Chapter II

Review of Literature:

Seasonal variations in physicochemical parameters of the sewage from Solapur sewage nala have been studied for a period of two years. The physicochemical parameters recorded include atmospheric and water temperature, Transparency, pH, Turbidity, Hardness, TSS, TDS, Conductivity, DO, CO₂, Alkalinity, Chloride, Salinity, Sulphate, BOD, COD, Calcium, Sodium, Bicarbonate and some heavy metals. Physicochemical factors of water environment are very important for assessment of level of various constituents present in water. The chemical and biological factors include light, turbidity, suspended solids and temperature. Chemical factors such as carbonates, bicarbonates, oxygen, carbon dioxide cations and anions dissolved organic materials. The main objective the present study is the analysis of various physicochemical of water are to determine the levels and status of different chemicals present in the aquatic ecosystem.

Running water systems like rivers, streams etc are highly and vulnerable freshwater ecosystems that are very critical for the maintenance of nutrient quality for all aquatic life forms. The degraded quality of water threatens sustainability for aquatic life and is therefore a matter of serious concern. World wide the rivers systems are having much importance as they providing water resources for the industrial development, agriculture and domestic use for human and animals husbandry Jain, (2009). Disposal of raw sewage to a water resource from domestic sewers, channels, industrial effluents, runoff from agricultural field and other sources are responsible for short term and long term effects on the water quality water resources system Akhtar et al, (2007)

Tayyab. et al, (2011) stated that, turbidity caused by agricultural, irrigation and surface run off and soil erosion severely affect the production of planktons in aquatic environment. Due to urbanization and industrialization increases levels of heavy metals such as copper, zinc, chromium, mercury, lead etc which are highly toxic to living biota. Numbers of studies have been elaborated the effect of heavy metals and plants, animals and human health Chist, 2004; Unger and Roesijiadi, (1996). Addition of
sewage and immersion of idols increases heavy metal pollution in lakes. Heavy metals are toxic to algae. Many studies have been carried out by various investigators on effect of heavy metals on algae Sultan and Fatima, (1999).

In India many researchers have worked on physic-chemical and biological characteristics of reservoirs and rivers Kodarkar, (1992); Patil et al., (2003). The discharge of industrial effluents in the reservoir water containing oxidisable organic matter reduces the dissolved oxygen content. The reduction of oxygen initially results in the pollution due to load of organic matter, but oxygen content is restored by re-aeration further downstream. In a health reservoir sufficient oxygen for microbial degradation of organic matter is essential to sustain its water quality. Less oxygen availability will lead to anaerobic break down of organic matter producing foul smell and consequent impact on water quality and bio-diversity.

Dissolved oxygen level influenced the density of all bird groups. Valuable information about biological and biochemical reaction which is going on water is provided in the entire biotic factor in fresh water life. Patil et al., (2001) stated that dissolved oxygen is of great limnological significance as it regulates metabolic process of aquatic organisms and indicates the status of water. TDS indicates the general nature of water salinity. Water contamination due to pesticide can cause chronic and acute poisoning to fishes and other organism. The pesticides are responsible for damage to delicate, sensitive and vital organs of fish Omitoyin, et al., (2006).

Gambhir, et. al. (2012), in their study of water pollution impact and promising techniques of pollution in purification process stated that most domestic waste from sewage or septic tank ends up in natural waters they also considered that in past some cities dumps barely or untreated sewage directly in river in present study similarly all sewage from Solapur city is directly dumped in to Sina river.

Dying industrial effluents affect on quality of ground water in Kancheepuram India Industrial waste constitutes biohazard to human and other living organism in environment. The contaminated water contains toxic substances which are injurious to health (Balakrishnan, et. al., 2008).

Anikwe and Nwobodo, (2006) studied the long term effect of municipal waste on the properties of soil and agro-productions in Abakaliki Nigeria. They stated that in waste water there is high level of organic material, micro organism; toxic compounds etc are present in large quantity added from domestic sewage and industrial effluents. Management of waste water will helpful for the protection of environmental quality in a manner of economic and human health concern.

There is no pure water for as it contains organic and inorganic substances like detergents due to washing clothes in fresh water, pesticide and fertilizers which is run off from agriculture, industrial toxic effluents which is poured by industries in to water bodies directly or indirectly, domestic waste etc. Now a day’s most challenging problem is pollution due to the unwanted substances added regularly in our environment and it is unsafe to all living organism. The rapid growth in population, economic development, unconscious activities happened by humans, industrializations all are transform our planet slowly in to a rotten place.

In this way our natural balance is affected we are facing severe draught and floods etc. Pollutant is a material responsible for adverse effect and interferes with health of biological components and deteriorated the natural quality of environment on earth. With advancement in technology all over the world leads to increase in population agricultural, urbanization and the change in weather conditions such as global warming worldwide etc takes place. The world is facing a water emergency. Now a day’s great need of management and preservation of water quality but people ignore this fact and polluted our aquatic environment.
Water contaminated due to domestic waste, industrial waste etc. containing various kinds of chemicals and toxic substances released into river without proper treatment contains variety of heavy metals become serious result on unrestricted health effect through biomagnifications, persistence and accumulation in food chain.

Ability to grow microorganisms in the presence of heavy metals and significant metal uptake has a potential use in bioremediation of polluted water. Shakoori, et.al. (2004) studied manifold conflict in the ciliate protozoan vermicelli microsoma isolated from industrial effluents and its possibility in bio-remediation of toxic wastes. Major source of pollution is effluent generated by industries mainly textile industries due to this contamination of air, soil and water occur and it is associated with heavy disease it is reason of the current shorter life all over the world. The location and activities of humans growing population is placing a great demand of the availability of water and natural fresh water resources. With regard to the occurrence and abundance of species the physico – chemical characteristics are highly important due to the discharge of urban, agricultural waste and industrial wastes have increased various types of chemicals they enter in the water bodies and alter their physico-chemical characteristics. Increase process of eutrophication due to the nutrients like nitrogen and phosphorous from the fertilizers and domestic wastes.

Waziri, et.al. (2009) studied levels of heavy metals in ground water from Gashua and Nguru areas of Yobe state Nigeria. Several works on water quality and physico-chemical characteristics of water are done and analyses water is important to determine that quality of water is suitable for drinking also for domestic as well as to determine the organic matter present in water. Izonfuo and Barewenti, (2001) in their study reported effect of urban runoff and anthropogenic activities on different physic-chemical and biological parameters of Epicreen in Niger Delta, Industrialization is chief tool for the overall development of nation and it is the main reason that expansion of industrial activities increased very greatly all over the world and this is become a matter of major concern of the fading environmental quality. The rapid growth of industrialization all over the country pollution of water by industrial waste has greater than before enormously. Muthuswamy and Jayabalan (2001), The pollution occur due to discharge waste water
from industries like fertilizers, tanneries, paper and pulp, chemical industries, petroleum, textile etc. Textile industries discharge large amount of waste water from the wet processing operations like bleaching, scouring, dyeing, desiring and printing etc. In this all process it require large amount of water and large amount of chemicals also used hence generate large quantity of waste water and chemical pollution occur due to the chemical pollution the normal function of cell is disturbed and this turn may cause alteration in physiology and biochemical mechanism of animals, also affect the important functions like reproduction, osmoregulation, respiration, and even mortality. Kumarguru (1995), Mudakkira, Fatima and Noorjahan, (2006). From analysis of physicochemical parameters and assessment of toxicity of effluents is often most of industrial effluents are mixtures of various components they exert antagonistic and synergistic effects on organisms use of organisms for monitoring water quality was suggested by Somnath,(2002).

High microbial is resulted in acidic pH. In aquatic ecosystem for microbial activity the main factor is responsible and that is sewage waste, domestic waste which is rich in nitrogen and carbon, it gives heterotrophic bacteria in a high amount. The absence of sulphate reducers, hydrocarbon degraders and coli forms are suggestive of the low levels of both sewage and effluent discharge, Phadke et al. (2011). Most studies shown that sewage can alter structural and efficient attributes of biodiversity but whatever effects are occurs can be different depend on type of investigation and analysis, Chapman et al. (2008), Shiddmallayya and Pratima (2008), Nanajkar and Ingole (2010). Effect of pollutants not quite evident immediately but after passing time their unremarkable effects are of lethal nature, Babu et al. (2007).

In developing countries most critical problem is improper management of large amount of waste generated by anthropogenic activities and unsafe disposal of these waste in environment due to this water bodies especially freshwater reservoirs are mostly affected, Fakayode, (2005). Most important mean for disposal of waste is river; mainly industrial effluents near of them these effluents alter the all biological, chemical and physical nature of receiving streams or water body. Sangodoyin (1991). Industrial activities have leads to contamination pressure on surface waters both from agricultural
and domestic sources. These wastes are highly hazardous and directly or indirectly affect on public health. Occurrence of heavy metals in aquatic ecosystem has been linked with the textile effluents Ekhaise and Anyansi, (2005).

Many pollutants are drained into aquatic system from agricultural field, industries, and from sewage water treatment plants, etc without any pre-treatment. Industrial effluents are most chief source of contamination and pollution of water bodies Bryan and Langston (1992). Some pollutants from industrial effluents reported harmful and toxic to the environment, depends on duration of exposure and dose administrated, Yusuff and Sonibare, (2004). it has been observed that discharge of untreated industrial effluents into aquatic environment can cause insignificant mortality of fishes and other life forms to receiving water bodies, Das,(2003).

According to Adewoye and Lateef, (2004), pollutants buildup the food chain is responsible for the adverse effects and lastly death of aquatic organisms. Ogundiran et.al. (2010) Pollutants affect through the food chain in aquatic organisms and can cause serious physiological disorder like by damage to the kidney, hypertension, and cramps. Karthikeyan, et.al.,(2006) at the higher tropic level pesticides or herbicide pollution severely affects aquatic organisms including human being, Peebu, et.al. (2008). Consumption of fish polluted by pesticides affects the immune system and can cause severe health related harms to human, Svensson, et.al. (1994), Mondal, et.al. (2007), Joshi, et.al. (2007). Each and every industry adds some quantity of harmful pollutant in environment. If it is not restricted on time it will lead into the hazardous effects; it can be reduced by modifications in mechanized process through reuse or recycling of the waste. The major industries that produce potentially hazardous material are the textile and paper mills, Dalmini and Joubert, (1996). In Indian cities drinking water quality has spoiled in recent years because of increase in population, urbanization, inappropriate disposal of waste water from domestic and industrial sectors and unscientific drainage system. Changes in quality of ground water due to sewage and industrial water are of common observations all over the country, Singh, et.al. (2003). Lohar, (2000) stated heavy metals often encountered in rivers and lakes due to this aquatic fauna being subjected to stress caused by heavy metals. Bribhante, et.al.
(1996), Momin, *et.al.* (2014) stated fertilizers and pesticides are used erratically in agricultural segment for increase crop production. Principle pathway that causes ecological impact is that water contaminated by pesticides runoff. Aher, (2014) similarly studies were carried out by Dayal and Gopal, (1992).

Sonawane and Saler, (2008). In rural areas water of bore well is become salty and is unsafe for drinking purpose. Sankpal and Naikwade, (2012), analyzed effluent discharged from fish processing industries from Ratnagiri and stated that the waste discharged during fish processing are degradable which are harmful to micro-organism in costal water, they also reported that amount of pollution was highly expressed by physico-chemical properties which were beyond permissible limit due to effluent discharged during fish processing.

Balakrishnan, *et.al.* (2008), in their study on ground water quality from Kanchipuram recorded high level of heavy metals such as lead, chromium, zinc etc due to effluents from dying industry. They also noticed level if these heavy metals were beyond permicible limit and concluded that all samples were not suitable for irrigation. Dugali and Shaikhi, (2011), in their study pollution of Mithi river in Mumbai reported, presence of heavy metals is not frightening and it may be due to release of household sewage including farm animal waste in the river. They also observed that domestic sewage volume is more than industrial effluent discharged in river. Kiran, B.R. (2010), in their study of fish ponds stated that growth of macrophytes, unhygienic conditions silting of pond create nuisance. He also observed that storage of water decrease and cattle grazing are serious problem near fish pond, he also reported that deterioration of water quality manure and agricultural runoff.

Noorjahan, (2011), studied on untreated stated that protein, lipid and carbohydrates highly reduced in gills followed by liver and muscle. This is because untreated sample affected gills first because gills not have any covering. She also observed that lipid was most depleted followed by carbohydrate and protein. At last she stated all parameters are higher than permissible limits so untreated textile effluents should be treated or diluted before disposal, so that it does not affect the food chain she suggested that treated effluent can be used for aquaculture and agricultural purpose.
Erma and Saksena, (2010), high level of pollution of Kalpi river was due to residence of people living reside to river banks using river water for grazing, bathing, cloth washing, irrigation of crops. Due to increasing urbanization on side of river leads to high pollution responsible for high level of water parameters. Physical or chemical estimation of water contamination is complicated study since its implication of water toxic waste on aquatic organism and the human.

Heavy metals at low concentration in water such as mercury, lead are very toxic and can be accumulated through the food chain; the heavy metals are also non-degradable in nature. Among the essential metals like Iron (Fe), Copper (Cu) and Zinc (Zn) are used by plants as micronutrients they also damaging to normal functioning of the living organisms at high concentration, Nair, et.al. (2010).

Total dissolved solids indicate the water salinity and it has an adverse effect on plant growth because it increases energy exhausted to obtain water from soil and to make biochemical alteration to live under stress. This energy is used for the growth and yield.

Kannan and Thavamani, (1993). In water environment the value of total dissolved solids is up to 500 mg/lit. Is potable water, if value is increased then it is unfit or not potable for human consumption such water can cause distress in animals and can cause damage in plants. High amount of suspended solids or particles has effects on aquatic flora and fauna and diversity of aquatic life system is reducing and promotes the oxygen level depletion. For the preservation of food products, food industries are used salts so that the waste water from such industries such as sugar mills, dairy industries the content of chloride is increased in waste water. Water having suspended particles animal during, human waste and organic matter is resulting high value of chloride content is essential to know quality of water sources include the animal wastes, fertilizers etc. from the nearby area. One of the most important indicators of pollution is chloride. It is responsible for brackish taste in water and also shows sewage water pollution because it is content of urine that the reason of chloride presents in sewage effluent and also in the form drainage water.
There are various authorities including Central Pollution Control Board (India), World Health Organization (WHO), World Bank, Indian Standard Institution, Indian Council of Medical Research, etc. have developed guidelines, rules, and standards for release of sewage and effluents wastes from industries, municipalities corporations etc. They also have developed guidelines for water quality of drinking water, agriculture irrigation and criteria for aquatic life in fresh water. The implementation of these rules, guidelines, and standards etc. is however, wanting. Improperly treated or untreated municipal sewage and industrial effluents have been continuing to pollute not only surface water but also the ground waters. There is a numerous ill health effect of pollution, which are based on the types of pollutant having different effect on human and animal health and also ecology. The pollutants are adversely affected the plants and agriculture. The pollutants enters the plants, vegetables, drains, fruits, and fodder thus ultimately entering the food chains causing ill effect and diseases and adversely affect animal life.

Analysis of various physicochemical parameters is very important for estimating the constituents of water and concentration of pollutant in it. The physico-chemical factors include light penetration, water movement, suspended solids in the water, temperature of water and turbidity. The chemical factors include O2, CO2, pH, carbonates and bicarbonates, cations dissolved organic matters. The objects of water analysis for the physicochemical parameter are to decide the condition of different chemical constituent, which are present in the natural water ecosystems. Human activities such as dumping of sewage, industrial waste water, over use of chemical fertilizers and pesticides has threatened natural conditions of all water habitat, so it become necessary for the quality of drinking water be supposed to be assessed at usual time period because altered water quality eventually replicate on health of biotic components.

Variations in physico-chemical parameter also have a direct bearing on the structure and functions of various organs Thelkade, et al., (2012b). The quality of water may be affected by a variety of ways due to toxic waste. The problem of aquatic contamination is further provoked through the release of household and domestic
sewage in the water bodies. In many developing countries government are having difficulties with fecal contamination and drinking water, the degradation of freshwater resources and hazardous waste pollution. Several investigator contributed their efforts in studies of various physiochemical conditions of water, Dhamji and Jain, (1994); Kodarkar, (1992b). The discharge of industrial effluents in the reservoir water containing oxidisable organic matter reduces the dissolved oxygen content. The reduction of oxygen initially results in the pollution due to load of organic matter, but oxygen content is restored by re-aeration further downstream. In a health reservoir sufficient oxygen for microbial degradation of organic matter is essential to sustain its water quality. Less oxygen availability will lead to anaerobic break down of organic matter producing foul smell and consequent impact on water quality and bio-diversity. Dissolved oxygen level influenced the density of all bird groups. Valuable information about biological and biochemical reaction which is going on water is provided in the entire biotic factor in fresh water life. Patil et al., (2001) stated that dissolved oxygen is of great limnological significance as it regulates metabolic process of aquatic organisms and indicates the status of water. TDS indicates the general nature of salinity of water Gupta et al., (2006). Direct release of industrial effluents and overspill comprise versatile chemicals put forth their poisonous effect on living life form, deplete the level of dissolved oxygen, altering pH, CO$_2$ content and finally affecting the life series of the flora and fauna.

Presence of coliform bacteria is due to the disposal of sewage and waste from different industries without any proper treatment. Irrigation with deprived quality of groundwater can cause problem with salinity, ion toxicity to soil which may affect crop production. Water with high pH and electric conductivity affect on seed germination, growth of roots, absorption of micro nutrients and water Solaimalai and Saravanakumar, (2004).

Karr et al., (2000). Turbidity is measure of suspended matter such as mud, clay, silt etc. large amount of turbidity can cause problem in water purification process and may be increase treatment cost it may be difficulty in the disinfect water. Dissolved oxygen is very important measure of water quality if the dissolved oxygen is low recorded that means the non maintenance of conditions and this is favorable condition to aerobic organisms, it may be result the water body uninhabitable to gill breathing in aquatic animals like fish. Dissolved oxygen is an index of the biological and also physical process which is occurring in water. Important parameter of the water quality is Dissolved Oxygen. Due to the increasing temperature the water solubility for oxygen decreases and activity of the microbial organism increases and these changes reduce the Dissolved oxygen in water. Dissolved oxygen is essential for keeping the proper balance of many populations in water. It can maintain the biological life that’s why dissolved oxygen is the essential as well as critical characteristics of water, dissolved oxygen can enter in water through photosynthetic evaluation by aquatic autotrophy as well as direct diffusion from air. With the help of alkalinity the acid neutralizing capacity can determine. Important characteristic of wastewater is solids concentration, in waste water the strength of alkalinity increase and it indicate the capability of waste waters to neutralize acid and it is undesirable. Heavy metals from wastewaters can be negative impact on environment, Sekhar et. al. (2003). According to Kamble, (2003) heavy metals from waste water get absorb into rivers soil and sediments. Further he stated that during dry season due to evaporation these heavy metals expose to environment. Increase the heavy metals concentration in river soil and sediments can be increase in suspended solid concentrations. In aquatic habitat one of the important factors is free carbon dioxide and it is highly soluble in water, plants absorb carbon dioxide from air
and water also. The untreated and undecomposed organic matter which is present in sewage water and industrial waste water caused turbidity in river water.

Many type of substances related to the basic property of water can be measures by alkalinity. Solubility of many substances depends on the alkalinity level. According to Singh et. al. (1998). Highly alkaline water if consumed would affect the mucous membrane and may cause metabolic alkalosis. The presence of iron in water causes the staining of cloths Kesavan and Parameswari, (2005). Free carbon dioxide is important factor in aquatic life it is soluble in water and main source of carbon in nature pathway plants absorb the free carbon dioxide present in atmosphere and water. Kiran (2010 a). the term Potable water is used for the safe water or water used for drinking drinking purpose for human consumption the quality of water changes changed seasons. Saxena and Kaur (2003).

Iqbal, et.al. (2005), noticed considerable change in fish relating slow and unexpected swimming in different directions with infrequent jump. they also observed other changes such as rapid scale loss especially from head region, excessive secretion of mucous by treated fish also observed in exposed to nitrate. Mohanta, et.al. (2010), observed in their study that fish died within two hours after liberate into effluent but after sewage treated with microorganisms fishes survived for 20 days. After adding up of glucose in treated effluent fishes survived for about 29 days. Sharma, et.al. (2011)

The effects of different toxicants on the aquatic fauna particularly fish have received notable attention of several. Loganthan, et.al. (2006), Ayas, et.al. (2007), Srivastava (2007), Tilak, et.al. (2007).

Industrial effluents directly discharged into the river causes serious water pollution and affect the aquatic ecosystem. These effluents and their toxic such as salinity, content of CO₂, altering PH, deplete the DO on aquatic animals and directly or not directly affecting the life cycles, also on the metabolic activities of aquatic animals at the natural level, Nikhalij, et.al. (2012).

Sewage and industrial effluent when discharged in to water body without any treatment causes the permanent changes such as increase in pH, temperature,
turbidity, etc. dyes and chemicals which are soluble in water can affect the aquatic green plants and increase of Biological Oxygen Demand and Chemical Oxygen Demand values in water Hussain,  et.al. (2004). Textile industries produce large amount of effluent it contain mainly chemical which are used at the time of processing in textile industry are the main cause of pollution in Solapur with high chemical as well as biological oxygen demand. Industrial effluents containing large amount of organic compounds, it is added into food chain through water, soil accumulation of toxic substances in the environment, it disrupt the biological process, can affect the different tissues of fish like liver, kidney, gills etc. Discharge of the domestic waste, agricultural and industrial waste in to the river it causes water pollution and fishes are exposed to the contaminated water, it is highly affected when the rate of dilution of waste water is low. In fish pollution of water can lead changes of different type from biochemical alteration in a single cell up to whole population. Bernet et.al. (1999). Introduction of waste containing toxic substances such as heavy metals, pesticides and other chemicals discharged in to water can change surface tension, conductivity, pH value, density, thermal properties, along with biodegradable and non-biodegradable pollutant, acidic and alkaline pollutants devastate the micro organisms and invertebrates, Barber and Sharma (1998), Ackerman (2001). Mainly the uptake and accumulation of the heavy metals from gills and gastrointestinal tract. Heavy metals like lead occur in environment from the agricultural runoff, waste waters industrial waste water discharged in to sewage etc. all these waste drained in to rivers where aquatic animals like fish take it and accumulate in their body.

Accumulation of chemical pollutants adversely affect the fish tissues like gill, liver, kidney etc. gills are the main organ of fish performs various functions like exchange of gases, regulation of ions and seepage of metabolic waste products, Wood (1991). Constant contact of polluted waste water with gills of fish leads to destruction of cytoarchitecture and thus the gill is first target to waterborne pollutants, Fracacio, et.al. (2003). Entery of pollutants in the body of organism through gills can exert their harmful effect on delicate epithelium membrane of branchium. Playle,  et.al. (1992), Garcia-Santos, et.al. (2006), Bonga and Lock, (2008). Contamination of heavy metals reported in aquatic organisms and it increase in food chain are the cause of chronic
illness and death of aquatic organisms. The dyes are commonly used in the textile industries. 15% water pollution is due to dyes discharged during manufacturing and printing process, Spadarry et.al. (1994). Even low concentration of dyes (0.1ppm) can pollute water, Golob and Ojstrsek, (2005). Their entry in water body is aesthetically undesirable and has serious environmental impact as they affecting aquatic flora and fauna, Figueiredo, et.al. (2000). Toxic effects of dyes on fish have been reported earlier by many authors most of which are confined to hematological and biochemical studies, Sharma et.al. (2003), Afaq and Rana (2008). Similarly, in Solapur mostly pollutants come from the textile industries they added their waste directly in sewage water and thus sewage water directly drained into Sina river water body.

In fish gills are multifunctional organ responsible for respiration, acid base regulation, ion regulation, excretion Bonga and Lock (2008). Pollution of water and its effect on the aquatic ecosystem create a great problem. Sewage water in Solapur receive large amount of compounds from industrial waste and domestic waste. Sewage water after treatment also affect the aquatic animals, it causes a histological lesions and high susceptibility to infectious diseases, Escher, et. al. (1999), Bernet, et.al. (2001). It also causes histopathological effects Billiard and Khan (2003), Sole et.al. (2003), Alberto et.al. (2005), Petterson, et.al. (2006). Dinzi, et. al. (2005) shows the presence of estrogenic compounds in sewage and industrial effects in fish these all reported the sewage water after treatment also affected on fish. In Solapur all sewage water drained into Sina river without any treatment how much it affect on the aquatic environment as well as affected on human being also. Iqubal, et.al. (2005) stated that substantial changes in fishes involving sluggish and abrupt swimming in different directions with occasional jumping. They also observed other changes such as rapid scale loss, especially from head region. Excessive secretion of mucous by treated fish also observed in exposed to nitrate.

Mohanta, et.al. (2010) Tannery industry create huge quantity of effluents of diverse nature and most of that effluents are highly pollutants, they also reported that major source of aquatic pollution is tannery effluent. The special effects of diverse to pollutants on the aquatic fauna such as fish have established consideration of a number

Discharging of oxygen demanding substances, toxic wastes, suspended solids, animal waste etc. into river damage the water quality and pollute natural water due to this there is placed restriction in water uses Ougal, *et al.* (2011). Murugavel and Pandian, (2000) recorded that a decrease in temperature enhances solubility of oxygen in water. Klug, *et al.* (2000) investigated the compensatory dynamics in planktonic community responses to pH perturbations. Carvalho, et. al. (2002) investigated the physico-chemical conditions for supporting different levels of biological quality for fresh water. Adak, *et al.* (2002), Dissolved oxygen play important role in water, it is important for the development of plants and animals of aquatic environemnt. The ability of water to conduct an electric current is measured by electric conductivity. It is important parameter to determine the quality of water that means the water is suitable for irrigation or not. It is also used for check the salinity of waste water. The conductivity is related to the amount of the dissolved solids in water.

Electrical conductivity determines water quality. Electric conductivity is tool used to decide the capability of caring electrical current and it is associated to the absorption of ionized substance in water. variation in electrical conductivity positively linked with total dissolved solids which are pollution indicator. Jayalakshmi, et. al. (2011 a).conductivity of the untreated textile effluent is higher and it increase the conductivity Mudakkra and Noorjahan, (2006) and Jamuna, (2008). How much solution can carry an electrical current by measuring electrical conductivity. It is important parameter to indicate the dissociated and dissolved substances in water it also indicate concentration of electrolyte which is dissolved in water. Maximum electrical conductivity is depending on the load of waste water, sewage water and domestic sewage it shows the electrical conductance in water, Sreenivas, *et al.* (2006). in natural water is normalized measure of water ability by dissolved salts from water. Electrical conductivity depends upon the ions, variation of dissolved solids and nutrients. Electrical conductivity shows positive correlation with TDS, Raghuwanshi and Pandey (2012). Due to the minerals from rain, irrigation management occurrence of uneven unionized chemical substance indicates
the variation of the electrical conductivity. Increase in levels of cations and conductivity are the products of decomposition and mineralization of organic materials

Abida, (2008) stated that the conductivity of water show positive correlation with all parameters expect dissolved oxygen, TDS and TS. Electrical conductivity itself is not a trouble if it lies just above the certain limit, it will influence solubility of many substances depends on pH of water.

Important physical factor that is temperature control the natural process of the environment. Temperature is important to note its effect on aquatic life, chemical reactions and its rate and mainly known about the suitability of water uses like drinking etc. due to the addition of warm water from industries the temperature of waste water is high. Due to the high temperature reduction in solubility of oxygen in water and amplified odor due to anaerobic reaction Akan, et.al.(2008).high temperature can increases the evaporation rate of wastewater and due to this the air pollution occur effect associated with the air pollution occur effect associated with the rainfall and it is characterized high precipitation reduce air pollution Jauregui and Luyando, (1999).Water temperature plays an important role variation in temperature influenced factors like temperature, wind, humidity and solar energy, temperature fluctuation also affect the zooplankton and phytoplankton and also fish productivity Kiran, (2010 b).in water system temperature plays an important role. Due to the biotic and biotic reactions we can observe change in temperature according to change in atmospheric change. Effect of temperature on biochemical reactions in the organism is important. The water temperature affects the efficiency of treatment units for example in cold water temperature viscosity increases Jayalakshmi, et.al. (2011 b). Due to the biotic and abiotic reactions and change in atmospheric temperature the water temperature is also change. The temperature is not only depending on atmosphere but also on weather condition, it is important for certain effects on the chemical reactions and biological reactions which are taking place in the aquatic organisms. Temperature is found negatively correlated with dissolved oxygen, Das, (2000c). Variation in temperature of water is depending on geological, geomorphical and geographical conditions of the region. It also depends upon the season, time of sampling and nature of effluents which
are disposed in to the water bodies. Ahipathy, (2006). Sharma, et.al. (2000) clean atmosphere, and low level of water in any water bodies leads to increase in temperature. During summer season the water temperature is high due to heat.

pH is the measurement of severity of acid and alkaline present in water, to measure concentration of determination of pH is significant objective in wastewater treatment. pH is indicator of the salinity of water, variation in the pH exerting stress on the inhabitant organism in aquatic environment.

Due to the environmental interference photosynthetic rate and microbial activity variation in pH occur, increased photosynthesis of algae results into the precipitation of carbonate of calcium and magnesium from bicarbonate leads to higher alkalinity Agarwal and Rozgar, (2010). pH is important factor of water quality if pH is more than 7 it indicates that water is hard and it shows containing of calcium and magnesium in water. Low level of pH is affected the growth of bacteria. Jayalakshmi, et.al. (2011c). Value of pH of effluent is affected the biological reaction rate and survival of different micro organism. pH has directly or indirectly affected on photosynthesis and growth of plants. Low pH dissociation of iron phosphate decreases and vice versa high pH causes more carbonate and bicarbonates in water Kara, et.al. (2004b). One of the most important parameter for operational water quality is pH, it is not direct affect on consumers value of pH above seven indicate the hardness of water it means water contain calcium and magnesium, Divya and Belagali, (2012).

Low value of pH means below seven is effected the growth of bacteria, Jayalakshmi et.al. (2011d). pH is the measurement of severity of acid and alkaline present in water to measure the concentration of determination of pH is significant objective in waste water treatment, pH is indicator of the salinity of water, variation in the pH exerting stress on the inhabitant organism in aquatic environment due to the environmental interference photosynthetic rate and microbial activity variation in pH occur. Due to increased photosynthesis of algae it results in to the precipitation of carbonate of calcium and magnesium from bicarbonate causing higher alkalinity, Agrawal and Rozgar, (2010b).
pH of any industrial effluent and sewage affect the organic reaction rate and survival of different life forms in water bodies includes micro-organisms. The range of pH is specific for aquatic life guard with control of unwanted chemical reactions like dissolution of metal ions in acidic or basic medium of water, Tayyab Aftab, et.al. (2011). pH of sewage shows the alkaline nature due to the domestic sewage, industrial waste etc. from natural water pH we can collect the information about the process like chemical process and biological process. The pH value is most important indicator which can indicate about water that means hard water or soft water potential activity of hydrogen ions from the sample can be measured by pH was positively correlated with electrical conductance and total conductivity, Thangdurai, et.al. (2010).

pH value indicate the acidic and alkaline nature of water, pH is nothing but the level of concentration and measures the concentration of hydrogen ions, Gupta, et.al. (2013b). Alkaline nature of any water bodies may be due to high temperature of environment, which leads to reduction in solubility of CO₂, (2010).

According to the Umavathi, et.al. (2007) high level of pH to water due to the liberation of sewage water from municipality and farming field. The pH value ranging between 5 to 8.5 is good for the growth of plankton. High pH value some time leads to eye irritation while skin disorders are associated with pH value above 11. Lower values also lead to similar effect, Khan and Ahmad, (2001), Jain, et.al. (2005), Khan and Bangash, (2001). pH values indicates the quality of water. the acidic and alkaline nature of water indicate that the water of that region either safe or not for the domestic, animal husbandry, agricultural and entertaining use Kumar and Sharma, (2005).

The pH variation is caused by different kinds of chemicals used in textile industries. Thorat and Wagh, (1999) observed pH value 8.4mg/lit in effluent sample. Rao, et.al. (1993) observed pH value ranges between 8.0 mg/lit to 11.0 mg/lit in industrial effluent. Jadhav and Prajapati, (2011) reported pH ranged between 7.52 mg/lit to 7.87 mg/lit and she stated that water is suitable for aquatic life similar observations made by Helen, et.al. (2008), Pejavar, (2002), Mohamed and Korium, (2009) and Patra, et.al (2010).
For preservation of food products food industries are used salt that’s why the waste water from such industries such as sugar mill, dairy industries the content of chloride is increased is waste water, water having suspended particles animal dung, human waste and organic matter is resulting high value of chloride content of chloride is essential to know quality of water sources include the animal wastes, fertilizers etc from the nearby area. One of the most important indicator of pollution is chloride, it is responsible for brackish taste in water and also shows sewage water pollution because it is content of urine that’s why chloride present in sewage effluents and also in the farm drainage water. Chlorides are not used directly or indirectly by aquatic plant for growth, large amount of chlorides responsible for organic matter and cause eutrophication it also affects the soil porosity and permeability. Jayalakshmi, *et.al.* (2011 d). Chlorides generally obtained in the form drainage and sewage water, it is mainly indicate the sewage pollution because mainly chlorides is content of urine values of chlorides higher in summer season. Chloride content is important parameter to know the water quality and sources like animals wastes, fertilizers etc. Ansari and Prakash, (2000), Dagaonkar and Saksena, (1992). Chloride content in water is indication of organic load of animal origin from the catchment area, Kumar, *et.al.* (2004). Chloride is most important anion in water it is mainly combined with sodium, calcium, magnesium, etc. high chloride in water means the pollution occurs due to the domestic effluents, sewage water of city. Concentration of chloride is related with the concentration of salinity. Due to the organic wastes mixed directly in water. level of chloride concentration indicates the presence of organic wastes in the water system and it is indication of the occurrence of untreated waste chiefly of animal origin, Saksena, *et.al.* (2008).

Chloride imparts salty taste, high concentration of chloride cause laxative effect in human being, Gupta, *et.al.* (2011). In all type of water chloride occur naturally it obtained in chloride containing rocks, agricultural activities etc. higher chloride concentration is association with increased level of pollution, Umavati, *et.al.* (2007). Gastrointestinal related problems may caused due to high level of chlorides in water. it also responsible for diarrhea and dehydration in human those who used water for the household use, Shakirullah, *et.al.* (2005), Qadeer, (2004). Chlorine is toxic gas but chloride is essential for life, Duffus, (1996). Chloride present in natural water but high
chloride content indicates pollution by sewage, industrial waste etc. Nduka, *et al.* (2008). High level of chloride that mean above 250 mg/lit is harmful it promotes pipe corrosion. Removal of chloride from portable water is very difficult and requires desalination in our study it is very high concentration if mix with Sina River water that mean high pollution occur. Plant growth in aquatic ecosystem can utilize chlorides directly or indirectly. High content of chloride responsible for high amount of organic matter causes eutrophication. Similar results observed by Jayalakshmi, *et al.* (2011e). Values of chloride ranged from 4.10± 0.40mg/lit to 16.00±1.00mg/lit reported by Agbalagba, *et al.* (2011b), similar values reported by Ekpete (2002), Nwala, *et al.* (2007) below the value reported by Manilla and Tamuno-Adoki, (2007), Bolaji and Tse, (2009) in Niger Delta region. The salinity of water is controlled by chlorides of water and osmotic stress on biotic communities Salaskar and Yeragi (1997).

Total dissolved solids indicate the water salinity and it has a adverse effect on plant growth because it increase vigor exhausted to obtain water from soil and modify the biochemical reactions to survive under anxiety. Solaimalai and saravanakumar, (2004b). Use poor quality water for irrigation may cause ion toxicity, salinity, problems of infiltration in soils which is affect the production of crop, on germination, growth in roots, absorption of water and nutrients, presence of total dissolved solids is not suitable for irrigation.

During winter and summer season decrease in water level due to this the solute amount was high. Bhattaraj, *et al.* (2008). High level of total dissolved solids is due to presence of sodium, potassium and chlorides it has short term effect or little effect but the cadmium, nitrate, lead etc. like these toxic ions also dissolved in water. High values suggested the presence of dissolved inorganic substances in an ionized form Saxena and Kaur (2003). Further Sastry, *et al.* (1999), Nawlakhe, *et al.* (1995). Reported about concentration of TDS ranges between 125mg/lit to 2490mg/lit. Dissolved solids come from salts, industrial waste, plankton, sewage water, fertilizers, pesticides used in agriculture etc. TDS ranged between 412mg/lit to 698mg/lit Saxena, *et al.* (1993). TSS value found very fluctuating it ranges 346mg/lit to 521mg/lit reported by Mathur, *et al.* (1987), Shahji, *et al.* (1991). Gradually nala passes through city the value increases it
indicates that the residential as well as from industrial effluent added in nala, in form of insoluble as well as dissolved. Water containing high total dissolved solids cannot use for the construction purposes, drinking for animal but the sewage water from Solapur is used for washing animals, agriculture purpose, grass cultivation for animals etc. High level of total dissolved solids generally indicates hard water and it can cause build up in pipes, valves and filters.

Bharati and Bharati, (2013). High total dissolved solids produces marks on cooking vessels. High total dissolved solids indicate pollution by extraneous sources high amount of dissolved. A suspended and total solid of samples adversely affects the quality of water and it is unsuitable for the irrigation purpose and drinking purpose, Kataria, et.al. (1996). Chlorides, nitrates, phosphates, carbonates, bicarbonates of calcium, sodium, magnesium, potassium, whole matter and other particles constitutes the total dissolved solids. TDS is the sum of the cataion in water, due to this dissolved solids provide a measures of amount dissolved ions in water. Farid, et.al. (2012). High level of total dissolved solids in water can indicates elevated levels of dissolved ions, which make water non-potable, corrosive and salty in taste, Shakirullah, et.al. (2005), Ahmad, (2005), Samina, et.al. (2004). Hose, et.al. (1994) observed value of TDS in waste water is range 488ppm and Rao, et.al. (1993) observed TDS value in textile industrial effluent it ranges 8500mg/lit to 10,000 mg/lit in present study value ranges from 1042mg/lit to 6142 mg/lit.

Hardness has no unfavorable effect on fitness of human but there are facts that such water can cause heart disease. Massod Alam and Anwar Ahmad, (2002), Kesavan, et.al. (2005). Total hardness means the addition of the calcium ions and magnesium ion concentration present in water. Hardness of water means the measurement of capacity of precipitation with soap. Calcium is rich in natural water and rocks; calcium is element which is combination of different cations such as carbonate, fluorides, and bicarbonates to exert hardness. Kiran, (2010d). Hardness of water depends on the salts dissolved in water. Water become hard due to the calcium and magnesium found dissolved state in water, this is because the domestic waste, sewage water, washing of animals and residues of soap. Water become hard due to excess
presence of chloride, bicarbonates and dissolved sulphate in water, Kamal, *et al.* (2007). The decrease in level of water leads increase in temperature in terms rate of evaporation attributed to high levels of salts of calcium and magnesium Hujare, (2008). Krishna, *et al.* (2011) reported value of hardness ranges between 12.11 mg/lit to 22.98 mg/lit which are below permissible limit similar observation reported by Bhatt, *et al.* (1999). Hardness is also responsible for gas trouble, renal calculi, cardio-vascular disorders, diarrhea etc. Chemical oxygen demand is the test to measure wastes in domestic sewage and industrial effluents in water. Chemical oxygen demand means the amount oxygen required for oxidation of organic matter. The waste is measure in terms of equality of oxygen required for oxidation of organic matter to produce carbon dioxide and water Sagar, (2012). High level of chemical oxygen demand indicate the toxicity and the presence of organic substances in waste water. Chemical oxygen demand is amount of oxygen which is required for decomposition of chemical waste coming from the many types of industries. High value of chemical oxygen demand indicates high level of accumulation of organic waste in water. It can estimate the carbonaceous factor of organic matter and it can measure the pollution in water or in aquatic ecosystem. Chemical oxygen demand change due to the discharge of the sewage and agricultural waste, also change due to seasonal variation.

Textile effluents are greatly colored and contain salty non-biodegradable compounds and require high biochemical and chemical oxygen. Yusuff, *et al.* (2004). for decomposition of the chemical waste amount of oxygen required that is chemical Oxygen Demand. Kolhe, *et al.* (2008) found chemical oxygen demand value up to 1230 mg/lit in industrial effluent, Sankpal and Naikwade (2012 b) found average value of chemical oxygen demand was 1825 mg/lit, in present study the value is ranging between 353 mg/lit to 860 mg/lit. Yadav, (2011) stated that high value (60.5 mg/lit) of chemical oxygen demand in summer and low value (12.3 mg/lit ) in winter and it is because of accumulation of organic waste, regarding these value, values in present study are very high due to high organic waste added from textile industries. Imtiazuddin, *et al.* (2012) observed chemical oxygen demand levels at different mills were 115.66 mg/lit to 705.25 mg/lit similar observations stated by Ademorotti, *et al.* (1992), Pathe, *et al.* (1995).
Biological oxygen demand is used to measure the required amount of oxygen by bacteria which is used to break down simpler substance in decomposable organic matter which is present in wastewater. Concentration of organic matter from water is measured by biological oxygen demand; if the decomposable matter is in large amount then the demand of oxygen is also in large amount hence the biological oxygen demand is also greater. Low value of biological oxygen demand is due to less quantity of solids, suspended solids in water also in quantitative number of microbial population. Avasan and Rao, (2001). High value of biological oxygen demand is designate the potency of pollution of the waste water it also specify the level of existing oxygen which is used by living organisms in waste water. Biological oxygen demands can measures necessity of oxygen by microbes to mortify the organic matter in aerobic state. High biological oxygen demand in a serious situation reduces the oxygen level which indicates the pollution in water. High level biological demand shows decline in level of dissolved oxygen, because the obtainable oxygen is used by bacteria and it is affected on fish and aquatic organisms to survive in water by calculating the biological oxygen demand and chemical oxygen demand ratio. We can estimate the biodegradability of water. High biological oxygen demand and chemical oxygen demand relation specify that the water is polluted and biodegradable. Waziri (2006). Biological oxygen demand means the amount of oxygen used for the physiological progression by living aquatic organisms. The biological oxygen demand is quantity of oxygen required by aquatic living organism engaged in the demolition and consumption of various organic water. Excess oxidation of various organic matters to carbon dioxide leads to depletion in oxygen and it may result in high biological oxygen demand. Due to effluents discharged through the drainage system results in high biological oxygen demand. Biological Oxygen Demand is required value of oxygen which is used by living organisms in the deployment and destruction of organic water during summer Bhattarai, et.al. (2008).

For the degradation of organic matter by microbes under aerobic condition they require oxygen is measured by biological oxygen demand. Increase in domestic waste the biological oxygen demand also increased, Barat and Jha, (2002). Biological oxygen demand measure the fractions of biodegradable consumption by bacteria, biological oxygen demand is help in deciding the water solubility for consumption. High biological
oxygen demand load due to discharges of waste water, human activities like defecation, washing etc. Biological oxygen demand depends on temperature extent of biochemical activities, concentration of organic matter etc. maximum value of biological oxygen demand observed in pre Monsoon period due to maximum biological affinity at elevated temperature and low in winter, Ghavzan, et.al. (2006). Avasan and Rao,(2001b) stated that low value of BOD is due to less value of suspended solids, quantity of total solids and quantitative number of microbial population. Due to biodegradation of organic material biological oxygen demand increases, this exerts oxygen tension in water body, Abida and Harikrishna, (2008). BOD demand increases eith biodegradation of organic materials present in water which exerts oxygen tension in a water body . Chandanshive, (2013), noticed low BOD during monsoon season during his study. In the present investigation maximum BOD was observed during summer all the stations and observation is in agreement with. The highest BOD values were recorded as 59mg/litre at station-C. Higher value of BOD observed during summer could be a result of reduced rate of water flow, degradation of organic waste and accumulation of wastes due anthropogenic activities, while low BOD values during monsoon may attribute to dilution of river water. Paul et al., (2012a) studied characterization of six textiles industrial waste water in Solapur city recorded BOD value between 170 to 450 mg/L and average value is found to be 348 mg/L. They further concluded that, these values were higher than prescribed standards stipulated by CPCB. Sankpal and Naikwade (2012) observed BOD value as 120 mg/lit, he also stated that Trivedy et.al. (1986) observed the effluent of textile industry in the range 320 mg/lit to 720 mg/lit.

Phosphate are come from the industrial waste, fertilizers and pesticides used in fields, washing, cleaning activities and bathing also release phosphates in water. In soil and water phosphorous is present in both forms that is in organic form as well as in inorganic form and it is very essential nutrient. Phosphates in high level can cause eutrophication due to this algal growth increase and it affect the reduction the dissolved oxygen in water.
Sujitha et al. (2011), Manjappa, et al. (2008), reported that Phosphate is primary limiting factor of water bodies it enters in water bodies from pesticides, fertilizers, industrial waste water and cleaning compounds, animal waste, human waste etc. higher values indicated detergents get accumulated. Sharma et al. (2012) recorded high level of phosphate in to the lake water from Thane city. He concluded that growth of algal bloom was might be due to high level of phosphate in water. The range of phosphate in lake water was 0.01 mg/lit to 0.79 mg/lit.

Pejaver, et al. (2000), Pejaver and Raut (2002), Pejaver and Somani, (2002). According to Desai, et al. (1995b), phosphate level rang between 0.51 to 1.28 mg/lit. And stated that phosphate level increases due to domestic waste added. Due to eutrophication growth of algae increases and ultimately dissolved oxygen decreases this is occur because of the high level of phosphate. Paul, et al. (2012) reported value of phosphate ranges between 3.91 mg/lit to 10.45 mg/lit in textile waste water in Solapur city. Raghuwanshi and Pandey (2012), in his study value ranges from 1.3 mg/lit to 3.44 mg/lit which is high Sujitha, et al. (2011) also stated about high value of phosphate. Pandey, et al. (2000) stated that phosphate is limiting and critical factor in the maintenance of water fertility. Lendhe and Yeragi (2004), Jayabhaye, et al. (2008) stated that phosphate values were minimum in post monsoon and maximum in monsoon.

Nitrate is essential nutrient, high concentration of nitrate in water may give rise a condition known as methaemoglobinemia in pregnant women and infants. Nitrate is a good indicator of pollution occurred by natural and human activities. High concentration of phosphate and nitrate shows the quick growth or death of plants, algae etc. Major threat to the aquatic organism is due to pollution by inorganic chemicals. The agricultural runoff contain residue of pesticides and fertilizers. The effluents generated during industrial activities in addition to household sewage supply to the water bodies and deposit with vast quantity of inorganic anions and heavy metals (ECDG, 2002). Due to the contamination of nitrate in higher level in water causes severe health hazards and also responsible for nitrate poisoning. The anthropogenic sources of metals from petroleum contamination, industrial, sewage water disposal and agriculture Santos et al., (2005).
Water is considered to be good for irrigation when sulphate level is less than 200 mg/lit Rajkumar, *et al.* (2003). Discharge of the domestic waste and surface runoff from field and surrounding areas in rainy season water contains sulphates. In natural water sulphate is present but its percentage is increased due to the industrial water containing sulphuric acid, aluminum sulphate and bisulphate’s which is used for the process of purification, high concentration of sulphate present in drainage water it may cause harmful effect and diarrhea. Guru Prasad (2003). Sulphate is one of the harmful anion. It is mainly occur in water due to industrial discharge. Farid, *et al.* (2012) reported sulphate level in water is ranged between 241 to 570 mg/lit. They also stated that the sulphate value above critical stage causes diseases and abnormalities like dehydration, gastrointestinal irritation, diarrhea, etc. similar statement was given by Shakirullah et al., (2005) and Guru Prasad (2003b). Water having sulphate level less than 200 mg/lit is excellent for irrigation. Rajkumar, *et al.* (2003b). As per this statement value of sulphate in present study are very high can be affected and not good for irrigation. Jayalakshmi, *et al.* (2011e). Reported sulphate value ranged between 11.23 to 30.6 mg/lit in waste water as compare to this value our investigate values are very high. In our investigation values ranging between 900 to 1250 mg/lit. Which is very dangerous for living organism and not good for irrigation but still this sewage water is used for irrigation and cultivation of grass for animals.

Sulphates occur due to sewage water, industrial discharge, paper mills etc. from the combustion of sulphur dioxide it convert in to sulphuric acid, it come down on earth by wind or rain. High concentration of sulphate decreases pH and bacterial load increases. Sulphate level increases due to the industrial waste, sewage and elements which are used in water purification plant like Aluminum sulphate, bisulphate and sulphuric acid it increased sulphate level in waste water. Discharge of the domestic waste and surface runoff from field and surrounding areas in rainy season water content sulphates. In natural water sulphate is present but its percentage is increased due to the industrial water containing sulphuric acid, aluminum sulphate and bisulphate’s which is used for the process of purification. Reported 128 mg/lit in lake which is lower value and 34mg/lit in treated water similarly Raval and Malik, (2010) also noted sulfate value.
The source of sodium in water is weathering of different type of rocks, industrial waste and domestic sewage are rich in sodium and it increases concentration of sodium, Gupta, *et al.* (2013b). Water alkalinity is capacity to neutralize strong acid; it is due to presence of carbonates, hydroxides, bicarbonates etc., Divya and Belagali, (2012). Bath, *et al.* (1998b) reported that Bicarbonates show direct relationship with free carbon dioxide similarly statement stated by Bath, *et al.* (1992), Chandanshive, *et al.* (2008). In aquatic ecosystem free carbon dioxide is important parameter. In nature it is main source of carbon pathway and highly water soluble. Free carbon dioxide absorbed by plants from atmosphere as well as in water. In water it is contributed by plants as respiratory activity. Jindal and Rumana, (2000) reported high value of free carbon dioxide means the high degree of pollution in water an inverse relation found between pH and carbon dioxide. High level of carbon dioxide may be ascribed to heavy inflow of untreated sewage and waste from the surrounding area of human settlement, Kosygin, *et al.* (2007), Saksena, *et al.* (2008).

Manganese is one of the essential elements for the animals and plant growth, Mn is not found in nature as metal but it found in the forms of various salts and minerals in association with iron (Fe). At some instance elevated levels of Mn found in freely flowing water usually association with manufacturing wastes impurity, Dwibedi and Tiwari, (1997). Manganese act as co-factor in numbers of enzyme systems and various metabolic processes in animal and plays very important role in proper function and synthesis of cholesterol, sulphated mucopolysacharides and pb. (WHO 1988). In ground water the contribution of magnesium occur due to the silicate minerals dissolved in water. Source of magnesium in water is from rocks, sewage waste water and industrial effluents. Higher concentration of magnesium in water makes the water unpalatable and act as laxative to human being, Gupta, *et al.* (2009). Someshekar, *et al.* (2000) collected and analyzed ground water from 48 tube well from Channapatona town observed that, the water quality of 80% of well is unsuitable for drinking purpose as it has higher level of hardness, higher level of Mg, nitrate and calcium in bore well water.

Tyagi et al. (2000) studied physicochemical parameters from industrial areas of India reported that, the concentration of some physico-chemical parameters such as
Hardness, Color, chemical oxygen demand, Dissolved oxygen, biological oxygen demand, Fluoride content, Chloride, Sulphate, Calcium, Nitrates etc was much higher than the acceptable limits of WHO (1993) and ISI (1991) for drinking water standards. Analyzed ground water and recorded value of magnesium varies from 3.65 mg/lit to 126.46 mg/lit. Murhekar, (2011), during his investigation also shows concentration ranges between 26.00 mg/lit to 162.00 mg/lit. Naturally calcium present in rocks in high quantity by leaching it mixes in water bodies. Calcium is associated very cation such as fluorides, bicarbonates, carbonates etc. High level of calcium causes deterioration of cloths and incrustation of pipes. Source of calcium in water is mainly from the sewage and industrial waste. And Balaji and Tse, (2009) stated that due to the concentration of magnesium and calcium the hardness of water increases. Dissolution of silicate, minerals which contributes calcium and magnesium to ground water. Paul, et al., (2012c) reported in their study value of calcium is ranges between 75 mg/lit to 404 mg/lit. They also stated that high value of calcium in Solapur city was high due to textile waste water.

Heavy metals are natural constituents of environment. They are involved in biogeochemical processes and reactions and are circulated in to the various components of ecosystems. Due to anthropogenic activates speed of alterations in behavior of these heavy metals took place. The mobilization of heavy metals can occurs by weathering process such as dissolution and erosion due to biological and physical activities. All such type if activates finds its way into aquatic system. Large quantities of heavy metals are added in the aquatic ecosystem due to domestic sewage, industrial effluents, run off from crop fields.

The property of metal ions can be incorporated into food chains and concentrated in non target aquatic organisms in such a level that they affects their different physiological actions. On another hand heavy metals have extreme ecological force on the whole organisms. When metals traced such as Fe, Zn, Mn, and Cu they play essential part in biochemical process of all the aquatic animals and plants for that resion, they are very essential in water ecosystem in very trace amount. In the Egyptian organization of irrigation, the source of Zn, Cu, B and Pb are industrial effluents as well
as algaecides are responsible for copper content in water, while that of Cd is the phosphate fertilizers used in agricultural practices Mason, (2002).

Effect of heavy metals on histological structure in fishes was noticed by various researchers recorded various changes in structural organization, changed cytoarchitecture and histopathological alteration in different organs Singh et al. (1990). Karuppasamy, (2000) exposed fishes to heavy metals and noted effect of heavy metals on various soft tissues of of freshwater fishes. *Labeo rohita* exposed to mercurichloride and *Chana punctatus* exposed to phenyl mercury acetate showed severe damage and histopathological changes in different tissues. These heavy metals are uptake and accumulated by gills and gastrointestinal tracts. Lead is found in environment and occur in urban waste waters, industrial discharge etc discharged in to the rivers water where they contaminate the water quality for fishes and other aquatic organisms and get accumulate in their body through exposure and bioconcentrate in the food chain. Therefore, heavy metals are responsible for ill effect due to chronic exposure and finally death of an organisms Rashed, (2001) and Adham, et.al. (2002). in fish heavy metals are accumulate in gills and liver. Liver is identified as storage sites. Gbem, et.al. (2001) buildup of chemical pollutant are negatively affected the different organs such as muscles, kidney, gill and liver of fish.

Cadmium is one of the non-essential heavy metals and is probably hazardous to the biotic components. Cadmium get accumulate in to the tissues leads to toxicity and adverse effect on various life forms in aquatic ecosystem. Cadmium is also toxic when present in small quantity in environment. Hence it is considered as most toxic element in the environment Chrastny, *et.al.* (2006) and Kiran, *et.al.* (2006). Cadmium is responsible for interfering with metabolic activities and biological functions like osmoregulation, growth of organism, reproduction and exert stress in aquatic organisms. Contaminated water bodies with cadmium leads alterations in various metabolic processes and damage to biological system. It resulting in an increase of cadmium deposit in soft tissues of aquatic organisms and find their way in to the food chain. Cadmium has major environmental concern because of its greater ability to
accumulate quickly into the animal tissue but excretion of cadmium from organisms is a slow process Thophon, *et al.* (2003).

Zinc is a heavy metal that gets accumulate in the tissues of organisms. Especially, heavy metal zinc accumulates in all parts of the kidney but mostly in distal tubules at the site of its filtration Woodling, *et al.* (2001). Zinc is cytotoxic and is related to prevention of synthesis of RNA and DNA. Due to prevention of synthesis of these nuclear materials it alters the protein metabolism in cell and Ca++ antagonism Walther, *et al.* (2003).

Histological analysis is seem like sensitive or essential parameter and is decisive in decide the cellular changes in different organs like gill, liver and kidney.

The main passage for entrance of pollutants in fishes is gills and gastrointestinal tract and it passes in some venerable body organs like liver, kidney etc. Due to exposure with the outer environment in fishes target organ are gills because gills expose directly to pollutants. In fishes and most of the animals liver is an organ for detoxification and biotransformation process because of this liver is also most affected organ. Vander Oost, *et al.* (2003).

Desai et al., (2011) reported histopathological alterations to gonads due to sub lethal concentration of organophosphorus pesticide, dimithoate in *Oriochromis mossambicus*. Cytoarchitectural alterations in ovaries of fishes and other aquatic animals may be due to several factors such as ionizing radiation, electric current, parasitic infection, xenobiotic toxicity Sarojini and Victor, (1985), Johnson, et al., (1988); Kumar et al., (2007). Kidney is vital organ of animal to maintain the homeostasis and for proper functioning of body. It involved in removal of nitrogenous waste from blood and also responsible for selective reabsorbing of useful substances. It helps to maintain pH and volume of blood and help to regulating blood pressure by producing rennin enzyme. Several toxic chemicals affected to kidney leads to some pathological changes observed in fish include degeneration of epithelial cells, excessive vacuolization of tubule cells, dilation of glomerular capillaries etc.

Histology study is useful to evaluate the level and amplitude of pollution due to lethal and chronic exposure of pollutants. Histology represents an indicator of the
exposure to contaminants. Histological alterations in any organs are due to exposure of toxic substances present in aquatic medium which responses the sub-lethal stress which provides a quick method to detect the irritating effect of mainly chronic exposure in different type of organs and tissues. The impact of water pollution not only divesting human being but also to the animals such as birds and aquatic animals like fishes Johnson et.al. (1993).

Pratap and Bonga, (1993) have noticed the histopathological alterations and accumulation potential of heavy metals like chromium’s in the fish soft tissues. They also noticed deterioration of the proximal renal tubules in kidney and increases in chloride cell turnover in gills. Various histopathological alterations take place in diverse tissues of fishes due to contaminated water containing various kinds of toxic pollutants in water. Pathological changes induced in fishes due to contaminated water containing various kinds of pollutants.

Zaki, et al., (1987) and Bandopadhyaya, (1987) noticed necrosis due to poisoning of ammonia in intestinal mucosa, gill hyperplasia, infiltration of fat in liver, destruction of parenchyma cells, tract, kidney and gills of juveniles Sparus auratus. In fishes gill are very vital tissue as it come in straight get in touch with with water and the various pollutants which are present in water pass through it, and find their way into different body tissues of fishes.

Gills plays important role in excretion of the nitrogenous wastes, helped in acid base balance, osmoregulation and mostly in respiration. Pollutants like heavy metals, pesticides, fertilizers, sewage are directly affected and damage the gills. Gills are directly come in contact with contaminated water exposed to poisons due to environmental pollution and cause cytoarchitecural change n aquatic animals like fishes and mollusks. The pollutant which are dissolved in water arises from industrial effluents and domestic sewage can damage gill cytoarchitecture because the gills are the uncovered structures of fish due to its poristion and direct contact with contaminated water Hadi and Alwan, (2012)..
Gill arches are present on either side of bucal cavity. Each and every gill arch is made up of numerous or many filaments having gill secondary gill lamellae in two rows lies perpendicular to each filament. Second gill lamellae made up of contractile cells and separate capillary channels. In lumen of capillary erythrocytes observed. Chloride cells lies at the bottom of gill lamellae having great epithelial cells with small cytoplasm. In gills the mucous cells are there in epithelium of filament at the bottom of lamellae but are characterized by lack of cytoplasm and reduced size than chloride cells. Peebuaa, et.al. (2006). Karlesson, et.al. (1985) mentioned that the because of the increasing number of the mitotic divisions of lamellar epithelium of the cellular layer of lamellar epithelium increases.

Kamtham and Richards, (1995) suggested that due to exposure of various pollutants leads to increase in gill hyperplasia and epithelial thickness also increases. Cellular proliferation of thick gill filament epithelium leads to lamellar fusion Figueiredo, Fernandez, et.al. (2007). in the cells the mucus covering of glycoprotein alters due to the effect of toxin in hyperplasia and fusion of gill lamellae. Due to severe edema another histological change induced consists lifting of lamellar epithelium. Pane, et.al. (2004). Observed lamellar axis vasodilatation in tilapia mossambica when exposed to aluminum. Garcia-Santos, et.al. (2006) also recorded change in the pillar cell of gills in normal structure with the loss of support, and become less functional for respiration. Damaged pillar cells result increase in blood flow and it can cause dilation of blood congestion. Rosety- Rodriguez, et.al. (2002), Randi, et.al. (1996). Histopathological changes in gills of fishes resulted in hypoxia, and failure in respiratory mechanisms and result in imbalance of acid and base.

Alazemi, et.al. (1996). Main function of the chloride cell is osmoregulation but the pathological changes in chloride cells show the osmoregulatory dysfunction, Virtanen, (1986). Aluminum toxicity kidney can accelerated surface and intracellular legends implicated, Exley and Birchall. (1992). DNA damage modifying the chromatin
In freshwater teleosts fishes heavy metal get accumulated from contaminated diet and indirectly from the aquatic medium through food chain and through respiratory lamellar surface of gills, Srivastava and Strivastava, (1994). The gills are in direct contact with water which allow to dissolved material to absorbed and accumulation of pollutants in to gill tissue through the highly vascular and delicate epithelium. Due to the action of lead on epithelial lining of gill lamellae create osmoregulatory imbalance, shrinkage of gill lamellae, degeneration of epithelium, rupture of brachial vessels, there is extreme reduction in the respiratory rate, slow movement, swimming and reduction in the feeding. Olojo, et.al. (2005). Observed, degeneration of the lamellar surface due to exposure with toxic substances and heavy metal pollutant.

The availability of insufficient respiratory gases is reason of death of the fingerlings due to dilation of lamellar capillaries and blood pooling leads to thrombososes and finally develops fibroses with adjacent gill lamellae, abnormal elongation of lamellae resulted the remarkable change, increase the gill surface area, it is might be due to effect of poison on system, Rashed (2001).

Collapse of blood vessels shows the food quality and oxygen which is reach up to cells is reduced and affecting the growth rate of fingerlings and due to this the loss of body weight occurs. Hemorrhage and swelling of the brachial arteries. These histological alteration take place at the base and tip of the primary gill lamellae, which affected on uptake of oxygen and leads the death of fish these also observed in Gambusia affinis and Clarias gariepinus which are exposed to textile effluents and herbicide, Olurin, et.al. (2006).

According to Fernandes, et.al. (2007), the epithelial lifting and edema is the defense mechanism. The distance of the lamellar epithelium is increases from secondary gill lamellae. it is the restrained direct diffusion of toxicant. Common
changes such as edema, lamellar fusion, hyperplasia, desquamation and necrosis of epithelium, collapsing of secondary lamellae, epithelial lifting etc were observed by Jiraungkoorskul, et.al. (2003). After exposure of dye, the hyperplasia and reduction in defense activity was takeplace.. Reduction in branchial surface protects the body from diffusion of toxicants. Van Heerden, et.al. (2004), Das and Mukherjee, (2000) and Mataqueiro, et.al. (2009) noticed polyhedral symmetry of hepatocytes in liver around central vein and this arrangement was muralium duplex fashion. Nucleus placed at the center with eosinophilic cytoplasm in hepatocyte. Some hepatocytes with vacuole observed and it shows in presence of glycogen in control group. In acute treatment group some morphological changes showed, due to textile effluent disorganization, dilation in vana centralis and hepatic cell cords woven frequently infiltration of lymphocytes increased, a slight dilation and vacuolization of sinusoids in livers was apparent. Fanta, et.al. (2003). Liver is large digestive gland plays very important important role in detoxification

Nikalje, et.al. (2012) noticed reduced blood cells near central vein in liver of fresh water fish Tilapia mossambica, few binucleated necrotic cells, in necrotic cell’s nucleus with basophilic cytoplasm. In treated group sinusoids get dilated and appeared irregular and it showed disconnection in between cells and hemorrhage severity of vacuoles in necrotic cells. In pyknotic condition swollen nuclei observed in hepatocytes. Chronic dose shows severe damage to liver, congestion and dilation in sinusoids shows irregular arrangement. Around the vena centralism the infiltration of mononuclear lymphocyte noticed. Significant histopathological alteration in liver observed these are more in high concentration than low concentration for the protein rich fish’s production, prawns.

The important medium is freshwater, but it is deteriorated due to the addition of the industrial effluents and sewage water, agricultural runoff and it is toxic to fishes and all aquatic life in aquatic environment. This condition is responsible for the
mortality of large numbers of inhabitant of water ecosystem like zooplanktons, phytoplankton mollusks and fishes.

Liver is the main metabolic organ and it plays important role in the uptake, buildup of pesticides, and seepage of xenobiotics. Kohler. (1990). Degradation of toxic compounds occurs in liver but regulating mechanisms result in structural damage. Electron dense heterochromatin was absent in nucleus of liver cells damage in liver cells shows swollen mitochondria, electron transparent matrix, vacillation, dilation of the endoplasmic reticulum system. Hepatocytes enlargement with large vacuoles and conjunction in sinusoid, pyknosis and karyolitic observed in cases of intoxication with pollutants. Jiraungkoorskul, et.al. (2003),

Narayan and Singh. (1991) studied effect of mercury on freshwater fish Channa punctatus recorded damage to liver due to this the tissue in liver show destruction of hepatocytes of liver with thrashing of normal stake arrangement. Degeneration of blood vessels, vacuolization and hypertrophy also observed. Selvanathan, et.al. (2012) observed cytoarchitectural changes in fresh water fish *Clarias batrachus*, subjected to heavy metal mercury and cadmium for 30 days. On 10\textsuperscript{th} day of treatment of heavy metal cadmium liver showed degenerated as well as swollen hepatocytes. Excessive vacuolation was observed throughout the tissue. After 20 day of exposure leads to congestion of liver tissue, high accumulation of cadmium was notice. On 30\textsuperscript{th} day of exposure to cadmium liver was highly damaged showed necrosis, indistinct cell boundaries between hepatocytes and sub capsular vacuolization dislocation of nucleolus. They also concluded that severe damage to livers was observed with increased temperature.

Iqbal Furhan, et.al.(2005) have observed, that liver showed high damage. It includes severe vacuolization, sub-capsular vacuolization in liver cells, cell boundaries become indistinct and displacement of nucleolus with highly damage due to heavy metal degradation of the liver cells. Exposes of nitrate fish shows severe degenerative changes in liver, the widening of bile canaliculated and blood sinusoids reduced,
lobules were disrupted and hepatocytes showed degeneration, loss of polygonal shape of hepatocytes, clumps of necrotic tissue.

Narayan and Singh, (1991b) noticed deterioration of cell cytoplasm with loss of glycogen and pyknosis of nuclei in liver tissue. Histological liver consists of hepatocytes which are not sloping into diverse lobules. The thick cells of branched laminae are separated by sinusoid having polygonal cells with centrally placed nucleus. Rana and Sudhir, (1999) noticed histological alterations in the liver tissue exposed liver of freshwater fish *Labeo rohita* to effluents from tannery.

Figueireda- Fernandes, *et al.* (2007). Noticed increase in size hepatocytes of liver. They further concluded that it was might be due to the high content of heavy metals from effluents accumulated in liver fat lipid *Nile tilapia, O. niloticus*. Hadi and Alwan, (2012). exposed fresh water, fish, *Tilapia zillii*, to varied concentrations of dissolved aluminum for a 96 hours observed histopathological alterations in gills, liver and kidney In liver the detoxification and biotransformation is mostly associated with its blood supply, position and function of liver are affected by contaminants in water by verity of pollutants.

Rodrigues and Fanta, (1998).stated that presence and exposure to heavy metals, enzymatic activities of liver either decrease or increase and lead to histopathological alterations, this change depending upon the type of metal and concentration in water, and species of different fishes etc.


. Destruction of glomerulus, shrinking in Bowman’s capsule and sever vacuolation take place around the Bowman’s capsule. Enlargement of kidney tubule, distal convoluted tubule and proximal convoluted tubules were due to effluents from tannery resulted in loss their normal structure and functions. Mohanta, *et al.* (2010)
due to nitrate exposer in fresh water fish *tilapia mossambica*. Noticed disintegration of kidney glomeruli. The cell of proximal tubule get destructed, space around Bowman’s capsule increased, increased tubular lumen were observed

Iqbal, *et.al.* (2004). Epithelial cells of renal tubules dissolution and degeneration, hypertrophy and necrosis exposers to phenolic compounds. Kidney plays important role in excretion of harmful material in kidney there is arrangement of renal corpuscles are numerous with glomeruli at the proximal segment there is tall columnar epithelial cells containing brush border and basal nuclei and at the distal segment the columnar epithelial cells are large and absence of brush border. Glomerulus large diameter than the distal segment. Aluminum affect the kidney and histopathological changes in kidney occur such as expansion of glomerular, renal tubules are having irregular diameter, damage in renal corpuscle, degeneration of tubules cells. Thus kidney is first organ affected by contaminates in water.

for excretion of harmful material kidney plays important role. Hydropic swelling means increase in size of the urinary tubules due to aluminum toxicity cause damage to the corpuscle, resulted in degenerative and neoplastic disease in organs Thophon, *et.al.* (2003). Aluminum toxicity can cause destruction of capillary endothelium leads of the shrinkage of kidney glomeruli, cellular degeneration, and increase of edematous fluid in the interstitial substance. Excessive blood hemorrhage red blood cells and serum and albumen appear in urine.

Pacheco and Santos, (2002) exposed freshwater fish to nitrate recorded the morphological changes, degenerative changes in kidney, glomeruli disintegrated vacuoles are disorganized tubule cells, increased lumen and excessive increasing hematopoietic tissue. In controlled fish glomeruli is in normal structure and architectural integrity in Bowman’s capsule and in tubules but effect of carbon tetrachloride shows shrunken glomeruli and dilated Bowman’s capsule and it is severely degenerated.

Marina et al., observed Histological changes in gills, kidney and liver of the Neotropical fish species *Prochilodus lineat exposed to urban streams for seven days during winter and summer season*. They noticed lesions a d lifting of epithelium,
lamellar fusion in gills. In kidney they noticed reduction of space in Bowman’s capsule and enlargement of the glomerulus, change in cytoarchitecture and nuclear degeneration, and were noticed. In liver they have noticed focal necrosis and lesions. They further reported that severity of lesions was more higher in liver as compare to gills and kidney.

Parikh (2010), studied effect of dimethoate exposure of 21 days observed moderate and severe damage to gills, liver. They also noticed some cytoarchitecture different tissues of freshwater fish Oreocromis mossambicus. Hajrudin, et.al. (2010). Observed histopathological alterations due to exposure of industrial effluents observed shrinkage and damage to glomerulus, severe vacuolization and degenerated tubules epithelium. These histological alterations indicate kidney failure.

Selvanathan et al., (2012), noticed histopathology changes in gills of freshwater fish C. batrachus exposed to cadmium and mercury for 10 and 20 days respectively. After 10th day of exposure minimum histological alterations were noticed in gill, livers and kidney. After 20th day of exposure severe damage was noticed includes hypotrophy of the gill filaments fusion of secondary gill lamellae resulted in reduction in surface area. They further concluded that, various metals are stored in different tissues of animals which are species dependant and metal dependant. They also stated that these metal appears in food chain and get accumulate in to the soft tissues of animals. To check continual addition of various metals in ecosystem there is need of cautious application of various pesticides, fertilizers and insecticides and disposal of industrial effluents and should be treated before disposed in to the environment.

Heavy metal are responsible for accumulation potential, histological and pathological changes in different soft tissues of fresh water fishes Labeo rohita and Chana punctatus exposed to mercurichloride and phenyl mercury acetate. The deposition of granules in the cells of liver, degeneration of the proximal tubules, and increased chloride cell in gills of fishes was also noticed due to heavy metal exposure by Karuppasamy (2000).