turbidity can promote regrowth of pathogens in the distribution system, leading to waterborne disease outbreaks.Although turbidity is not a direct indicator of health risk, numerous studies show a strong relationship between removal of turbidity and removal of protozoa. The particles of turbidity provide "shelter" for microbes by reducing their exposure to attack by disinfectants. Microbial attachment to particulate material has been considered to aid in microbe survival. Fortunately, traditional water treatment processes have the ability to effectively remove turbidity when operated properly. (Source: EPA).From the graph it is crystal clear that the maximum value of turbidity is recorded in site III (above 60NTU)

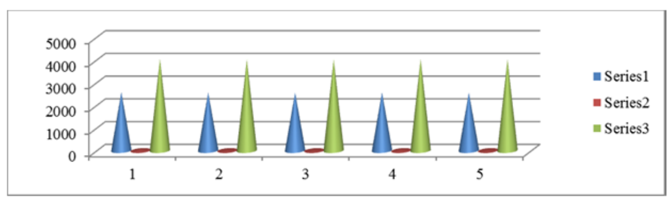
TDS



The term "total solids" refers to matter suspended or dissolved in water or wastewater, and is related to both specific conductance and turbidity. Total solids (also referred to as total residue) is the term used for material left in a container after evaporation and drying of a water sample. Total Solids includes both total suspended solids, the portion of total solids retained by a filter and total dissolved solids, the portion that passes through a filter (American Public Health Association, 1998).

It may taste bitter, salty, or metallic and may have unpleasant odors. It is less thirst quenching and interferes with the taste of foods and beverages, and makes them less desirable to consume.Some of the individual mineral salts that make up TDS pose a variety of health hazards. The most problematic are Nitrates, Sodium, Sulfates, Barium, Cadmium, Copper, and Fluoride. Most will be eliminated through excretory channels. But some of this will stay in the body, causing stiffness in the joints, hardening of the arteries, kidney stones, gall stones and blockages of arteries, microscopic capillaries and other passages in which liquids flow through our entire body. All the sites (textile industries)discharge effluents of different kinds, but the maximum discharge is found to be highly effective from site III.

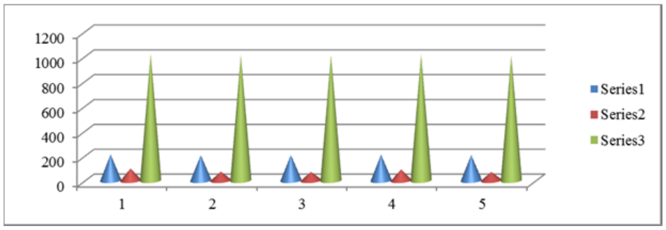
TSS



High TSS in a water body can often mean higher concentrations of bacteria, nutrients, pesticides, and metals in the water. These pollutants may attach to sediment particles on the land and be carried into water bodies with storm water. In the water, the pollutants may be released from the sediment or travel farther downstream (Federal Interagency Stream Restoration Working Group, 1998).

High TSS can cause problems for industrial use, because the solids may clog or scour pipes and machinery. It is clear from graphical representation that max.value of TSS in all the sources of water is the hihest (4020-4037mg/l)

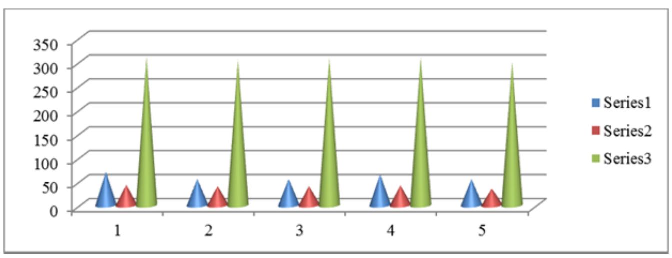
COD



High levels of COD in water often correlate with threats to human health including toxic algae blooms bacteria from organic wastes and seafood contamination.

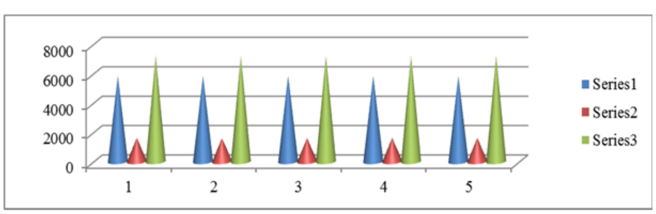
High COD levels decrease the amount of dissolved oxygen available for aquatic organisms. Low (generally under 3 mg/L) dissolved oxygen, or "hypoxia," causes reduced cell functioning, disrupts circulatory fluid balance in aquatic species and can result in death of individual organismsas well as large "dead zones". Hypoxic water can also release pollutants stored in sediment

BOD



BOD is the measure of quantity of oxygen required by bacteria and other microorganisms under aerobic condition in order to biochemically degrade and transform organic matter present in the water bodies (Bhadja and Vaghela, 2013). The high levels of BOD are the indicators of the pollution strength of the waters (McMullan et al., 1995; Yusuff et al., 2004; Geetha et al., 2008).They also indicate that less oxygen is available for the living organisms in the wastewaters. The BOD values were found to be highest in site III(300-310mg/l) (Table 1). However, the values were high according to the DOE standard (150 mg/L). 2007). It is clear from the several studies that, the composite textile mill release a lot of biochemical oxygen demanding waste.

EC



EC values were observed 7221 to 7234µs/ cm at different sampling points which were generally higher than DOE standard given as 250µs/ cm(Table1).

4. CONCLUSION AND RECOMMENDATIONS

Majority of the textile industries in India is devoid of pretreatment plant for detoxifying waste effluents. These effluents spread on agricultural land as well through the drainage system and negatively impact water physiochemical parameters.Thehman health is severely affected near these textile industries.The hygienic condition is also impacted negatively. The quality of groundwater is hampered by way of increased sodium, TDS, EC etc. Toxicity of physiochemical parameters of the water effluent and soil are significantly 2 to 100 times higher than the standard value of DOE and BARC. Thus, the study concludes that, the level of pollution due to effluent from textile dyeing industries of barnala district is alarming. However, if Environment Impact Assessment (EIA) prior to the establishment of textile industries is properly done, effluent treatment plant (ETP) for detoxification of textile pollutants is established in each industry and site selection is done carefully for industry establishment, impact on public health and environment would surely beminimized.

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