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Effect of Textile, Dyeing and Printing industrial effluents on river Kshipra at Bherugarh Ujjain, M.P., India

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ABSTRACT: Water is the resource that sustains all life on earth and is a key element of sustainable development. It is essential if human beings are to enjoy healthy and safe lives or realize social and economic development.
Water pollution occurs when a body of water is adversely affected due to the addition of large amounts of materials to the water. Water pollution means such contaminations of water or such alteration of the physical, chemical or biological properties of water likely to create a nuisance or render such water harmful to public health or safety.
Present study deals with the study of the pollution levels of Kshipra river at Bherugarh, Ujjain. There are many small scale textile, dyeing and printing industries in this locality. In these industries many chemicals, dyes, detergents, waxes, starch and cellulose are used. These industrial effluents are directly thrown in the river without prior treatment. Due to this effluent, river water gets polluted hence this water becomes unfit for drinking, bathing and even washing purposes.
The physicochemical study of river indicates that river water is highly polluted. All parameters showed higher values than the prescribed standard values.

KEYWORDS: Sustainable development, Contamination, Kshipra river, Bherugarh, Physicochemical.

INTRODUCTION

All known forms of life depend on water. Water is vital both as a solvent in which many of the body's solutes dissolve and as an essential part of many metabolic processes within the body. Water had been regarded as an infinite resource. As population growth and economic expansion accelerated and intensified the use and abuse of water resources over the past few decades, a greater and greater imbalance between water availability and water demand has resulted. This imbalance has brought a veritable crisis with regard to water in many regions of the world, including but not limited to such problems as widespread water scarcity, water quality deterioration, and the destruction of freshwater resources[1]. From biological standpoint, water has many distinct properties that are critical for the proliferation of life that set it apart from other substances. It carries out this role by allowing organic compounds to react in ways that ultimately allow replication. Clean and plentiful water provides the foundation for prosperous communities.

Pollution means the introduction of materials that harm the health or survival of plants, animals and humans. Pollutants increasingly overwhreth the biosphere's capacity to deal with them and often have long term consequences[2].

Water pollution includes all of the waste materials that cannot be naturally broken down by water. In other words, anything that is added to the water, above and beyond its capacity to break it down, is pollution. A toxic substance is a chemical pollutant that is not a naturally occurring substance in aquatic ecosystems. Water pollution is a major global problem that requires on going evaluation and revision of water resource policy at all levels (from international down to individual aquifers and wells). In addition to the acute problems of water pollution in developing countries, industrialized countries continue to struggle with pollution problems as well[3].

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Ujjain is a holy city, situated in Madhya Pradesh, India. Mokshdayani river Kshipra encircles this region. This river has a special religious importance. Present state of river is miserable. It is polluted to such a level that it is not even fit for washing purposes. Many planktons etc. grow in it. It has lost its flow due to pollution and eutrophication. City waste and industrial waste is directly thrown in to the river.

Bherugarh is a village situated in the north of Ujjain on the banks of river Kshipra. The main occupation of people in this region is Bherugarh printing and dyeing cotton textiles which is small scale industry. Here cotton printing is done and in this printing many chemicals, dyes, detergents, waxes, starch and cellulose are used, its effluent is directly thrown in the river without treatment.

The water of river gets contaminated affecting the flora, fauna, microbial population, health of people and aquatic ecosystem.

AIM

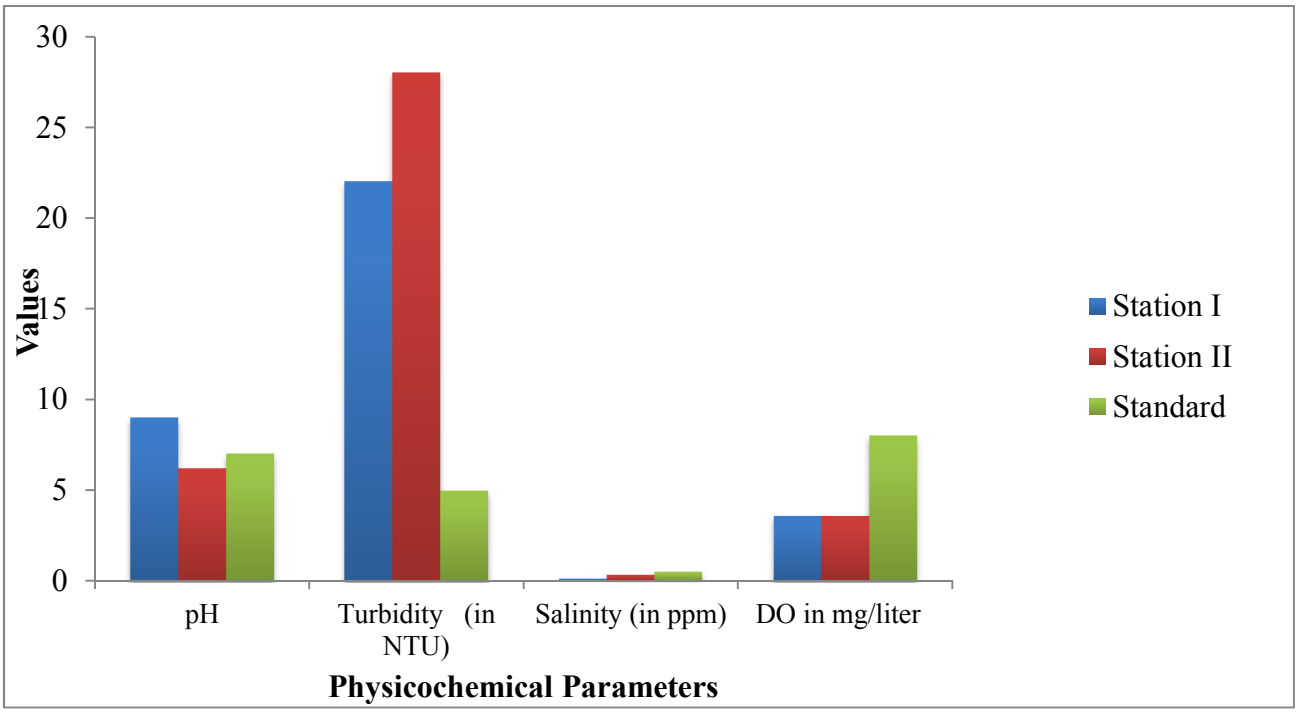
The objectives of present study is to study the pollution level of river Kshipra at different sampling stations of Bherugarh with the help of different physicochemical parameters, to check the potability of water.

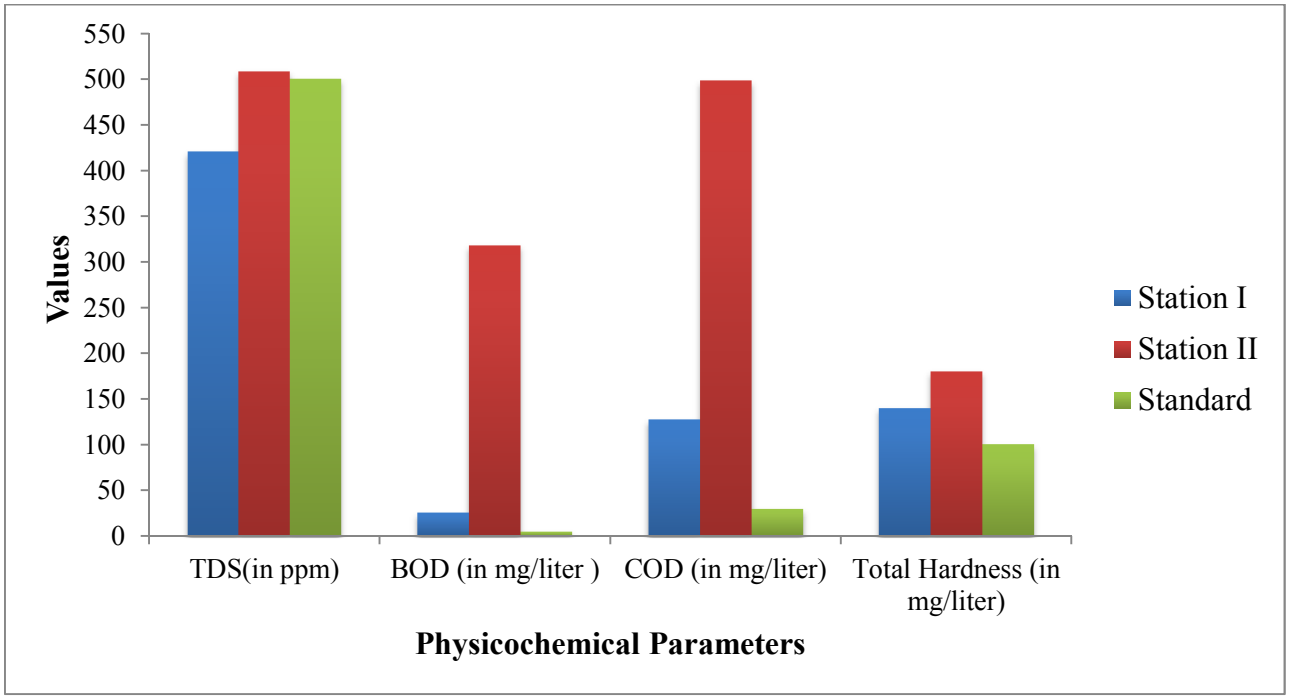
MATERIALS AND METHOD

In present study physicochemical parameters of the river Kshipra at Bherugarh were analysed at two sampling stations, which were selected for sample collection. First sampling station is river Kshipra before joining of the effluent drain and the second sampling station is at the confluence of effluent drain and river Kshipra. Physicochemical parameters studied were i.e. pH, TDS, turbidity, Salinity, BOD, COD, Total hardness and DO by using methods from APHA, AAWA and WPCA[4].

Parameters	Station I	Station II	Standard
pH	9.0	6.2	6.5
TDS(in ppm)	420	508	500
Turbidity (in NTU)	22	28	5
Salinity (in ppm)	0.10	0.32	0.5
BOD (in mg/liter)	26	318	<=5
COD (in mg/liter)	128	498	30
Total Hardness (in mg/liter)	140	180	100
DO in mg/liter at 35^0C	3.6	3.6	8.0

Observation- TABLE (1):- Study of physicochemical parameters





RESULTS AND DISCUSSION

pH- At station I and station II the pH was reported as 9.0 and 6.2 respectively, which indicated the drain water is slightly acidic, while river water is alkaline. When the pH value falls below 6.15 or rises above 8.5, many of the basic nutrients become died up, so that they are unavailable to plants and the overall productivity is lowered. pH is affected not only by the reaction of carbon dioxide but also by organic and inorganic solutes present in water. Any alteration in water pH is accompanied by the changes in other physico-chemical parameter. pH maintenance is one of the most important attributes of any aquatic system since all the biochemical activities depend on the pH of the surrounding water[5].

TDS- The value of TDS at station I is 420mg/l. At station II TDS is 508mg/l. TDS value of drain is slightly higher than the river water that indicates that the drain water is polluted. NAFDA (2001) recommended maximum TDS value of 500mg/l in drinking water supply. In natural waters, dissolved solids are composed mainly carbonates, bicarbonates, chlorides,

sulphates, phosphates, nitrates, magnesium, sodium, potassium, iron and manganese etc. The excess amount of TDS in waters disturb the ecological balance and cause suffocation of aquatic fauna[6].

Turbidity- At station I the turbidity is 22NTU and at station II the turbidity is 28NTU which is much higher than the standard value. Turbidity of water may be of organic or inorganic origin. The higher the turbidity level, the higher the risk that people may develop gastrointestinal diseases. This is especially problematic for immune-compromised people, because contaminants like viruses or bacteria can become attached to the suspended solids[7]. The suspended solids interfere with water disinfection with chlorine because the particles act as shields for the virus and bacteria.

Salinity- At station I the salinity is 0.10 and at station II salinity is 0.32. After the addition of industrial effluent salinity value has increased three fold. There by affecting the quality of water in the river. Salinity is the total concentration of all dissolved ions in the water and is measured in mg/l or ppm. Fresh water species have limited range of tolerance to salinity fluctuations (stenohaline). In fresh water ponds high salinity may have an adverse effect on the growth and survival of plants and animals, ultimately affecting the yield of the crop.

BOD- At station I BOD is recorded as 26mg/l. At station II the BOD value was 318mg/l. At both the stations BOD value is higher than the standard value but at station II the value is much higher indicating that the water has got polluted on addition of effluent. BOD is a measure of the oxygen in the water that is required by the aerobic organisms[8]. BOD is an important parameter that indicates the magnitude of water pollution by oxidizable organic matter. The main source of organic pollution include untreated domestic sewage, agricultural runoff containing residual fertilizers. The components of oxidizable matter include carbonaceous organic matter, nitrogenous compounds and chemically reducing compounds. In natural course the organic matters on oxidation enters into bio-geo-chemical cycles. BOD is measure of oxygen required by microbes to degrade the organic matter under aerobic condition. BOD increases inflow of the domestic waste [9].High BOD depletes the oxygen level to a critical condition thus indicating the pollution status of water, due to discharge of animal fecal wastes coupled with high temperature indicating organic pollution. BOD is the amount of oxygen required by the living organisms engaged in the utilization and ultimate destruction or stabilization of organic water. It represents a significant positive correlation with temperature and COD[10].

COD- COD determines the oxygen required for chemical oxidation of organic matter with the help of strong chemical oxidant. COD is an oxygen demand to decompose the biodegradable as well as non biodegradable organic waste. At station I COD value is 128mg/l. At station II COD is 498mg/l. At both the station the value of COD is much higher than the standard value but at station II the value of COD is very high. COD is a measure of the oxygen equivalent of the organic matter content of water that is susceptible to oxidation by a strong chemical oxidant. Thus, COD is a reliable parameter for judging the extent of pollution in water .The COD of water increases with increasing concentration of organic matter[11]. COD is a measure of oxygen required to oxidize the organic matter by a strong chemical oxidant. It is used to measure the pollution strength of domestic and industrial wastes. COD gives an idea of concentration of substances, which may undergo immediate chemical oxidation. All organic compounds with little exception can be oxidized by the action of strong chemical oxidants under acidic condition. The estimation of COD is of great importance for water having unfavorable conditions for the growth of microbes, such as in the presence of toxic chemicals. It is a fact that all organic compounds with few exception, can be oxidized for the action of strong oxidizing agents under acidic condition, COD test is useful in pinpointing toxic condition and presence of biologically resistant substance.

Total Hardness- The value of total hardness is 140mg/l at station I. At station II the value of total hardness is 180mg/l. At both the stations Hardness value is higher than the standard value, addition of effluent increased hardness. Water hardness refers to the concentration of Ca and Mg. As calcium and magnesium bond with carbonates and bicarbonates and water hardness are closely interrelated and produce similar measured levels[12]. The hardness of water is not a pollution parameter but indicates water quality mainly in terms of Ca and Mg expressed as $CaCO_3$. The increase in hardness can be attributed to the decrease in water volume and increase in the rate of evaporation at high temperature.

DO- At station I DO is 3.6mg/l. At station II DO is 3.6mg/l. DO is governed by rate of photosynthesis, BOD, water temperature and carbon dioxide concentration. Low content of DO is sign of organic pollution, is also due to inorganic reductants like ammonia, nitrates, and other such oxidisable substances. Since DO in water samples depends on water temperature, partial pressure of the gas in contact with water, the concentration of the dissolved salts, biological activities and geology of river basin. Further, concentration of DO is inversely proportional to temperature at a given time. DO is negatively correlated with temperature, BOD and COD[12].

The values of physicochemical parameters indicate that the river water is itself polluted and addition of industrial effluent at Bherugarh increases most of the parameters studied. This indicates that it is polluting the river to such an extent that the river water has become much more polluted which may cause serious problems if the water is used for any of the purposes.

Hence it becomes necessary to remove or detoxify the pollutants from the river water for its potability and use for other purposes.

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