

# **Evolution of the Water Quality of River Yamuna Using RS and GIS from Dakhpathar to Yamuna Nagar and Its Management**

Harish Chandra Joshi<sup>1</sup>, I. P. Pandey<sup>2</sup>

Dept. of Chemistry, Uttaranchal University, Dehradun, Uttarakhand, India

Dept. of Chemistry, DAV (PG) College, Dehradun, Uttarakhand, India

**ABSTRACT:** The functioning of an aquatic ecosystem and its stability to support life forms depend, to a great extent, on the physico-chemical characteristics of its water. It is necessary to know details about different physicochemical parameters such as colour, temperature, hardness, pH, sulphate, chloride, DO, BOD, COD, etc. used for testing of water quality. Heavy metals such as Pb, Cr, Fe, Hg etc. are of special concern because they produce water or chronic poisoning in aquatic animals. GIS system and RS are the two important tools which are being used in the present study to analyse the water resources development planning.

**KEYWORDS:** Preliminary water analysis, Heavy metals, River Yamuna, GIS and Remote sensing

## **I. INTRODUCTION**

The river Yamuna sometimes called Jamunais the largest tributary river of the Ganges, (Ganga) in northern India. Originating from the Yamunotri Glacier at a height of 6,387 metres on the south western slopes of Banderpooch peaks in the uppermost region of the lower Himalayas in Uttarakhand it travels a total length of 1,376 kilometres (855 mi) and has a drainage system of 366,223 square kilometres (141,399 sq mi), 40.2% of the entire Ganga Basin. It crosses several states, Uttarakhand, Haryana and Uttara Pradesh, passing by Uttarakhand and later Delhi, and meets its tributaries on the way, including Tons, its largest and longest tributary in Uttarakhand, Chambal, which has its own large basin, followed by Sindh, the Betwa and Ken. There are three main sources of pollution in the river namely households and municipal disposal sites, soil erosion resulting from deforestation occurring to make way for agriculture along with resulting chemical wash-off from fertilizers, herbicides, and pesticides and run-off from commercial activity and industrial sites.

The water quality and human health are closely related. The domestic sewage discharged from a population of about 2 millions gives rise to numerous water-borne diseases like typhoid, cholera, dysentery, poliomyelitis and cysticercosis, thereby affecting the human health, disturb the aquatic life and deterioration of the water quality. During the recent years the pollution of riverine system by heavy metals has attracted a lot of attention of the scientific community. metals are introduced into the aquatic system as a result of weathering of soil and rocks, from volcanic eruptions and mining activities.

GIS provides a fast and compact method of data storage, which is beneficial for long term management of the rivers and the availability of water as well as causes of pollution. The advent of remote sensing has opened up new vistas in resources mapping with improved accuracy. Remote sensing data obtained in digital form can be processed by computers to produce images for interpretation purpose.

One of the greatest advantages of using remote sensing data for hydrological modelling and monitored is its ability to generate information in spatial and temporal domain, which is very crucial for successful model analysis, prediction and validation.

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## II. MATERIALS AND METHODS

**Study area and Collection of the sample:** The study period is divided into three seasons mainly winter (Nov-Feb), summer (Mar-Jun) and monsoon (July-Oct). The water sample were collected at regular intervals from two sites:

Sample station I – Dakhpathar (Uttarakhand) and sample station II – Yamuna Nagar (Haryana).

The samples were taken in BOD bottles and plastic jerry canes and brought to the laboratory with necessary precautions. All samples were labelled properly. Some physico-chemical parameters like temperature were measured on site.

### Analysis of Physico-chemical Parameters

Standard analytical methods (APHA 1990, Trivedi and Goel, 1986 etc.) followed in the analysis of water samples.

All the parameters like pH, Temperature, Acidity, Carbon Di Oxide, Colour, Odour, Taste, Turbidity, TDS, TSS, Hardness, Chloride, Sulphates, Phosphates, DO, COD, BOD, Reactive silica, Sulphate, Hydrogen Sulphide, Total Alkalinity, Carbonates, Bicarbonates, Total Phosphorus, Magnesium, Iron, Zinc, Sodium, Potassium, Cadmium, Nickle, Copper, Chromium etc. were analysed for water quality index.

## III. RESULT AND DISCUSSION

The results obtained from the analysis of water samples of different sites of river Yamuna in Table 1 and Table 2. The reported values of water samples collected in different seasons at different areas along the stretch of Yamuna River. The results indicate that the quality of water varies considerably changes from location to location and seasonably.

**Table: 1 Seasonal variation in Physico-chemical parameters of river Yamuna at sample station I (Dakhpathar, Uttarakhand)**

PHYSICOCHEMICAL PARAMETERS	YEAR 2011-2012			YEAR 2012-2013		
	SUMMER (MAR-JUN)	MONSOON (JUL-OCT)	WINTER (NOV-FEB)	SUMMER (MAR-JUN)	MONSOON (JUL-OCT)	WINTER (NOV-FEB)
Colour	Colourless	Colourless	Colourless	Colourless	Colourless	Colourless
Temperature( <sup>0</sup> C)	20.50	17.85	9.50	21.00	18.10	9.90
PH	7.20	7.40	7.10	7.30	7.35	7.15
Conductivity (μS/cm)	0.30	0.34	0.26	0.32	0.34	0.28
Total Alkalinity (ppm)	182.00	180.00	178.00	181.20	179.80	176.00
Total Solid (ppm)	122.00	196.06	96.80	125.00	200.02	97.04
TDS (ppm)	95.50	155.00	71.00	98.00	156.00	72.50
TSS (ppm)	32.00	48.00	28.85	30.22	50.00	28.01
DO (ppm)	3.42	5.70	7.95	3.56	5.80	8.00
BOD (ppm)	0.91	1.10	0.81	0.93	1.21	0.80
COD (ppm)	3.21	4.60	2.87	3.02	4.80	2.88
Total Hardness (ppm)	84.52	100.20	93.00	85.00	100.60	94.00
Calcium (ppm)	11.00	20.47	10.12	11.10	21.01	10.54
Magnesium (ppm)	8.02	10.24	7.54	8.11	11.31	7.28
Chloride (ppm)	5.45	14.18	4.85	5.52	14.45	5.00
Sulphate (ppm)	14.60	17.60	12.40	14.00	18.00	11.80
Sodium (ppm)	11.00	16.80	8.00	10.10	17.25	8.22
Potassium (ppm)	3.62	5.08	2.00	3.54	5.12	2.10
Iron (ppm)	0.016	0.024	0.012	0.016	0.026	0.014

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Zinc (ppm)	NA	NA	NA	NA	NA	NA
Copper (ppm)	NA	NA	NA	NA	NA	NA
Arsenic (ppm)	NA	NA	NA	NA	NA	NA
Cadmium (ppm)	NA	NA	NA	NA	NA	NA
Mercury (ppm)	NA	NA	NA	NA	NA	NA
Chromium (ppm)	NA	NA	NA	NA	NA	NA
Lead (ppm)	NA	NA	NA	NA	NA	NA
Manganese (ppm)	NA	NA	NA	NA	NA	NA
Nickle	NA	NA	NA	NA	NA	NA

**Table: 2 Seasonal variations in Physico-chemical parameters of river Yamuna at sample station II (Yamuna Nagar, Haryana)**

PHYSICOCHEMICAL PARAMETERS	YEAR 2011-2012			YEAR 2012-2013		
	SUMMER (MAR-JUN)	MONSOON (JUL-OCT)	WINTER (NOV-FEB)	SUMMER (MAR-JUN)	MONSOON (JUL-OCT)	WINTER (NOV-FEB)
Colour	Colourless	Colourless	Colourless	Colourless	Colourless	Colourless
Temperature( <sup>0</sup> C)	24.70	19.30	9.60	24.10	18.70	9.30
PH	7.15	7.42	7.23	7.45	7.48	7.19
Conductivity (μS/cm)	0.32	0.34	0.28	0.30	0.35	0.27
Total Alkalinity (ppm)	169.00	172.00	167.00	167.00	173.00	168.00
Total Solid (ppm)	145.50	170.00	109.02	146.10	169.30	111.05
TDS (ppm)	129.02	148.00	98.00	130.50	145.00	101.50
TSS (ppm)	25.10	28.04	19.53	26.30	29.08	21.45
DO (ppm)	3.19	7.50	7.63	4.55	7.85	7.35
BOD (ppm)	1.05	1.65	0.96	0.97	1.85	1.03
COD (ppm)	3.88	5.06	2.78	2.85	5.36	2.98
Total Hardness (ppm)	61.90	81.10	68.07	61.30	79.20	69.05
Calcium (ppm)	11.52	24.40	12.00	11.58	24.55	12.50
Magnesium (ppm)	8.17	16.12	8.90	8.21	16.05	8.95
Chloride (ppm)	6.20	18.06	6.26	6.35	18.18	6.40
Sulphate (ppm)	15.80	17.80	12.80	15.95	17.75	12.66
Sodium (ppm)	11.00	16.02	7.88	10.70	16.12	7.65
Potassium (ppm)	3.34	5.37	3.10	3.10	5.00	2.10
Iron (ppm)	0.028	0.027	0.018	0.018	0.023	0.014
Zinc (ppm)	NA	NA	NA	NA	NA	NA
Copper (ppm)	NA	NA	NA	NA	NA	NA
Arsenic (ppm)	NA	NA	NA	NA	NA	NA
Cadmium (ppm)	NA	NA	NA	NA	NA	NA
Mercury (ppm)	NA	NA	NA	NA	NA	NA
Chromium (ppm)	NA	NA	NA	NA	NA	NA
Lead (ppm)	NA	NA	NA	NA	NA	NA
Manganese (ppm)	NA	NA	NA	NA	NA	NA
Nickle	NA	NA	NA	NA	NA	NA

#### IV. CONCLUSION

In the Wake of Increasing Urbanization and industrialization, the pollution potential of river is gaining very less. The survey of river revealed that villages and towns which are situated in the way of river do not dump much waste water

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and toxic waste in the river. Due to this there is not much pollution in the river and so the river water is potable and is posing no threats to the survival of aquatic flora and fauna.

GIS and Remote sensing technology has clearly demonstrated its usefulness its understanding the factors responsible for maintaining the hydrological cycle, mainly the vegetal cover, surface water bodies, lithotypes and landform. Supply of groundwater even in the dry month is very much essential for sustainable development.

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