# A Study on water quality of Aami River in Gorakhpur

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**ABSTRACT:** Water is the most vital element among the natural resources, and is crucial for the survival of all living organisms. Rivers have traditionally been used for the disposal of domestic and industrial waste waters in the world. Owing to the indiscriminate discharge of point and non-point pollution from various sources has not only rendered such water bodies eutrophic but also their beneficial uses such as water supply, recharge of ground water, irrigation, recreation and habitat for flora and fauna have been adversely affected.

In terms of quality, the surface water of the country is unprotected from untreated industrial effluents and municipal wastewater, runoff pollution from chemical fertilizers and pesticides. Water quality also depends on effluent types and discharge quantity from different type of industries, types of agrochemicals used in agriculture, and seasonal water flow and dilution capability by the river system.

In view of the pollution of Indian rivers through various sources along their length of travel, the monitoring of impact of the discharge of municipal and industrial waste waters on river water quality is of paramount importance and, in this perspective, the river water quality parameters assessment is considered quite useful.

**Keywords:** Aami River, Water Quality, DO, BOD, COD, MPN, Acidity.

## INTRODUCTION

It is imperative to realize the importance of water to our quality of life because; the water problem is not only confined to the quantity of water available, but also to the quality of water available.

Ami River is a meandering river which originates from Sohanara and serves as a lifeline for the people of Siddarth Nagar, Sant Kabir Nagar, Basti and Gorakhpur district in Eastern Uttar Pradesh. It travels a distance of about 126 km and drains into Rapti in Gorakhpur district of Uttar Pradesh. . Discharges from agricultural, industrial and most important urban areas have changed the physical, chemical and biological characteristics and additionally the ecological characteristics of water bodies.

The common practice of unregulated waste disposal into water course can affect their normal use by municipalities. Aquatic environment in near cities are usually prone to over loading with a variety of pollutants either through direct or indirect discharges. This situation may be worsened by indiscriminate disposal of untreated waste, often heavily laden with sewage into actively used streams. In addition to their characteristics micro flora, sewage polluted water carry numerous sewage micro-flora, some of which pose a public health risk (Gordon and Stuart 1972; Baross et al. 1975).

During the past few decades Indian industries have registered a quantum jump, which has contributed to high economic growth but simultaneously it has also given rise to severe environmental pollution. It is found that one-third of the total water pollution comes in the form of effluent discharge. The surface water is the main source of industries for waste disposal. Although all industries function under the strict guidelines of the Central Pollution Control Board (CPCB) but still the environmental situation is far from satisfactory. Different norms and guidelines are given for all the industries depending upon their pollution potentials.

In the past several decades, industrial production has increased in India owing to an increasingly open economy and greater emphasis on industrial development and international trade. Water consumption for this sector has consequently risen and will continue growing at a rate of 4.2 per cent per year (World Bank, 1999). According to the World Bank, demand of water for industrial, energy production and other uses will rise from 67 billion m3 to 228 billion m3 by 2025.

The main goal of the present study was to assess the impact of urban and industrial activities on the water quality of river Ami in Eastern Uttar Pradesh.

**Water Quality Definition and Importance**

Water quality is the condition of the water body or water resource in relation to its designated uses. It can be defined in qualitative and/or quantitative terms. Parameters in defining water quality can be grouped into three board categories: physical, chemical, and biological. *Physical factors* include temperature, sediment and bed material, suspended sediments, turbidity, color, and odor. *Chemical factors* consist of the major and minor elements, and other chemical parameters such as pH, Dissolved Oxygen (DO), Biological Oxygen Demand (BOD), and Chemical Oxygen Demand (COD). The major elements include agro-nutrients such as Nitrogen and Phosphorus; and minor elements include elements such as arsenic (As), lead (Pb), and mercury (Hg), etc. *Biological Constituents* include Fecal Coli-form and *E. coli*. Conventionally water quality is expressed in terms of the measured value(s) of one or more of these parameters in relation to their accepted or implied limits. They are expressed in different units, and their magnitudes can vary significantly from one location to another and over time. For example, the temperature is expressed in degrees Celsius or degrees Fahrenheit, and coliforms in numbers, and most chemicals and nutrients in milligrams per liter (mg/L) or in parts per million (ppm).

PRIMARY WATER QUALITY CRITERIA FOR CLASSSW-II WATERS

(For Bathing, Contact Water Sports and Commercial Fishing)

| S.No. | Parameter | Standards | Rationale/ Remarks |
|---|---|---|---|
| 1 | pH range | 6.5-8.5 | Range does not cause skin or eye irritation and is also conductive for aquatic lives. |
| 2. | Dissolved Oxygen | 4.0mg/l of 50% saturation value whichever is higher | Not less than 3.5mg/l at any time for protection of aquatic lives. |
| 3. | Colour and Odour | No noticeable colour or offensive odour | Specially caused by chemical compound like creosols phenols, naphtha, benzene pyridine, toluene etc. causing visible colouration of water and tainting of and odour in fish flesh. |
| 4. | Floating Matters | Nothing obnoxious or detrimental for use purpose | None in concentration that would usages specially assigned to this class |
| 5. | Turbidity | 30NTU (Nephelo Turbidity) | Measured at 0.9depth |
| 6. | Fecal Cliform | 100/100 ml (MPN) | The average value not exceeding 200/100 ml in 20 percent of samples in the year and in 3 consecutive samples in monsoon months. |
| 7. | (BOD) (5 days | 3mg/I | (aesthetic quality of water) |

| | | | |
|---|---|---|---|
| | at 27°C) | | Also prescribed by IS: 2296-1974. |

Anthropogenic disturbances Changes the physicochemical characteristics and resource availability of rivers from headwater to mouth and influence community structure and function of stream biota. Assessment of stream system health cannot be fully achieved without a careful analysis of the benthic fauna and benthic process (Reice & Wholenberg 1993).

| Designated-Best-Use | Class of water | Criteria |
|---|---|---|
| Drinking Water Source without conventional treatment but after disinfection | A | Total Coliforms Organism MPN/100ml shall be 50 or less<br>pH between 6.5 and 8.5Dissolved Oxygen 6mg/l or more<br>Biochemical Oxygen Demand 5 days 20°C 2mg/l or less |
| Outdoor bathing (Organized) | B | Total Coliforms Organism MPN/100ml shall be 500 or less pH between 6.5 and 8.5 Dissolved Oxygen 5mg/l or more<br>Biochemical Oxygen Demand 5 days 20°C 3mg/l or less |
| Drinking water source after conventional treatment and disinfection | C | Total Coliforms Organism MPN/100ml shall be 5000 or less pH between 6 to 9 Dissolved Oxygen 4mg/l or more<br>Biochemical Oxygen Demand 5 days 20°C 3mg/l or less |
| Propagation of Wild life and Fisheries | D | pH between 6.5 to 8.5 Dissolved Oxygen 4mg/l or more<br>Free Ammonia (as N) 1.2 mg/l or less |
| Irrigation, Industrial Cooling, Controlled Waste disposal | E | pH between 6.0 to 8.5<br>Electrical Conductivity at 25°C micro mhos/cm Max.2250<br>Sodium absorption Ratio Max. 26<br>Boron Max. 2mg/l |
| | Below-E | Not Meeting A, B, C, D & E Criteria |

*(Source: Central Pollution Control Board Environmental Standards)*

**REVIEW OF LITRETURE**

Water quality directly affects virtually all water uses. Fish survival, diversity and growth; recreational activities such as swimming and boating, municipal, industrial, and private water supplies, agricultural uses such as irrigation and livestock watering, waste disposal, and general aesthetics-all are affected by the physical, chemical, biological, and microbiological conditions that exist in watercourses and in subsurface aquifers.

Gordon and Stuart (1972) studied that situation may be worsened by indiscriminate disposal of untreated waste, often heavily laden with sewage into actively used streams. In addition to their characteristics micro flora, sewage polluted water carry numerous sewage micro-flora, some of which pose a public health risk.

Singh (2007) studied that density of the river is high in eastern Uttar Pradesh and Bihar. Rivers are considered as a lifeline but are now adversely affecting the population by fluvial hazards.

Choudhary(1981) syudied that96% of water pollution problems in India are due to the indiscriminate discharge of municipal wastes. These wastes, being biodegradable in nature, produce a series of directional but predictable changes in water bodies.

Kankal N. C. et al(2012) studied that surface water from coastal south region to north region of Gujrat is poor for drinking purpose as per water quality index but may be used for irrigation purpose.

Afroz Zuby (2011) studied that Physico-chemical parameters were found above the recommended tolerance limits of pollution control board of India. The findings of the present study suggest that fish displayed impaired health attributed to changes in water quality of river due to effluent discharge.

Vishwakarma Pramod(2013) studied that the water quality of Aami River is of class-E after mixing of industrial waste from paper mills and different industrial sources located in GIDA.

**Water Quality Parameters**

Analysts determine water quality by testing for specific chemicals. Most often, the type of water being tested determines what parameters the analyst looks for. For example, chlorine is an important parameter in finished drinking water, but is not usually a factor in natural water. This section lists common water quality parameters important in drinking water, wastewater, and natural water. Many parameter listings include descriptions of the effects of parameters levels on living organisms.

**Acidity:**

Acidity of water is its quantitative capacity to react with a strong base to a designated pH. Acidity is a measure of an aggregate property of water and can be interpreted in terms of specific substances only when the chemical composition of the sample is known**.**

**Alkalinity:**

The Alkalinity or the buffering capacity of a stream refers to how well it can neutralize acidic pollution and resist changes in pH. Alkalinity measures the amount of alkaline compounds in the water, such as carbonates, bicarbonates and hydroxides. These compounds are natural buffers that can remove excess hydrogen, or H+ ions.

**BOD:**

The Biochemical Oxygen Demand, or BOD, is the amount of oxygen consumed by bacteria in the decomposition of organic material. It also includes the oxygen required for the oxidation of various chemical in the water, such as sulfides, ferrous iron and ammonia. While a dissolved oxygen test tells you how much oxygen is available, a BOD test tells you how much oxygen is being consumed.

**CBOD:**

Carbonaceous biochemical oxygen demand, or CBOD, measures the amount of demand that is oxidized by carbon. CBOD is a fraction of the BOD that excludes the nitrogenous oxygen demand by the addition of nitrogen inhibitors during the analysis.

**COD:**

The chemical oxygen demand, or COD, is used as a measure of the oxygen equivalent of the organic matter content of a sample that is susceptible to oxidation by a strong chemical oxidant.

**Conductivity:**

Conductivity is a measure of how well water can pass an electrical current. It is an indirect measure of the presence of inorganic dissolved solids such as chloride, nitrate, sulfate, phosphate, sodium, magnesium, calcium, iron and aluminum.

**Dissolved Oxygen:**

The amount of Dissolved Oxygen, or DO, in water is expressed as a concentration. A concentration is the amount of in weight of a particular substance per a given volume of liquid.

**Fecal Coliform:**

Human and animal wastes carried to stream systems are sources of pathogenic or disease-causing, bacteria and viruses. The disease causing organisms are accompanied by other common types of nonpathogenic bacteria found in animal intestines, such as fecal coliform bacteria, enterococci bacteria, and escherichia coli, or E. coli bacteria.

**Hardness:**

Hardness is frequently used as an assessment of the quality of water supplies. The hardness of a water is governed by the content of calcium and magnesium salts (temporary hardness), largely combined with bicarbonate and carbonate and with sulfates, chlorides, and other anions of mineral acids (permanent hardness).

**Metals:**

The effects of metals in water and wastewater range from beneficial through troublesome to dangerously toxic. Some metals are essential; others may adversely affect water consumers, wastewater treatment systems, and receiving waters. Some metals may be either beneficial or toxic, depending on concentration.

**Nitrogen:**

Nitrogen is important to all life. Nitrogen in the atmosphere or in the soil can go through many complex chemical and biological changes. It can be combined into living and non-living material and return back to the soil or air in a continuing cycle called the nitrogen cycle.

**Phosphorus:**

Phosphorus is often the limiting nutrient for plant growth, meaning it is in short supply relative to nitrogen. Phosphorus usually occurs in nature as phosphate, which is a phosphorous atom combined with four oxygen atoms, or $PO_4^{-3}$.

**pH:**

pH is an important limiting chemical factor for aquatic life. If the water in a stream is too acidic or basic, the H+ or OH- ion activity may disrupt aquatic organism's biochemical reactions by either harming or killing the stream organisms.

**Solids, Total:**

Total Solids is a measure of the suspended and dissolved solids in a body of water. Thus, it is related to both conductivity and turbidity.

**Temperature:**

Water Temperature is a controlling factor for aquatic life: it controls the rate of metabolic activities, reproductive activities and therefore, life cycles.

**Turbidity:**

Turbidity is a measure of the cloudiness of water. Cloudiness is caused by suspended solids (mainly soil particles) and plankton (microscopic plants and animals) that are suspended in the water column.

**CONCLUSION**

The pollution of Ami river which is a tributary of Rapti River in Uttar Pradesh is one such issue that gathered the public attention and there is a great need to assess the present status of water quality in the river with view to formulate suitable strategies for the management of the problems.

It is realized that urgent steps are needed to restore the water quality and regenerate the aquatic ecosystem in the river. This necessitates adequate treatment and disposal of industrial effluents and regular monitoring of the river water to ensure that the river remain a river throughout its length. This can be materialized with a coordinated effort of government agencies, industrial units, local bodies and public. This should go a long way towards saving Ami river from the fury of industrial pollution.

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