Journal of Advanced Laboratory Research in Biology
E-ISSN: 0976-7614
Volume 10, Issue 1, January 2019
PP 27-30
https://e-journal.sospublication.co.in

Research Article

# Comparative Statistical Analysis of some Hydrobiological Parameters in Upstream and Downstream of River Asan

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**Abstract**: Today world is facing a number of challenges affecting the availability, accessibility, use and sustainability of its freshwater resources. Water is the most vital resource for living beings because there is no life without water as cellular activities never occur. Water is essential for the socio-economic development of human beings. Industrialization, urbanization, population explosion and green revolution have deteriorated the various sources of water. Keeping these points in mind, this study is designed to comparatively analyze the water quality of river Asan at upstream and downstream sites.

**Keywords**: Temperature, Water flow, Turbidity, Conductivity.

## 1. Introduction

There is plenty of water on the earth's surface. The freshwater is however limited and at present, a large part of freshwater is in a polluted state. Only 2.7% of the total global water content, approximately 1.4 billion cubic km are fresh, suitable for aquatic ecosystem. Sustained supply of safe and potable water is of paramount importance in the promotion of health and well being of the people. Since the beginning of 1970s environmental pollution became a serious problem in India because of rapid increase of population and in the number of factories around the coastal region of rivers. Global studies show a challenging future and a chaotic view when considering total use and water availability in the third millennium. According to UN estimates by 2025, the demand for freshwater will rise by nearly 60% more than is currently available. An estimated more than 1.1 billion people worldwide lack access to clean drinking water with 500 million people from India.

Asan river is one of the most important river in Morena district. It is the biggest water collecting river of this region. It is situated in the middle of the district from south to northeast. It is extended in Joura, Morena and south part of Ambah Tahsil. Kunwari water collecting area is situated on its west, north and northeast part and in the south part of Gwalior district. The water of Asan river is mainly used for agricultural purpose. Villagers from nearby areas use water for bathing, washing clothes and for waste disposal, etc. in some areas, dead bodies are also dumped in Asan river, due to all these activities the water of Asan river becomes polluted. The direct use of polluted Asan river water creates some unhealthy and unhygienic environment among the lower middle class and lower class residential. Not only health crisis but also many waterborne diseases, including pollution due to lack of cleanliness, affects the lives of people throughout the year.

The industrial effluents, sewage and polluted water from other sources discharged into any stream or river not only cause pollution but drastically disturb the fauna and flora. The same is true with Asan river flowing in Madhya Pradesh. It therefore becomes must assess water quality of Asan river at upstream site (A) and downstream site (D) throughout its entire length in Morena district.

## 2. Material and Methods

Water samples were collected from river Asan at Morena District, from different water sampling points from October 2010 to July 2011 for the study of water quality. Sampling was done significantly after each three month interval for the analysis of different parameters. Samples were collected in the middle of streams and at mid-depth in the direction of flow. Samples are stored at a low temperature (4°C).

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Received: 08 December 2018
Accepted: 28 December 2018

River water samples were collected in five litres precleaned plastic bottles for physicochemical analysis. One glass bottle (capacity 300ml) was filled with water at every sample point for the estimation of dissolved oxygen as referred by APHA (1992). Water temperature was determined at the sampling point while other parameters were analysed in the laboratory.

### 2.1 Temperature

Temperature of water sample was measured by a centigrade mercury thermometer having marks from 1 to 100°C with division calibrated for 0.1°C.

### 2.2 Water flow measurement

A number of methods may be used for measuring flow of stream. The choice of methods depends largely on the affordability, but the type of local effluents also influences. For this, I used surface float method.

**Procedure:** It is a simple approach in which a float (Plastic ball) is thrown on the surface. The time required for a float to travel (t), a known distance (d) is observed and the average velocity is obtained by;

$$[\overline{V}] = \frac{d}{1.2t}$$

The factor 1.2 accounts for the fact that surface velocity is normally about 1.2 times the mean velocity.

### 2.3 Turbidity (Nephelometric methods)

Turbidity of water sample was measured by using Digital Nephelo-Turbidimeter. When light is passed through a sample having suspended turbidity, some of the light is scattered by the particles, the light scattered is directly proportional to the turbidity i.e. higher the turbidity, higher will be the light scattered. The amount of light scattered by the sample is compared with the intensity of light scattered by a standard suspension.

#### 2.3.1 Process (Preparation of turbidity standards)

#### (a) Stock Turbidity Suspension

**Solution A:** Dissolve 1.0 g of Hydrazine Sulphate $[(NH_2)_2 \cdot H_2SO_4]$ in 100 ml of distilled water.
**Solution B:** Dissolve 10 g of Hexamethylenetetramine $[(CH_2)_6N_4]$ in 100 ml of distilled water.

Mix 5.0 ml solution A and 5.0 ml solution B in a 100 ml volumetric flask. Allow the mixture to stand for 24 hours at 25 $\pm$ 3°C and diluted to mark and mixed. The turbidity of this suspension is 400 NTU.

#### (a) Standard Turbidity Suspension

Diluted 10 ml stock turbidity suspension to 100 ml turbidity-free water. The turbidity of this suspension is 40 NTU.

**Procedure:** Instrument was set to 100 by using standard turbidity suspension of 40 NTU. Sample was added in Sample tube. Surface of the sample tube was cleaned by using tissue paper. Sample tube was then put inside the Nephelometer and reading was noted in NTU.

Turbidity (NTU) = Nephelometer reading x 0.4 x dilution factor

### 2.4 Conductivity

Conductivity is generally measured by conductivity meter. Conductivity may be defined as the measure of ability of aqueous medium to carry on electric current. Conductivity is totally dependent upon concentrations of ions. The unit of conductivity is siemens per centimetre (S $cm^{-1}$). The older unit mho $cm^{-1}$ is now rarely used. The conductivity of most waters is generally low, so the unit µS $cm^{-1}$ shall be much appropriate.

As the ionization of the solutes is totally dependent on temperature, therefore all, the result is measured at 25°C.

**Procedure:** Conductivity cell was standardized by using 0.01M KCL solution and adjust the temperature at 25 $\pm$ 0.1°C. Then cell constant was computed. Conductivity cell was then rinsed with sample. Adjust the temperature of sample to 25 $\pm$ 0.1°C. Then measured the conductivity in mS $cm^{-1}$ (Millisiemens per centimetre).

Conductivity (mho) = observed conductivity x cell constant

**Statistical Calculations**

The statistical calculations were done by the following formula described by Fischer and Yates (1993).

**(i) Mean:**

$$\overline{x} = \frac{\sum x}{n}$$

Where,
$\sum x$ = Sum of Observations, n = Total number of observations.

**(ii) Standard Deviation (S.D.):**

$$S.D. = \sqrt{\frac{\sum(x - x)^2}{n - 1}}$$

Where,
x = Individual observations, $\overline{x}$ = Mean of observations, $(x - \overline{x})^2$ = Sum of the square of the deviation from the mean, n = Number of observations, $\sum$ = Summation.

## 3. Results and Discussion

### 3.1 Comparative Temperature Changes

The temperature of Asan water slightly varies at upstream site (A) and downstream site (D) during sampling of water. Minimum temperature is recorded in the end of January 2011, while maximum in the month of July 2011. However, variation in the temperature has been recorded in three month intervals in the present investigation. Such variation may be attributed to a lot of chemical composition due to discharge of major portion of the city sewage into the river which exerts influence on the river temperature. The sewage and other waste when mixed with the river water, raise the temperature of the water as it is fact that on mixing the acidic or alkaline waste in a water body the temperature of water gets elevated. The mean temperature for each session shows little variation from one sampling point to another. The basis of three season water temperature varies during rainy, winter and summer respectively. During summer temperature increases and in winter temperature declines, indicate that there is a reciprocal relationship between air and surface water temperature in the river. The water temperature is generally higher during the dry season. This may be due to the surface evaporation requiring heat from the water body. The above findings are in affirmation to Pandey (1986), Gandheeswari *et al*., (1990), Hasnain *et al*., (1992), Verma *et al*., (2005) and Thakur *et al*., (2007) in river Ganga, Yamuna, river Asan and other polluted industrial belt of rivers respectively. It becomes quite clear that water quality of upstream site (A) and downstream site (D) is different with regards to temperature parameter.

**Table 1. Average Temperature.**

| Month | Temperature ($^0$C) | |
|---|---|---|
| | Upstream (A) | Downstream (D) |
| Oct-10 | 21 | 21.0 |
| Jan-11 | 15 | 17.6 |
| April-11 | 27 | 28.5 |
| July-11 | 30 | 32.0 |

**Table 2. Analytical Table of Temperature.**

| Variable | Number of cases | Mean | Standard deviation |
|---|---|---|---|
| Temperature ($^0$C) | | | |
| Upstream | 4 | 23.25 | 6.65 |
| Downstream | 4 | 24.78 | 6.63 |
| | Mean difference | 1.53 | |
| | S.D. difference | | 0.02 |

### 3.2 Comparative Water Flow Changes

Water flow was maximum in July 2011 at upstream site (A) while it was minimum in January 2011 at upstream site (A). It may be due to hardness and turbidity of water. Turbidity is very much responsible for the disturbed speed of water flow and weather condition.

**Table 3. Water Flow Measurement.**

| Month | Water flow measurement (m/sec) | |
|---|---|---|
| | Upstream (A) | Downstream (D) |
| Oct-10 | 0.81 | 0.86 |
| Jan-11 | 0.75 | 0.81 |
| April-11 | 0.86 | 0.80 |
| July-11 | 0.90 | 0.83 |

**Table 4. Analytical Table of Water Flow Measurement.**

| Variable | Number of cases | Mean | Standard deviation |
|---|---|---|---|
| Water flow measurement | | | |
| Upstream | 4 | 0.83 | 0.07 |
| Downstream | 4 | 0.83 | 0.03 |
| | Mean difference | 0.0 | |
| | S.D. difference | | 0.04 |

### 3.3 Comparative Turbidity Changes

In the present investigation, a nonsignificant turbidity value has been observed between upstream site (A) and downstream site (D) from October 2010 to July 2011. Maximum turbidity recorded in the month of October 2010, which may be due to highly silted condition. An increasing rate of turbidity is recorded from April 2011 to July 2011 at upstream site (A) against downstream site (D). Most probably such higher values of turbidity are due to higher concentration of suspended solid particles, coming through sewage system, drains as well as due to foundry wastewater. In winter season October 2010 to April 2011 turbidity has been recorded maximum due to deficiency of proper running water in river as well as due to suspended solid particles which decreases the water flow velocity. During summer season rate of turbidity increased, may be associated with the velocity of water flow and also due to waste pollutants of city areas. The above finding clearly indicates that the turbidity is directly proportional to the different kinds of pollutants. The present investigation supported by Mathur *et al.*, (1998), Singh *et al.*, (1989), Tarzwell (1971) and Saxena and Chauhan (1993) who earlier recorded the rate of turbidity in river.

**Table 5. Average Turbidity.**

| Month | Turbidity | |
|---|---|---|
| | Upstream (A) | Downstream (D) |
| Oct-10 | 29 | 36 |
| Jan-11 | 24 | 26 |
| April-11 | 18 | 19 |
| July-11 | 24 | 26 |

**Table 6. Analytical Table of Turbidity.**

| Variable | Number of cases | Mean | Standard deviation |
|---|---|---|---|
| Turbidity | | | |
| Upstream | 4 | 23.75 | 4.5 |
| Downstream | 4 | 26.75 | 6.99 |
| | Mean difference | 3.0 | |
| | S.D. difference | | 2.49 |

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