Short Communication

ASSESSMENT OF THE IRRIGATION QUALITY OF RIVER YAMUNA IN DELHI, INDIA.

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ABSTRACT
This paper is an attempt to analyze the water quality of river Yamuna in Delhi region for irrigation purpose. Water samples were collected from 4 sampling stations. The study area has been divided into three seasons: Winter (November-February), summer (March to June) and rainy (July to October). Water quality variables were measured in the river over a period of two years (Nov, 2009 to Oct, 2011). The samples were analyzed for electrical conductivity (EC), pH and total dissolved salts (TDS). Study of all these characteristics indicates that river water in rainy season is not suitable for irrigation purpose because of high values of total dissolved salts.

KEY WORDS - Water analysis, Yamuna river water, Irrigation water quality, TDS, EC and pH.

INTRODUCTION
India is rich in water resources being endowed with a network of rivers that can meet a variety of water requirements of the country. However, with the rapid increase in the population of the country and the need to meet the increasing demands of irrigation, human and industrial consumption, the available water resources are getting depleted and the water quality has deteriorated. Indian rivers are polluted due to the discharge of untreated sewage and industrial effluents. It can be said that no water is pure or clean owing to the presence of some quantities of gases, minerals and life[1]. The addition of various kind of pollutants and nutrients through the agency sewage, industrial effluents, agricultural runoff etc. into the water bodies bring about a series of changes in the physicochemical and characteristics of water, which have been the subject of several investigations [2-5]

River Yamuna, with a total length of around 1,370 kilometers, is the largest tributary of the Ganges River Ganga in northern India. The main stream of the river Yamuna originated from the Yamunotri glacier near Bandar Punch in the Mussorie range of lower Himalayas in the district of Uttar Kashi in Uttar Pradesh. Yamuna is considered the most sacred among all the rivers as per Hindu mythology. Its source is at Yamunotri, in the Uttarakhand Himalaya, in the Himalayan Mountains. It flows through the states of Delhi, Haryana and Uttar Pradesh, before merging with the Ganges at Allahabad. The cities of Delhi, Mathura and Agra lie on its banks. Originating in the Yamunotri glacier in the Himalayas, Yamuna covers a distance of over 1,300 km, before merging with the Ganga in Allahabad.

Yamuna is one of the most polluted rivers in the world, especially around Delhi, which dumps about 57% of its waste into the river. Delhi alone contributes around 3,296 million litres per day of sewage in the river. The river water maintains a reasonably good quality from its origin to Wazirabad in Delhi (a stretch of about 396 km). But, 80 percent of the pollution in Yamuna's 1375 km stretch enters and is prevalent in its 22 km of the river (1.6 percent stretch) while it flows through Delhi. This is because of the domestic and industrial wastewater that drains into the Yamuna, when it flows through Delhi. Thus, in its 22 km stretch through Delhi, discharge of wastewater through 16 drains between the Wazirabad barrage and the Okhla barrage, renders the mighty and sacred river into a sewage drain and maintains a seemingly good quality of water till it reaches Wazirabad in Delhi. In Delhi, 15 drains discharge their filthy muck and waste into the river, making it the most polluted river in the country with practically no biologically dissolved oxygen.

Irrigation is an important use of Yamuna river water. It is estimated that about 92% of Yamuna river water is used for irrigation. In the entire Yamuna basin the irrigated land is about 12.3 million hectares and approximately half of it (about 49%) is irrigated exclusively from surface water. Irrigated agriculture is dependent on an adequate water supply of usable quality. In irrigation water evaluation, emphasis is placed on the chemical and physical characteristics of the water. This study is an attempt to assess the irrigation water quality of river Yamuna in Delhi.

This study was performed at four stations starting from sampling station A (Burari chauk- situated at the upstream of Yamuna in Delhi region) sampling station B (Wazirabad Barrage-entry point of Yamuna in Delhi) Sampling station C

(Okhla Barrage -exit point of Yamuna from Delhi) Sampling station D (Kalindikunj- situated at the downstream of Yamuna from Delhi region). The water at this point is polluted by a newly constructed colony on the northeast bank of the canal and the entire fecal matter, decaying leaves, and flowers, wooden parts, waste clothes, food materials and ashes, charcoal etc. can be observed in the Yamuna at this point. The quality characteristics studied in the present investigations were as follows: Electrical conductivity (EC), pH and Total dissolved salts (TDS).

METHODOLOGY

Water samples were collected for two years (November 2009 to October 2011), for three seasons i.e. summer, rainy and winter. Samples were collected from four sampling stations located at the upstream and downstream of Yamuna River. Water samples were collected in plastic containers with tight lid. Water samples were analyzed by standard methods of APHA 1998[6].

RESULTS AND DISCUSSION

The results obtained from analysis of water samples of river Yamuna are shown in Figures 1 -3.
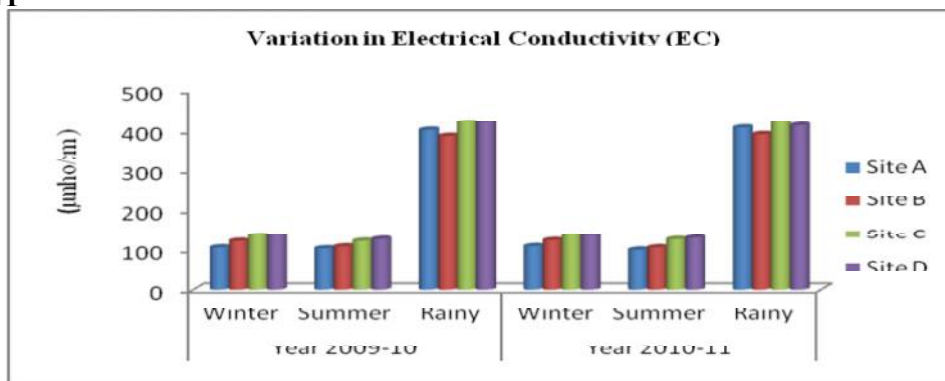

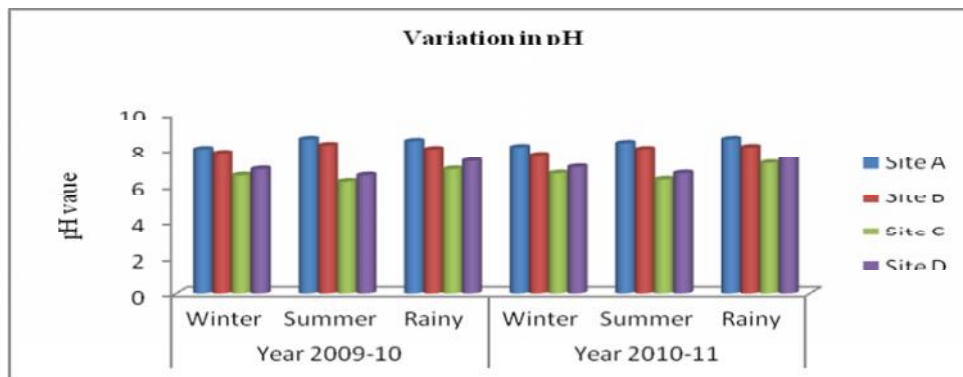**FIGURE 1:** A plot showing variations in EC of water sample in winter, summer and rainy season for two consecutive years.

FIGURE 2: A plot showing variations in pH of water sample in winter, summer and rainy season for two consecutive years.
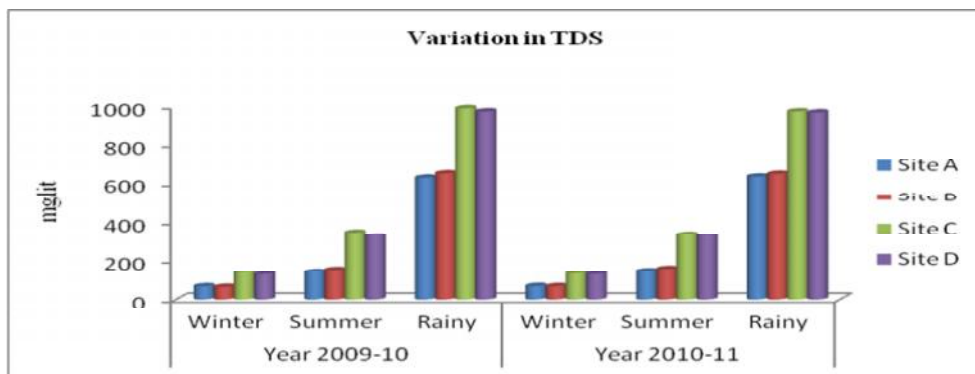

FIGURE 3: A plot showing variations in Total Dissolved Solid (TDS) of water sample in winter, summer and rainy season for two consecutive years.

Electrical conductivity (EC):
The primary effect of high EC water on crop productivity is the inability of the plant to compete with ions in the soil solution for water (physiological drought). The higher the EC, the less water is available to plants, even though the soil may appear wet. Because plants can only transpire "pure" water, usable plant water in the soil solution decreases dramatically as EC increases. Water with EC less than 250µmhos/cm is considered good and that with greater than 750 µmhos/cm is unsuitable for irrigation. In the year 2010 and 2011, the minimum EC was recorded in the winter season ranging from105.75 µmho/cm to140.80 µmho/cm. The maximum EC was recorded in rainy season ranging from 386.72 µmho/cm to 425.66 µmho/cm.

pH:
pH varies from 6.2 to 8.5 in summer and 6.5 to 8.0 in winter. WHO has recommended maximum permissible limit of pH from 6.5 to 9.2. All the samples are showing pH value within the range but Okhla is showing slightly low pH. The maximum pH is shown by Burari Chauk which may be due to either industrial discharge or contributed by soil or by the formation of bicarbonates ions. The high pH values during summer may be due to high photosynthesis of micro and macro vegetation resulting in high production of free CO2, shifting the equilibrium towards alkaline side[7].

Total dissolved salts (TDS):
In the case of irrigation, the salts are applied with the water and remain behind in the soil as water evaporates or is used by the crop. A salinity problem exists if salt accumulates in the crop root zone to a concentration that causes a loss in yield. Yield reductions occur when the salts accumulate in the root zone to such an extent that the crop is no longer able to extract sufficient water from the salty soil solution, resulting in a water stress for a significant period of time. Water with TDS less than 450 mg/l is considered good and that with greater than 2000 mg/l is unsuitable for irrigation purpose.

In the present study the minimum value of total dissolved solids was found in winter season with a range of 56.50 mg/lit to 125.12 mg/lit. The maximum value was found in rainy season with a range of 645.65 mg/lit to 990.10 mg/lit.

In the present study, TDS, EC and pH were found to be within permissible range except in rainy season. In rainy season, TDS was a little higher. Hence irrigation water quality of river Yamuna was found to be good except in rainy season.

CONCLUSION
In the present study pH, were found in the permissible range for Yamuna river water in Delhi. But EC and TDS are higher in rainy season. Hence Yamuna river water in Delhi is suitable for irrigation purpose except in rainy season.

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