Rivers at Risk: A Comprehensive Review of Human-Induced Pollution and Its Seasonal Variation.

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Abstract

The worldwide deficiency of clean water is common for both developed and developing countries. Current time reports claims, Municipal solid waste from India estimated to contribute 10% waste leakage to world's rivers till 2020, according to study. Future scenarios where population growth is high, but urbanization slow, India and China will face great leakage into rivers due to rural population close to water courses throughout 2025. A little over half of India's 603 rivers were found to be polluted by the Central Pollution Control Board in 2022.This same issue stretches out to districts inside nations, like the Indian territory of Uttarakhand, known for its perfect climate however presently confronting extreme water quality issues. The proposed review utilizing multivariate factual procedures viewed that as 90% of water tests from Doon were contaminated. Rising populations, industrialization, and urbanization have expanded the interest for clean water, strengthening this emergency.

This review study broke down river water quality in Uttarakhand across various seasons — summer, winter, and monsoon. The outcomes were contrasted with norms set by the Central Pollution Control Board (CPCB), Indian Standard Institute (ISI), and the World Health Organization (WHO). Various parameters like Total Dissolved Solids (TDS), Ammonia-N, Chloride, Sulfate, Chemical Oxygen Demand (COD), Biological Oxygen Demand (BOD), Electrical Conductivity, Alkalinity, Total Hardness, temperature, E. coli, pH level, Dissolved Oxygen, and Turbidity were measured and analyzed. Study will demonstrate requirement for vigorous systems to safeguard water assets and safeguard general wellbeing, highlighting the basic requirement for composed worldwide endeavors to address the water emergency.

Keywords: Water pollution, Contamination, Pesticides, Heavy metals, Aquatic ecosystem, industrial effluent.

Introduction:

On earth, survival rely upon three main sources including water, air and soil and all these three are given us by nature, from which water is most crucial from all others, water is chief source required for the origin of life, that makes 50-95% of all plants and animals, but now water is poorly managed source in the world (S.O. Fakayode 2005). The total quantity of water that is crucial to utilize available as fresh water for human is 0.3-0.5% only (Hegde and Kale 1995). Rivers along with their drainage basin are major fragment of true inheritance. It is used by humans from the time they appear only few of the rivers are left with unaffected condition (Ngoye and Machiwa 2004). Most of the activities are dependent up water (Siamak Gholami and S.Srikantaswamy 2009).

The quality of water depends upon the physical, chemical and biological characteristics shows the environmental change, activities done in it and seasons facing by it, the pollution increase with the increase of industries, agriculture production and urbanization (S. Postel 1997). In world about 20 percent population is facing the shortage of clean drinking water (László J. Dávid 2007). The water ecosystem are getting too much contaminated due to raw sewage (includes flushing from toilets, wastes, that drains from sinks, bathtubs, showers and other faucets in homes that are collected from homes after its being used known as waste and raw sewage) and the waste from industries falling directly or indirectly in river water. These wastes involved both organic and inorganic polluting solvents and solid mixtures that have- solvents and solids such as oils, grease, plastic, pesticides, phenol, heavy metals and suspended solids. These pollutants enters to the river through transports ways that are normally storm water runoff, ditches and creeks through discharges, leaching, ground water, agricultural lands, urbanization and industrialization near rivers and atmospheric deposits and these pathways are dependent upon the seasons. Hence, the seasonal changes can also be assumed as a pathway of changing in the quality of water (Ying Ouyang 2005). The Open disposal, disposal and dumping of dead bodies is also one reason for water pollution (Moingt *et al.*,2013). Hydrochemistry shows the heavy concentration of pollutant in water hardly affects the spatial and temporal abnormalities of water (Singh et al., 2005, Zhang et al., 2017). As the number of water born disease increase, there is result in reducing health strength and ability of body (Sharma, M.L., 1996).

The primary source of water used by humans is for agricultural irrigation, industrial purposes, and personal consumption. Human activities, both direct and indirect, are increasingly affecting water quality, making it more unfit for use day by day. Consequently, water quality has become a global problem (Mahananda et al., 2005). The deterioration of river water quality is caused by natural processes and human activities, particularly the discharge of industrial, agricultural, and domestic wastes into rivers. A significant portion of river water quality is impacted by these wastes (Stephen R. Carpenter et al., 2011). The health of water ecosystems depends on the variety of organisms and their physio-chemical characteristics (Venkatesharaju et al., 2010). Certain healthcare issues and a major loss in biological diversity have arisen due to the adverse impact of pollution in waterways. Consequently, aquatic life is expected to be more significantly affected than terrestrial life (Sala et al., 2000)

Any negligent disposal or dumping of waste, including hazardous chemicals, into rivers leads to severe environmental damage and distress to the biological communities inhabiting those waterways (Vega et al., 1998; Singh et al., 2004). Water pollution adversely affects human health, disrupts aquatic ecosystems, and hampers social and economic development (Milovanovic, 2007). The increasing problem of toxic pollution and eutrophication is generally related to point and non-point sources of pollution (Sharma, 1996; Jain, 2002). Research indicates that global water quality issues are due to both anthropogenic and natural activities that affect water quality, such as temperature and precipitation (Y. Ouyang, 2006, Shrestha and Kazama, 2007). Highly toxic and hazardous chemicals or compounds present in water readily combine with or are retained by immovable or organic matter within rivers. These compounds settle near the lower part of the area, where they are stored with impurities and low concentrations of compounds that are not easily soluble or compatible (Biney et al., 1994)

The care of both the quality and quantity of water is required for its use by humans and the surrounding environment (Chang, 2008). Without fresh water of good quality and adequate quantity, sustainable development is impossible (M. Kumar et al., 1997). Good and healthy water is an essential requirement for public health, current water management, and future preparation to address pollution (Khadam and Kaluarachchi, 2006; Singh et al., 2005). Seasonal changes describe the quality of surface water, playing an important role in assessing pollution changes in particular areas over time, whether naturally occurring or influenced by human activities such as urban, agricultural, industrial, and domestic wastewater; sewage from metropolitan centers; small electroplating workshops; repair shops; hospitals; and medical and scientific laboratories. Therefore, regular monitoring and identifying water quality requires a good management system for maintaining healthy life. This method provides information about the current condition and situation of local water, including the quality of river water and its regular changes (Sarkar et al., 2007; Zhou et al., 2007; Srivastava et al., 2011; Bu et al., 2009; Vega et al., 1998).

The rising development of industries has led to an increase in toxic pollution in rivers, as these industries often discharge waste into waterways. Seasonal analysis of water quality samples helps identify natural and man-made sources of pollution, including metal plating, repair works, hospitals, industries, laboratories, medical equipment, domestic wastes, and agricultural wastewater. These are essential contributors to point and non-point sources of water pollution. The results of such analyses can help minimize pollution problems in rivers resulting from mining and industrial activities. Consuming polluted water can cause diseases such as diarrhoea, cholera, dysentery, typhoid, amoebiasis, jaundice, and infections by Enterobacteriaceae (Mishra, 2010). A significant global effort to address environmental issues began with the UN Conference held in June 1972 in Stockholm, focusing on the environment and human health. Since then, concepts related to eco-friendly environments and sustainable practices have become central to policy-making worldwide to protect the environment from pollution (Gupta, 2001). The increase in water pollution worldwide has led to numerous deaths and diseases, with approximately 14,000 people dying each year due to water pollution (Lechinger 2000; Pink, 2006; Larry, 2006). Both developed and developing countries face problems related to water pollution (Florescu et al., 2010).

Regular management, assessment, and prevention of river water pollution help control additional losses and warn people of potential future damages (Srivastava et al., 2011; Singh et al., 2005). Different health organizations have established various standards for water quality (Lester, 1969). The results from water examinations are compared to standards set by the CPCB (Central Pollution Control Board), Indian Standards (ISI), U.S. Public Health Service Drinking Water Standards (USPHS, 1962), Indian Council of Medical Research (ICMR, 1962), and WHO (World Health Organization). These standards prescribe the necessary limits to be maintained by communities, as water quality directly affects human health, making these standards crucial for human well-being (Umar, 2000). Effective monitoring of water quality involves sampling collection from regional and 9temporal areas, providing details about the physical state of the river and changes in the environment over time and across seasons and geographical locations (Berzas et al., 2000, Simeonov et al., 2003).

The main factors affecting water quality include climate, precipitation, soil type, vegetation, geology, flow conditions, groundwater, and human activities. On a large scale, water quality is impacted by point sources such as municipalities and industries. Other activities affecting water quality include mining, urban development, agriculture, and non-point sources of pollution, including sediments, nutrients, and toxic contamination (National Water Quality Inventory Report to Congress, 2009). Lotic habitats have been heavily impacted by various wellness issues, leading to a significant reduction in biological diversity. In the future, the depletion of biological diversity and its impacts are expected to be higher for lotic habitats compared to terrestrial biomes (Sala et al., 2000).

The highest authority on managing the quality of water in India is for the Central Pollution Control Board (CPCB). The type, degree and the amount of degradation of water quality is known by CPCB, to plan and manage water quality project intelligently. Hence a strong water quality monitor scientifically by program is required, understanding this, the CPCB started paying attention and started monitoring the quality of water from 1976 and built 18 stations across the Yamuna River and further this strategy extended steadily. In partnership with state pollution control boards/Committees, the CPCB monitors 4484 locations across 28 states, 7 Union Territory including 2108 rivers,713 on unchanged water bodies(lakes, ponds and tanks), 64 creeks (marine, 1235 on wells and 364 on the other water bodies (drains, canals, WTPs/STPs) (file:///G:/CPCB).

The Water (Prevention and Control of Pollution) Act 1974 is enacted by the Indian Government to maintain wholesomeness of aquatic resources to maintain the water resource clean. The act defined the amount of function of the pollution control board in states as level and CPCB at national level for eliminating and regulating the contamination, this legislation aims to protect and recover the healthy condition of the nation water resources. The level of purity which has to be maintained or recovered in entire country's different bodies of water is not defined in Acts provisions. Through this effort describe the health in respect to preserving human utilization. The CPCB utilize the private consumption of the water and its starting point to determine standard quality of water bodies throughout the country. The task of preserving and restoring all water related basin back to its original state. Implementing the pollution mitigation operations to achieve this type of goal is going to hamper economic activities or prohibitively costly. The objectives is to recover and maintain the natural bodies of water or with their best utilization knowing that they have to be employed in a range of opposing or contending goals. Main functions of the Central Pollution Control Board: Is to suggest Central Government on the matters related to the restoration and maintaining the wholesomeness of water resources and the prevention, control and abatement of water pollution, To make planning and cause to be executed a nation-wide program for the protecting, monitoring and abatement of water pollution, to give technical training and guide to the local Pollution Control Board, is to hold and sponsor inventing and researching related to protection, control and policy of water pollution, To collect, compile and publish technical and statistical data related to water pollution and to lay down and annul standards for the quality of water in streams and wells. To perform the above functions, CPCB needs continuous monitoring of water quality of aquatic resources in the country. CPCB has established a network of water quality monitoring to fulfill the following objectives (http://www.cpcb.nic.in).

Material and Methodology:

pH: The full meaning of pH is Power of Hydrogen. The hydrogen molecules in a substance determine its acidic or basic nature. Meaning, if the pH of a liquid or product is 1 or 2 then it is acidic and if the pH is 13 or 14 then it is alkaline. If pH is 7 then it is neutral. pH stands for 'potential of hydrogen' or 'power of hydrogen'. It is a scale used to specify the acidic nature or basicity of an aqueous solution. Acidic solutions (solutions with high concentration of H ions) are measured to have a lower pH value than basic or alkaline solutions. If we talk about the human body, pH balance plays an important role in the chemical makeup of the human body. The term 'pH' refers to whether a substance is an acid, an alkaline (also called basic) or neutral (Shailesh Kumar Dewangan et al., 2007).

Turbidity: High turbidity means that the water is not very clean. Less turbidity means the water is cleaner. Turbidity is caused by suspended solids in water. These particles scatter light, making the water appear cloudy or cloudy. Turbidity can be seen with the naked eye. Turbidity is often used to estimate water quality. High turbidity means low water quality. According to the World Health Organization (WHO), the turbidity of drinking water should not exceed 5 NTU. Ideally, it should be less than 1 NTU. Optical devices are used to measure turbidity. With this device, particles hidden in water become visible. The particles can provide a hiding place for harmful microorganisms and thus protect them from the disinfection process. Suspended material can clog or damage a fish's gills, reduce its resistance to diseases, reduce its growth rate, affect the maturation of eggs and larvae, and affect fishing methods can affect the efficiency of the fishing method.

Suspended particles provide adsorption medium for heavy metals such as mercury, chromium, lead, cadmium and many hazardous organic pollutants such as polychlorinated biphenyls (PCBs), polycyclic aromatic hydrocarbons (PAHs) and many pesticides. The amount of available food is reduced because high turbidity increases the temperature of the water as suspended particles absorb more of the sun's heat. As a result, dissolved oxygen (DO) concentrations may decrease because warmer water carries less dissolved oxygen than colder water. Turbidity is measured by an instrument called a nephelometric turbidimeter, which expresses turbidity as NTU or TU. One TU is equivalent to 1 mg/litre silica in suspension (Vanessa Fernandez Alvarez 2023).

COD: COD in water means chemical oxygen demand. It represents the amount of oxygen required to decompose oxidizable compounds present in a waste water sample. COD is an important parameter of water quality. To detect this, a special chemical (potassium dichromate in sulfuric acid solution) is used in the water sample. The acceptable range of COD is 250 to 500 parts per million (PPM). COD test is used to detect the amount of organic matter in waste water. COD testing can also test highly toxic waste water for BOD testing. The higher the COD value of water, the more serious the pollution. COD testing is also used to assess the impact of waste water on the environment (Nor Syamimi Musa and Wan Azlina Ahmad 2010).

BOD: Biochemical oxygen demand (BOD) in water refers to the amount of dissolved oxygen required by microorganisms to decompose organic matter present in water. This is a measure of the severity of pollution. BOD measures the amount of organic matter present in water. The lower the BOD in the water, the cleaner it will be. BOD in safe drinking water should be zero. If BOD is high, the need for treatment will also be high. BOD is often used in wastewater treatment plants as an index of the degree of organic pollution in water. The BOD value of moderately polluted rivers can be in the range of 2 to 8 mg/L. When the BOD value exceeds 8 mg/L, rivers can be considered seriously polluted (A B Abdullahi et al., 2021).

TDS: TDS in water means total dissolved solids present in water. The amount of TDS in water is a parameter to determine the quality of water. The amount of TDS in water is usually measured in milligrams per liter (mg/L) or parts per million (PPM). According to the Bureau of Indian Standards (BIS), the amount of TDS in water should not be more than 500 ppm. At the same time, according to the World Health Organization (WHO), the amount of TDS in water should be less than 300 ppm. Water with TDS more than 300 ppm is not considered potable. Due to high amount of TDS in water, water becomes salty. When the amount of TDS in water is 65 to 95 ppm, water becomes sweet. However, many important minerals are also removed from it. To reduce the amount of TDS in water, purification systems like carbon filters and reverse osmosis (RO) are used (Mohammad Rafiqul Islam et al., 2016).

Electrical conductivity: Electrical conductivity of water is the ability to conduct electricity in water. It is also called EC or specific conductivity. To measure the conductivity of water, a laboratory bench or portable meter is used. The units for measuring the conductivity of water are: siemens per meter in SI, milliohms per centimeter in CGS, micrograms per square centimeter.
Pure water is an insulator and has very low conductivity. The conductivity of distilled water is between 5.5 to 6 S/m. The conductivity of water increases due to the substances dissolved in water. Chemicals or salts dissolved in water break down into positively and negatively charged ions. These ions become free in water and conduct electricity. Water conductivity gives information about the purity and quality of water. Rainfall, geology, evaporation, road salt, septic/landfill leachate, impervious surface runoff, and agricultural runoff affect water conductivity (Yang Xianhong et al., (2021).

Hardness: The hardness of water is the total number of divalent ions present in a certain amount of water is called hardness of water. Divalent ions such as calcium ion, magnesium ion, and Fe2 ion can be found in water. The hardness of water is measured on a scale. To measure water hardness, the amount of calcium carbonate is generally measured in milligrams per liter (mg/L). On the basis of hardness of water it is classified as follows: 0 to 60 mg/L is soft ~61 to 120 mg/L is moderately hard 121 More than 180 mg/L is considered hard. More than 180 mg/L is considered very hard due to the salts dissolved in sea water. Normally the hardness of sea water is around 6,570 ppm (6.57 grams per liter) (Mohammad Rafiqul Islam et al., 2016).

Iron: Important things about the amount of iron in water. Generally, the iron present in water is not dangerous for health. The amount of iron in drinking water should be 0.3 milligrams per liter (mg/L) or 0.3 parts per million (ppm). If the amount of iron in water is high, the color of water becomes red or brown. Due to excess iron content in water, it can cause skin diseases. Drinking iron-rich water can affect the liver. This can cause jaundice, hair fall, kidney related problems. Most iron comes from food, because the body cannot easily absorb iron from water. Method to find out the amount of iron in water: If there is iron in the water, then when water is poured into the sink or tub, the water turns red or brown. To find out the amount of iron in water, it is necessary to get water tested. Sodium forms water soluble components such as halide, sulphate, nitrate, carboxylate, and carbonate (Rahman I et al., 2024).

Sodium

Sodium, when added to water, forms hydrogen gas and sodium hydroxide. Sodium reacts with water and gives an explosive reaction. A bright yellow flame is produced in this reaction. This reaction is exothermic and energy giving in nature. Sodium catches fire due to reaction with water. Sodium salts are usually isolated as solids by evaporation or precipitation with an organic antisolvent such as ethanol.
Sodium bismuthate (NaBiO 3), is insoluble in cold water and decomposes in hot water (Tassew Arega 2020).

Potassium hydroxide (KOH)

Potassium hydroxide (KOH) is formed by the reaction of potassium with water. This reaction can be violently exothermic. Potassium permanganate is used to purify drinking water. It dissolves impurities in water. Potassium permanganate is a purple-black crystalline salt. Its chemical formula is KMnO4.Potassium permanganate is used as a strong oxidizing agent in the chemical industry and laboratories. Potassium permanganate is also used as a medicine for dermatitis, for cleaning wounds, and for general disinfection. Potassium chloride (KCl) is a naturally occurring potassium salt. It is used as fertilizer. Potassium hydroxide is also called caustic potash. It is used in making liquid soap and detergent (Tassew Arega 2020).

Nitrate: Nitrate in water is a naturally occurring compound that contains oxygen and nitrogen. It is found in small quantities in water and soil. Nitrate has no color, taste, or odor in drinking water.High levels of nitrate can lead to the disease Mithecoglobinaria. Due to this the body of the newborn baby turns blue. Excess of nitrate in water is also a sign of biological pollution. Therefore, it is important to check the water being used (Mary H. Ward et al., 2018).

Ammonia: ammonia in water has adverse effects on health. Ammonia is a colourless, pungent smelling gas. Its chemical formula is NH3. It is made up of nitrogen and hydrogen. Ammonia dissolves in water to form ammonium hydroxide solution. According to the Bureau of Indian Standards, the amount of ammonia in water should not be more than 0.5 ppm. Due to high amount of ammonia in water, water becomes unfit for drinking. Excessive amount of ammonia in water has adverse effects on health. Ammonia is dangerous for health, but is not carcinogenic. If suffering from ammonia, problems

like fever, cough, chest pain, nausea, vomiting, dizziness, severe stomach pain, difficulty in breathing, swelling of lips, difficulty in walking, restlessness and temporary blindness can occur.
Suffering from ammonia can damage lungs and vascular function (M Alamgir Hossain 2007).

Fluoride: According to the Bureau of Indian Standards, the amount of fluoride in water should be 1 mg per liter. According to the report of the World Health Organization, the amount of fluoride in water should be half to one milligram per liter. Fluoride in excess quantity can harm health.
Excessive amounts of fluoride can cause white spots on the teeth, which is called dental fluorosis. This problem affects children up to 8 years of age. Excessive amounts of fluoride can cause damage to bones and joints, which is called skeletal fluorosis. Reverse Osmosis (RO) filtration can be used to avoid fluoridated water. RO systems have a semipermeable membrane that separates water molecules from contaminants. Fluoride is a mineral found naturally in many foods and water. Fluoride helps prevent tooth decay (Stephen Peckham 2014).

E. coli bacteria: E. Drinking water infected with E. coli bacteria can cause intestinal infection. This infection can cause diarrhea, abdominal pain, and sometimes bloody stools. E. When infected with E. coli bacteria, urinary tract infection can also occur. E. If infected with E. coli bacteria, serious diseases like food poisoning or pneumonia can also occur. E. If infected with E. coli bacteria, serious problems can also occur in blood and kidneys (Stephen T. Odonkor and Joseph K. Ampofo 2013).

Result and Discussion

The drinking water quality is an important part of environment, which has a great impact on the human health. The basis for the drinking water safety assurance is a foundation for the prevention and control of diseases occurring due to poor quality of water. In an internal level WHO has given the guidelines, which involves various national and international authorities as well as international agencies.
As the Central Pollution Control Board (CPCB) India classifies the surface water based on its designated best use (Table-1 and Table-2). This classification helps determine the suitability of water for various purposes such as drinking, bathing, industrial use, and agriculture. The categories include:

1. Class A: Drinking water source without conventional treatment but after disinfection.
2. Class B: Outdoor bathing (organized).
3. Class C: Drinking water source with conventional treatment followed by disinfection.
4. Class D: Fish culture and wildlife propagation.
5. Class E: Irrigation, industrial cooling, and controlled waste disposal.

Each class has specific water quality criteria to ensure its suitability for the designated use.
Standard parameters use to designate the best use classification of Surface water by CPCB guidelines. MPN: Most Probable Number (Source: CPCB, 1978) (http://www.cpcb.nic.in) that is divided into classes A, B, C, D, E discussed below:

Class A- Criteria Designated for best use for the supply of drinking water from supply before cleaning and after normal treatment with chlorination is given by Central Pollution Control Board (CPCB) India is that the total number of Total Coliforms Organism MPN/100ml not more than 50, The pH range between 6.5 and 8.5, Dissolved Oxygen more than 6 mg/l, The Biochemical Oxygen Demand 5 days 20C less than 2mg/l.

Class B- Criteria Designated for best use for the Bathing outdoor (arranged) given by Central Pollution Control Board (CPCB) India is that the total number of Total Coliforms Organism MPN/100ml not more than 500, The pH range between 6.5 and 8.5, Dissolved Oxygen more than 5mg/l, The Biochemical Oxygen Demand 5 days 20C less than 3mg/l less.

Class C- Criteria designated for best use as the Source of drinking water with regular clearing and purification method. The criteria given by Central Pollution Control Board (CPCB) India is that the The total number of Total Coliforms Organism MPN/100ml not more than 5000, The pH range between 6.5 and 9, Dissolved Oxygen more than 4mg/l, The Biochemical Oxygen Demand 5 days 20C less than 2mg/l.

Class D- Criteria Designated for best use for the Wild life and fisheries propagation, it is given by Central Pollution Control Board (CPCB) India is the pH range between 6.5 and 8.5, Dissolved Oxygen more than 4mg/l, Free Ammonia less than 1.2mg/l

Class E- Criteria designated for best use for Monitored waste disposal, irrigation, Industrial cooling. The criteria given by Central Pollution Control Board (CPCB) India states that, the pH range should be in between 6.5 and 8.5 and the Electrical Conductivity should be Max.2250 at 25C micro mhos/cm Sodium absorption Ratio Max.26 Boron max. 2mg/l.

UTTARAKHAND POLLUTION CONTROL BOARD, Government of Uttarakhand. Designated Best Use Water Quality Criteria as per standard according to its class A,B,C,D, E as:

Class A- Criteria Designated for best use for the supply of drinking water for Drinking water from supply before cleaning and after normal treatment is the total number of Total Coliforms Organism MPN/100mlnot more than 50, The pH range between 6.5 and 8.5, Dissolved Oxygen more than 6 mg/l, The Biochemical Oxygen Demand 5 days 20C less than 2mg/l.

Class B- Criteria Designated for best use for the supply of drinking water for Bathing outdoor (arranged) as the total number of Total Coliforms Organism MPN/100ml not more than 500, The pH range between 6.5 and 8.5, Dissolved Oxygen more than 5mg/l, The Biochemical Oxygen Demand 5 days 20C less than 3mg/l less

Class C- Criteria Designated for best use for the supply of drinking water for Source of drinking water with regular clearing and purification method given as The total number of Total Coliforms Organism MPN/100ml not more than 5000, The pH range between 6.5 and 9, Dissolved Oxygen more than 4mg/l, The Biochemical Oxygen Demand 5 days 20C less than 2mg/l.

Class D- Criteria designated for best use for the supply of drinking water for Wild life and fisheries propagation as the pH range between 6.5 and 8.5, Dissolved Oxygen more than 4mg/l, Free Ammonia less than 1.2mg/l.

Class E- Criteria Designated for best use for the supply of drinking water for Monitored waste disposal, irrigation, Industrial cooling for the The pH range between 6.5 and 8.5, electrical conductivity should be max.250 at 25C micro mhos/cm sodium absorption Ratio Max.26 Boron Max. 2mg/l.
International norms on water quality and human health is produces by WHO in the form of guidelines that are utilizing for regulating and standard setting, in developing and developed countries worldwide.

Literature Survey: Summary of few previous studies conducted on various rivers:
Patel et al. (2013) directed an appraisal of the occasional variety in water nature of the Mahi Stream at Sindhrot, Vadodara in 2013. They estimated different boundaries including conductivity utilizing a conductivity meter, pH with a pH meter, alkalinity through titration, turbidity with a nephelometric technique, smelling salts nitrogen by means of spectrophotometry, chloride utilizing argentometric titration, sulfate through a turbidimetric strategy, complete broke up solids (TDS) by gravimetric strategy, all out hardness with EDTA titration, compound oxygen interest (COD) by means of open reflux technique, biochemical oxygen interest (Body) utilizing Winkler's strategy, and disintegrated oxygen (DO) likewise utilizing Winkler's strategy.

Ahmed et al. (2016) evaluated the spatial and occasional water quality variety of the Oum emergency room Rbia Stream in Center-Western Morocco from 2000 to 2012 utilizing multivariate factual methods. Boundaries estimated included temperature with a thermometer test, pH with a pH meter, all out suspended solids (TSS) gravimetrically, disintegrated oxygen (DO) by means of Winkler strategy, biochemical oxygen interest (Body) through 5 days hatching at 20°C and titration of starting and last DO, substance oxygen interest (COD) by means of open reflux technique, complete broke up solids (TDS) utilizing a computerized conductivity meter, turbidity with a nephelometric technique, all out phosphorus through spectrophotometry, all out hardness as $CaCO_3$ through EDTA titration, conductivity utilizing a conductivity meter, and waste coliforms through the various cylinder procedure.

Loryue et al. (2018) concentrated on the occasional variety in water quality boundaries of the Stream Mkomon Kwande feeder of the Waterway Benue in Nigeria in 2018. They estimated disintegrated oxygen (DO) utilizing the Winkler technique, pH with a pH meter, biochemical oxygen interest (Body) following 5 days of brooding at 20°C followed by titration of beginning and last DO, substance oxygen interest (COD) utilizing the open reflux strategy, alkalinity through titration, complete broke up solids (TDS) utilizing a computerized conductivity meter, chloride by means of argentometric titration, sulfate utilizing the gravimetric technique, turbidity with a nephelometric strategy, smelling salts nitrogen (NH_3-N) through spectrophotometry, all out hardness as $CaCO_3$ through EDTA titration, conductivity utilizing a conductivity meter, temperature with a thermometric technique, weighty metals through spectrophotometry with nuclear retention, and phosphate utilizing the stannous chloride strategy.

Taskeena et al. (2017) studied the occasional varieties in water quality boundaries of the Stream Yamuna in Northern India from Yamunotri ice sheet to Banderpuch pinnacle of the lower Himalayas in 2017. They estimated conductivity utilizing a conductivity meter, pH with a pH meter, temperature with a thermometer, alkalinity through titration, all out disintegrated solids (TDS) by gravimetric strategy, synthetic oxygen interest (COD) by means of open reflux technique, biochemical oxygen interest (Body) utilizing Winkler's strategy, broke up oxygen (DO) with Winkler's technique, phosphate utilizing the stannous chloride technique, and nitrate (NO3- - N) utilizing spectrophotometry.

Bilal et al. (2018) evaluated the physicochemical boundaries at three stations of the Yamuna Waterway, viz. Station 1 (NCT Delhi), Station 2 (Mathura), and Station 3 (Agra) in 2018. They estimated temperature with a mercury thermometer, pH with a computerized pH meter, conductivity (EC) with a computerized conductivity meter, biochemical oxygen interest (Body) by means of Winkler azide strategy, synthetic oxygen interest (COD) with refluxing gathering utilizing reflux titrimetry technique, disintegrated oxygen (DO) through titration get together utilizing Winkler iodometric technique, phosphate (PO4-P) utilizing UV-spectrophotometer with colorimetric stannous chloride technique, nitrate (NO3-N) with UV-spectrophotometer utilizing phenol-disulphonic corrosive technique, and chlorine (Cl-) through titration utilizing argentometric titration strategy.

Vega et al. (1998) evaluated the occasional and contaminating consequences for the nature of water in the Pisuerga Stream in the Castilla y León district (Center-North of Spain) in 1998 utilizing exploratory information examination. They estimated broke up oxygen (DO) utilizing the Winkler strategy, pH with a pH meter, biochemical oxygen interest (Body) following 5 days of brooding at 20°C followed by titration of introductory and last DO, compound oxygen interest (COD) utilizing the open reflux technique, stream rate, complete hardness as CaCO3 through EDTA titration, bicarbonate by means of corrosive base titration, conductivity utilizing a conductivity meter, temperature with a thermometric technique, calcium, iron, potassium, magnesium, sodium, manganese utilizing fire AAS, chloride, phosphate, sulfate through particle chromatography, and ammonium, nitrate, nitrite through spectrophotometry.

Shrestha et al. (2007) evaluated the surface water nature of the Fuji Stream bowl west of Mount Fuji, Japan in 2006 utilizing multivariate factual procedures. They estimated release with a flow meter, temperature with a mercury thermometer, disintegrated oxygen (DO) utilizing Winkler azide technique, biochemical oxygen interest (Body) utilizing Winkler azide strategy, synthetic oxygen interest (COD) through potassium permanganate, pH with a pH meter, all out suspended solids (TSS) by drying at 103 to 105 degrees C, electrical conductivity (EC) with electrometric strategy, all out coliforms (TC) utilizing the various cylinder technique, nitrate nitrogen (NO3-N) by means of particle chromatography, ammoniacal nitrogen (NH4-N) with phenate strategy, and inorganic broke up phosphorus (PO4-P) with ascorbic corrosive strategy.

The studies assessed hazardous chemicals and metals in various rivers, including TDS, Ammonia-N, Chloride, Sulphate, COD, BOD, Electrical Conductivity, Alkalinity, Total Hardness, temperature, E. coli, pH, Dissolved Oxygen, and Turbidity. Seasonal fluctuations were analyzed and compared to CPCB, ISI, and WHO standards for freshwater.

Findings indicate that urbanization, industrialization, human activities, agriculture, irrigation, households, livestock, and domestic waste significantly degrade river water quality. The water is generally poor and unsuitable for human consumption and other uses. Improving water quality requires restricting untreated sewage and industrial effluents, penalizing solid waste disposal in rivers, and promoting wastewater treatment, reuse, and recycling. Continuous monitoring of river water quality is essential to manage future changes effectively.

RIVER POLLUTION IN INDIA

In India water pollution reached at hypercritical place. Now days in India most of the rivers are considered as polluted. It is given by national environmental engineering research institute (NEERI) Nagpur, approx 70% Indian river water are considered polluted (Martin, 1998).

Many Scientist considered River Ganga as polluted river after studying its parameters Mirzapur by Shukla (1989) and shukla et al. in 1989 studied and shows the River Ganga polluted in Varanasi.

The both study were done and culminate into a common conclusion which shows that the physico-chemical characteristics of Ganga River water is continuously decreasing and till now following the same track. The Bacteriological study of Ganga river pollution was studied by Shukla et al. (1992) and the Varuna River studied by Shukla et al. (1988). The reports finds that the presence of a large number of microorganisms including pathogenic and non-pathogenic are very high and even in their excess limit. Sewage water quality that is merging into the river Yamuna was studied and reported by Sharma et al. (1981).

The Yamuna river water quality analyzed by Sangu et al. (1984) and further by Mohan et al. (1965) by Okhla, whereas The bacterial analysis of Yamuna River at Delhi is done by Kaushik and Prasad (1964).

After the study it is clear that River Yamuna is more poorer than Ganga in many cities. The production of blue-green algae study of River Gomati is reported by Saxena and Prasad (1980).

INTERNATIONAL STUDIES IN RIVER POLLUTION

Likewise studies conducted on National level, in similar way the study conducted at international level also. The quality of River Raisin is analyzed in Canada and Reichert (2001) by and Watelet and Johnson (1999) in river Glatt in Switzerland. The macrophytes study of Nile River chemistry is conducted by Obeid and Chadwick (1964). The Gibbs (1972) analyzed the River Amazon Chemistry that highly shows the microbiological aspects by Rai and Hill (1984). Eutrophication and nutrient pollution study of coastal river in Israel conducted by Herut et al. (2000). Physico-chemical analyses report of lake Mellwaine in Rhodesia is prepared by Marshall and Falconer (1973).

The stream pollution in general streams is analyzed by Ellis (1937). The study of the river Aliakman in Greece with Multidisciplinary study aspects is conducted by Lazaridou et al. (1999). Study of the chemistry of River Odzi at Zimbabwe is reported by Jannalagadda and Mhere (2001). The study of river Niger is conducted by Imevbore (1978) similarly.

All the literatures above analyzed and reported that shows that the problem of water pollution only to India in India but another countries even the complete globe is struggling with water problems with its effects on human beings and another organisms too.

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