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REVIEW ARTICLE

HYDROBIOLOGY OF RIVER GANGAN

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ABSTRACT

The major problem faced by current period is water pollution. Due to this pollution the physicochemical properties of water are highly influenced. The parameters show different values at upstream and downstream level, the value of parameters also fluctuate with changing locations. This problem is created by man itself either through industrialization, or discharge of sewage or chemicals in water bodies which affect the life of aquatic flora and fauna and becomes unsafe for agricultural and drinking purpose.

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INTRODUCTION

Water is essential for the existence of all life forms. In addition to household uses, water is vital for agriculture, industry, fishery and tourism etc. About 3/4th of our planet earth's surface is covered by water. However, very little of it is available for consumption. Most (about 97%) of the water on earth is present in the seas and oceans. It is too salty to be of any use for drinking, agriculture and industrial purposes. The remaining 3% is fresh water, 75% of which is locked up in the polar ice caps and in glaciers and quite deep under the earth surface as underground water. The freshwater, which we can use, comes to us from 2 sources. (1) surface water (2) Ground water. Rain and snow are good natural resources of fresh waterage. A large amount of water is discharged back after domestic and industrial usage. This is contaminated with domestic waste and industrial effluents. When this contamination reaches beyond certain allowed concentrations ,it is called Pollution. Water pollution is defined as the contamination of streams, lakes, seas, underground water or oceans by substances, which are harmful for living beings. Industralization and population explosions are two important factors for water pollution. Water pollution are of different types like Petroleum pollution, Sewage pollution.

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Many Factories and nuclear power plants use water cooling during manufacturing processes at reactor cooling, cause thermal pollution which change the quality of water and affects micro-world like plants and animals.

Review

Khan, *et al.* (2015) studied the effect and distance on physico-chemical and biological parameters of Ghaggar river water, India and concluded that the electrical conductivity changes from 0.54 (minimum) to 0.67(maximum), dissolved oxygen changes from 5.9 mg/l(minimum) to 7.4 mg/l (maximum), alkalinity ranged between maximum 179 mg/l to minimum 99.9 mg/l. Baidya and Biswas (2015) studied the seasonal variations of Chathe river of Dimapur and found that the temperature lies in between 32.8 ^{o}C (maximum) and 17.7 ^{o}C (minimum) limits, the pH changes from 8.53 ± 0.06 (maximum) and 7.43 ± 0.06 (minimum). Electrical conductivity ≤ 55ms/cm, total dissolved solids maximum (151.67±17.2 mg/l), dissolved oxygen between maximum 13.47mg/l ± 0.8 mg/l to minimum 7.6 mg/l ± 0.4 mg/l and also concluded that a 10 ^{o}C rise in water temperature could double the rate of physiological and reproductive function of some aquatic species. Matta and Kumar, (2015): monitor and evaluate the limnological aspects of river Ganga system in Himalaya region and found that the light in summer and monsoon season majorly increases the biological and chemical

process in the water and variance in light intensity was ranging from 1198.88 ± 284.189 to 164.74 ± 1161.82, the temperature ranged from 12.2 ± 0.77 to 13 ± 1.1^{o}C in winter but a rapid increases was recorded in summer and monsoon with 16 ± 1.71^{0}C to 16.3 ± 1.59^{o}C and 16.2 ± 15.6^{0}C to 18.2 ± 0.58^{o}C and also concluded that Ganga river and canal polluted due to mass bathing ,washing, disposal of sewage, Industrial waste, continues discharge of industrial discharge, tourism, anthropogenic and spiritual activities. Chakrabarty and Nath, (2015) analyse some physic-chemical parameters of a tributary of Ganga, West Bengal, and found that the dissolved oxygen ranges in limits of 8.11 mg/l (maximum) and 0.67 mg/l (minimum) limits. The analytical data of free CO_2 and BOD indicated above and DO is found below the normal limit in some water sample. Baitula, Deshmukh and Bhorkar, (2015) works on the investigation of water quality parameters of Nag region Maharashtra and reported that the temperature ranges between 31.5 ^{o}C to 33^{o}C, colour was noted as brown/greenish or brown, pH value ranges from 7.21 to 7.71,conductivity measures between 400 µmho/cm and 600 µmho/cm. DO content varied from 8.9 mg/l to 1.1 mg/l. Manjeet and Kumar, (2015) evaluate the seasonal variations in physic-chemical properties of z-minor canal of Gang canal in Sriganganagar Rajasthan, India and found that the temperature ranges between 16^{o}C to 30^{o}C, the value of pH is found maximum (7.4) in monsoon season and minimum (7.04) was observed during winter season, temperature ranges between 7.5 ^{o}C minimum to 24 ^{o}C maximum in winter season. DO changes from 5.6 higher to 3.06 lower. Total alkalinity ranges between 260 mg/l minimum to 383 mg/l maximum.

Kumar, Singh, Srivastava and Mohan, (2015) works on the assessment of seasonal variations in water quality dynamics in river Varuna and found that the temperature of Varuna changes from 37^{o}C to 15.9^{o}C, turbidity of river Varuna ranges between 99.05 NTU to 17.17 NTU, pH ranges between 8.86 to 7.18, electrical conductivity recorded in river Varuna ranges between 1194 µs/cm to 286 µs/cm, amount of TDS recorded in the water of Varuna ranges between 846 mg/l to 203 mg/l, total suspended ranges between 1880 mg/l to 248 mg/l, total suspended solids ranges between 1630 mg/l to 23 mg/l, alkalinity ranges between 686 mg/l to 178 mg/l, hardness ranges between 394 mg/l to 80mg/l, DO ranges between 10.9 mg/l to 0.8 ml, BOD ranges between 218 mg/l to 22.4 ml, COD ranges between 536 mg/l to 58mg/l. Selakoti and Rao, (2015) works on the study of seasonal fluctuations in physic-chemical variables in spring fed Kosi river at Almora provine from central Himalaya, India and found that temperature ranges from 22.3 to 11.2^{0}C,TDS changes between 78mg/l to 47 mg/l, the transparency of water ranges between 320 to 25,the level of pH varies between 8.8 to 7.5, the DO of water has maximum value in limits of 10.5 mg/l and lowest in 8 mg/l, the value of CO_2 varies between 4.8 to 2.4, alkalinity ranges between 75 mg/l to 56 mg/l, the Conductivity ranges between 165.95 to 100. Rajvanshi, Singhal, Kannan and Bhatt, (2015) works on the seasonal variations of some physical parameters and heavy metals present in Dhamola river at Saharanpur district (U.P.) and found that water temperature varied from 22.13^{o}C to 5.21,the turbidity varied between 381.33 NTU ±233.57,the seasonal average value of total heavy metals ranged between 14.89 mg/l ± 12.3 to 9.05 mg/l ± 0.95, pH varies between 7.38±0.09, hardness undercomes in limits of 109.96 ± 9.06mg/l, DO lies between 280 ± 0.50mg/l, BOD lies in limits of 405.57±59.47 mg/l, alkalinity lies between 77.5 ± 5.94mg/l, conductivity varies between limits of 288.76 ± 11.00 mg/l, TDS 554.39 ± 49.9mg/l, turbidity ranging between 22 to 72 NTU,COD was 33.5 mg/l to 41 mg/l .Tamilarasi *et al.* (2015): carried out hydrochemical evaluation of groundwater in Pernampet block in Palar river basin at Vellore district, Tamil nadu, India and revealed that the value of all parameters at different sites is as follows-total dissolved solids ranged from 1738 mg/l (minimum) to 3662 mg/l (maximum), pH ranged between 7.55 to 7.84, total alkalinity ranged between 3.52 mg/l (minimum) to 7.84 gm/l (maximum), total hardness lies from 614 mg/l (minimum) to 1151 mg/l (maximum). Balaji (2015): works on the study of physico-chemical properties of reservoir at Makni, Osmanabad district (Maharashtra),India and recorded maximum temperature within limits of 30.55^{o}C ± 0.68 ^{o}C in May and minimum temperature within limits of 18.73^{o}C to 0.77^{o}C ,maximum pH was (9±0.063) recorded in January and minimum pH was (6.3 ± 0.024) in April, Water transparency (Wtr) had maximum value (56 ± 0.34) in may and minimum value (16 ± 0.67) in July, maximum and minimum DO was recorded within limits of (6.1 ± 0.45mg/l) and (3.48±0.15mg/l), maximum and minimum total hardness value observed by them were (172.6±1.57mg/l) and (98.64 ± .56 mg/l) respectively, maximum alkalinity value was (97.7 3 ± 0.78mg/l) in may and minimum alkalinity value was (46.37 ± 0.34 mg/l) in June, maximum value of chloride was recorded (29.5 ± 0.54 mg/l) in may and minimum value of chloride was recorded (8.92 ± 0.21 mg/l) in August, maximum value of nitrate (NO_3) was recorded (0.62 ± 0.56 mg/l) in July and minimum value was recorded (0.51 ± 0.068) in may.

Patil *et al.* (2015) works on limnological study of Venna Lake ,Mahabaleshwar, Maharashtra, India and found that the pH value lies within permissible limits of drinking i.e. pH 6.5-8.5, average water temperature was found to be in range of 20-30 ^{o}C during sampling , the value of phosphate ranged from 0.02 mg/l to 0.23 mg/l, DO ranged from 4.4mg/l to 10 mg/l, free CO_2 varies between limits from 17.6 to 4.4, alkalinity reaches the peak value of 32 and lowest value of 4, DO ranges maximum 10.4 to minimum 4.0 Leena and Maneemegalai, (2015) studied the water pollution status of Varahanadhi river by physic-chemical analysis and found that the value of electrical conductivity was low at the upstream site of the river and high at the downstream site of the river ,the average concentration of turbidity was higher in monsoon season and lower in post monsoon season, Higher turbidity was observed in downstream during post monsoon season and lower turbidity was observed in midstream during pre monsoon. Majumder *et al.* (2015): works on zooplankton diversity influenced by hydrobiological parameters in some ponds of south eastern part of Bankura town of West Bengal, India and found that the water temperature in this region lies in between limits from higher (23.0±2.1) to lower (20.2±1.9), pH ranges in between limits of higher (8.02 ± 0.79) to lower (7.45 ± 0.53), DO ranges in between limits from lower (0.46 ± 0.02) to higher (0.90 ± 0.43), Free CO_2 ranges in limits of higher value (57±3.02) to lower limit (12.66±0.38), higher value of alkalinity was (238 ± 6.21 mg/l) and lower limit of alkalinity was (10.2 ± 0.56), total hardness ranges from higher limits (186.25±9.5) to lower limit

(114±4.59), conductivity changes form higher limit (1200 ± 8.3µs/cm) to lower limit (690 ± 5.1µs/cm), TDS ranges from higher value (804±8.1ppm) to lower value (462±6.9ppm). Agarwal and Agarwal, (2014) studied the effect of heavy metals on aquatic life in Gangan river at Moradabad, UP, India, and found that the chromium (Cr) is more toxic in comparison to Copper (Cu) and Nickel (Ni) for aquatic life. Majumder and Dutta, (2014) works on the studies on seasonal variations in physic-chemical parameters in Bankura segment of the Dawrkeshwar river (West Bengal) India, and found that the value of pH was higher (7.7) in summer season and in monsoon it was lower (6.6), surface water temperature has higher value in summer season (28.4^{o}C) and lower value (19.15^{o}C) in winter season, the value of DO was higher (9.9mg/l) in monsoon and was lower (7.7mg/l) in winter, the value of free CO_2 was higher (11.0mg/l) in monsoon and lower (6.3) in winter ,total alkalinity ranges from higher value (165.1mg/l) in monsoon and lower (145mg/l) in summer season. Kumar *et al. (*2014) works on seasonal variations in physic-chemical properties of Kali river in Pithoragarh district of Uttrakhand, India and found that the value of temperature showed its maximum value in the month of may (23.9 ± 0.36^{o}C) and maximum (12.83 ± 0.76^{o}C) in the month of january, the transparency of water was higher (69 ± 2.08cm) in march and lower (18.36 ± 10.23cm) in august, the pH value was higher (9.26 ± 0.20) in january and was lower (7.4 ± 0.10) in june, the value of DO was higher (11.03 ± 0.25mg/l) in january and was lower (7.66 ± 0.15mg/l) in august, the value of free CO_2 was higher (4.29 ± 0.02mg/l) in august and was lower (1.58 ± 0.16mg/l) in january, the value of TDS was higher (170.33 ± 1.52mg/l) in august and was lower (126.33 ± 1.52mg/l) in january, the value of conductivity was higher (340.66 ± 3.05 µs/cm) in august and was lower (252.66 ± 3.05µs/cm) in january, the value of alkalinity was higher (163.33 ± 1.52mg/l) in september and was lower (107.33±2.51mg/l) in july.

Korgaonkar *et al.* (2014) studied the physic-chemical characters of freshwater pond Osargaon-Ghonsari Kankavli taluka of district Sindhudurg, Maharashtra, India and found that the values of various parameters fluctuate in their 2 year study time such as the pH values recorded ranged in between 7.3 to 9.2 in year (2012-2013),while 7.1 to 9.2 in year (2013-2014), total alkalinity value fluctuate from 24 mg/l to 36 mg/l in year (2012-2013), while 22 mg/l to 36 mg/l in year (2013-2014), total hardness ranged from 15 mg/l to 37 mg/l in year (2012-2013), while 17 mg/l to 37 mg/l in year (2013-2014), the value of DO reported during 2 year study ranged in between 6 mg/l to 8.24 mg/l, BOD value ranged from 2.41 mg/l to 2.86 mg/l ,COD's value ranged from 90 mg/l to 106 mg/l during 2 year study. Verma and Bansal, (2014) studied the physic-chemical characteristics in river Ganga at Bithoor Ghat in district Kanpur, and found that the of maximum value of temperature was 22.9 ^{o}C and minimum was 7.3^{o}C, the maximum value of (Total Dissolved Solids) TDS was 144 mg/l and minimum value was 140 mg/l, maximum value of total hardness was 130.2 mg/l and minimum was 104.2 mg/l ,maximum value of (Dissolved Oxygen) DO was 8.1 mg/l and minimum value was 7.6 mg/l, the maximum value of(Biochemical Oxygen Demand) BOD was 3.5 mg/l and minimum value of BOD was 2.5 mg/l, maximum value of Chemical Oxygen Demand (COD) was 29 mg/l and minimum value was 24 mg/l. Pandey, (2014) studied the water quality of river Ganga along ghats in Allahabad city, and found that the temperature increased rapidly which was about 30.5^{o}C, the maximum pH value of river at investigation time was 8.75 and minimum was 8.06, the maximum value of of electrical conductivity(EC) was 542 µmho/cm and the minimum value of EC was 392 µmho/cm, the maximum value of turbidity was 11.90 NTU and minimum value of turbidity was 8.10 NTU, the maximum value of total hardness was 145 mg/l and minimum value of total hardness was 110 mg/l, the maximum value of TDS was 280.6 mg/l and minimum value of TDS was 238.2 mg/l, the maximum value of alkalinity was 248 mg/l and minimum value of alkalinity was 120 mg/l ,the maximum value of dissolved oxygen (DO) was 9.90 mg/l and minimum value of DO was 5.10 mg/l, the maximum value of biochemical oxygen demand (BOD) was 5.80 mg/l and the minimum value of BOD was 2.60 mg/l at their study time. Chandra, *et al.* (2014): studied the hydrobiology of river Burhi Ganga in district Etah (UP) and found that the hardness was maximum (962.3 mg/l) and in summer was minimum (539.6 mg/l) in monsoon, the total solids (TS) were maximum (1936.4mg/l) in monsoon in the year 2012-2013, the maximum value (7.2mg/l) of DO was noted in rainy season, and minimum value (2.1 mg/l) of DO was noted in the summer in their study time. Patel and Datar, (2014) studied the seasonal variations of Physic-chemical characteristics of river Betwa in Vidisha district and found that the maximum value of temperature was 31^{o}C and minimum value of temperature was 22 ^{o}C, the maximum value of pH was 8.1 and minimum value of pH was 7.5, the maximum value of DO was 8.2 mg/l and minimum value of DO was 3.19 mg/l, maximum value of BOD was 7.16 mg/l and minimum value of BOD was 1.3 mg/l, the maximum value of COD was 165 mg/l and minimum value of COD was 24 mg/l, the maximum value of alkalinity was 256 mg/l and minimum value of alkalinity was 60 mg/l, free CO_2 was totally absent, the maximum value of TDS was 0.89 mg/l and minimum value of TDS was 0.63 mg/l, the maximum value of total hardness was 350 mg/l and the minimum value of total hardness was 134.4mg/l.

Singh, (2014): studied the seasonal variations in physic-chemical parameters of the river Gomti and found that the maximum value of temperature was 16.3^{o}C in winter and minimum value of temperature was 30.8 ^{o}C in summer ,the maximum value of pH was 7.79 mg/l in summer and minimum value of pH was 5.1 in winter, the value of DO was maximum (10.7mgl) in monsoon and minimum value of DO was (8.25mg/l) observed in winter, the maximum value of free CO_2(61.7) was observed in summer and minimum value of free CO_2(39.3) was observed in winter, the maximum value of acidity (91.2) was observed in summer and minimum value of acidity (37.9) was observed in winter, the maximum value of alkalinity (259 mg/l) was observed in summer and minimum value of alkalinity (155 mg/l) was observed in winter, the maximum value of hardness (250 mg/l) was observed in summer and minimum value of hardness (174 mg/l) was observed in monsoon, the maximum value of chloride (24..7 mg/l) was observed in summer and minimum value of chloride (15.1) was observed in winter. Chandra, *et al.* (2014): studied the quality of Burhi Ganga and found that the odour of water was putrefying, the temperature of water was maximum during

summer and minimum during winter, turbidity was recorded maximum in July and minimum in December, the average value of pH was 7.2 to 7.9 during investigations. Seth, *et al*. (2014): studied the water quality evaluation of Himalayan River of Kumaun region, and found that the turbidity average value varied from 5.4±1.08 to 14.3±3.10 and from 7.4 ±1.61 to 47.3±8.12 NTU during pre monsoon and post monsoon season respectively. The pH average value in the analysed water samples ranged from 7.66 ±0.27 to 8.48 ±0.14 in pre monsoon season and from 7.61±0.22 to 8.12±0.34 in post monsoon season, the hardness ranged from 342±19.69 to 570±86.16 mg/l in pre monsoon season and from 70±23.18 to 206±35.77 mg/l in post monsoon season, the alkalinity in water ranged from 218±7.60 to 461 ±12.51 and from 57±10.13 to 186±34.7 mg/l during pre monsoon and post monsoon season respectively, the average value of TDS in pre monsoon season ranged from 427±18.87 to 884 ±124.88 mg/l and in post monsoon season varied from 127±19.91 to 344±43.05 mg/l, the mean value of calcium and Magnesium in water ranged from 62±43.83 to 119±75.72 and from 9±2.38 to 36±7.81 mg/l in pre monsoon season, from 15±3.17 to 37±3.90 and from 6±0.73 to 20±8.94 mg/l in post monsoon season.

Praveen, *et al.* (2013): studied the physic-chemical properties of the water of river Ganga at Kanpur and found that the value of temperature ranges in between limits of 21-30 ^{o}C, the value of turbidity ranges in between limits of 18-471 NTU, the value of total hardness (TH) ranges in between limits of 123-213 mg/l, the value of Fe (iron) content ranges in between limits of 0.2-0.7 mg/l, the value of chloride ranges in between limits of 6.9-26.8 mg/l, the value of TDS ranges in between limits of 255-501 mg/l, the value of Ca^{2+} ranges in between limits of 27.8-47.9 mg/l, the value of SO_4^{2-} ranges in between limits of 51-90 mg/l, the value of NO_3^- ranges in between limits of 0.00-1.763 mg/l ,the value of F^- ranges in between limits of 0.00-0.039 mg/l, the value of TA(total acids) ranges in between limits of 12.7-245 mg/l, the value of Mg^{2+} ranges in between limits of 9.24-27.24 mg/l. Vaishali and Punita, (2013): works on the assessment of seasonal variations in water quality of river Mini, at Sindhrot Vadodara and found that the value of pH was 8.16 ± 0.10 during post monsoon season 8.40 ± 0.14 during pre winter and 7.70 ± 0.09 during post winter season, the value of TDS was 890.00 ± 20.00 during post monsoon season , 906.67 ± 55.29 during pre winter and 3339.33 ± 11.37 during post winter season, the value of Conductivity was 1400.00 ± 10.00 during post monsoon , 1516.67 ± 5.77 during pre winter and 5423.33 ± 30.55 during post winter season, the value of turbidity was 15.67 ± 4.16 during post monsoon season 4.17 ± 0.29 during pre winter and 3.00 ± 0.50 during post winter season. the value of COD was 50.33 ± 7.64 during post monsoon, 31.00 ± 20.30 during pre winter 163.00 ± 10.00 was during post winter season ,the value of BOD was 10.67 ± 1.16 during post monsoon, during pre winter the value of BOD was 8.0 ± 4.58 and during post winter the value of BOD was 40.33 ± 2.52 the value of DO was7.87 ± 0.30 during post monsoon season, 12.73 ± 0.25 during pre winter and the value of DO was 3.27 ± 0.12 during post winter season. The value of Alkalinity was 42.00 ± 0.00 during post monsoon season 166.67 ± 5.77 during pre winter season and 273.33 ± 56.86 during post winter season. the value of Ammonia was 1.84 ± 0.35 during post monsoon 3.70 ± 3.59 during pre winter and 22.21 ± 8.90 during post winter season ,the value of Chloride was 198.57 ± 32.00 during post monsoon season 283.33 ± 5.77 during pre winter season and 1200.00 ± 100.00 during post winter season, the value of Sulphate was 218.33 ± 11.68 during post monsoon , 167.27 ± 3.18 during pre winter season and 290.67 ± 22.12 during post winter season, the value of Total hardness was 202.67 ± 16.17 during post monsoon season 323.33 ± 20.82 during pre winter and 1010.00 ± 222.71 during post winter season.

Sarkar, (2013): studied the impact of idol immersion on water quality of river Ganga at Ranighat, Chandernagore (West Bengal) and found that the maximum value of temperature was 33.0±0.07 ^{o}C and the minimum value of temperature was 30.4±0.03,the maximum value of pH was 7.91±0.26 and the minimum value of pH was 7.26 ± 0.05, the maximum value of transparency was 32.90 ± 2.34 cm and the minimum value of transparency was 21.30±1.65 cm, the maximum value of dissolved oxygen (DO) was 8.29 ± 0.59 mg/l and the minimum value of DO was 5.67 ± 0.23 mg/l, the maximum value of conductivity was 283.96 ± 37.43 (µS/cm) and minimum value of conductivity was 210.30 ± 23.18 (µS/cm), the maximum value of BOD was 3.41 ± 0.47 and the minimum value of BOD was 2.25 ± 0.22 mg/l, the maximum value of COD was 21.77 ± 3.40 mg/l and minimum value of COD was 11.10 ± 1.12 mg/l, the maximum value of total alkalinity was 167.24 ± 43.33 mg/l and the minimum value of total alkalinity was 95.67 ± 22.18 mg/l ,the maximum value of chloride was 47.77 ± 15.51 mg/l and minimum value of Chloride was 14.77 ± 12.39 mg/l, the maximum value of total hardness was 136.74 mg/l and the minimum value of total hardness was 116.33 ± 6.93 gm/l, the maximum value of phosphate was 0.94 ± 0.07 mg/l and the minimum value of phosphate was 0.38 ± 0.02 mg/l during their investigation process.

Verma, (2013) studied the current status of physic-chemical characteristics and biological factor of western Ramganga river in Kumaun Himalaya and found that the value of temperature was maximum (21.26) in monsoon and the value of temperature was minimum (15.06) in winter, the maximum value of water current velocity was 0.849 in monsoon and the value of water current velocity was minimum 0.313 in winter, the maximum value of turbidity was 92.9 NTU in monsoon and the minimum value of turbidity was 7.9 NTU in winter, the maximum value of pH was 8.28 during the summer and the minimum value of pH was 7.83 during monsoon season, the maximum value of DO was 10.57 mg/l during the winter and minimum value of DO was 7.93 mg/l during the monsoon ,the maximum value of alkalinity was 104.45 mg/l during the winter and the minimum value of alkalinity was 60.91 mg/l during monsoon, the maximum value of total hardness (TH) was maximum 104.45 mg/l during the winter and the minimum value of TH was 79.41 mg/l during the monsoon. Singh and Chaudhry, (2013) studied the physic-chemical characteristics of river water of Ganga in middle Ganga plains and found that the value of pH ranged between two limits i.e. from 8.3 to 6.2,the value of dissolved Oxygen DO ranges from 8.4 to 2.4 mg/l, the value of total solids (TS) ranges from 82 to 90 mg/l, the value of PO_4^- ranges from .97 to 0.009 mg/l, the value of NO_3^- ranges from 0.098-0.020. Alam and Pathak, (2013) studied the hydrochemical profile of wetland situated in Ram

Ganga flood plains and found that the value of water temperature ranged between two limits ,the maximum value of temperature was 39.60, the minimum value of temperature was 12.80 and the mean value of temperature was 29.10,the maximum value of transparency was 54.00, the minimum value of transparency was 7.00 and the mean value of transparency was 29.46, the maximum value of Turbidity was 98.00 and the minimum value of turbidity was 7.00 and the mean value of turbidity was 27.58, the maximum value of total solids was 148.00, the minimum value of total solids was 116.00 and the mean value of total solids was 407.13, the maximum value of dissolved solids was 148.00 ,the minimum value of dissolved solids was 72.00 and the mean value of dissolved solids was 110.92, the maximum value of electrical conductivity (EC) was 780.00, the minimum value of electrical conductivity was 300.00 and the mean value of electrical conductivity was 542.29, the maximum value of pH was 9.10, the minimum value of pH was 6.90 and the mean value of pH was 7.84, the maximum value of alkalinity was 162.00, the minimum value of alkalinity was 32.00 and the mean value of alkalinity was 103.29, the maximum value of dissolved oxygen (DO) was 12.80, the minimum value of DO was 5.50 and the mean value of DO was 8.89, the maximum value of carbon dioxide (CO_2) was 12.00, the minimum value of CO_2 was 0.00 and the mean value of CO_2 was 4.25, the maximum value of chloride (Cl^-) was 35.46, the minimum value of Cl^- was 5.67 and the mean value of Cl^- was 14.71 , the maximum value of total hardness was 260.00, the minimum value of total hardness was 94.00 and the mean value of total hardness was 134.33, the maximum value of Calcium (Ca^{2+}) was 54.66, the minimum value of Ca^{2+} was 20.40 and the mean value of Ca^{2+} was 33.44, the maximum value of Sodium (Na) was 18.00, the minimum value of Na was 5.00 and the mean value of Na was 10.33, the maximum value of Potassium (K) was 32.00, the minimum value of K was 2.00 and the mean value of K was 12.96, the maximum value of SO_4^{2-} was 30.50, the minimum value of SO_4^{2-} was 5.00 and the mean value was 15.40, the maximum value of Phosphate (PO_4^{3-}) was 1.65, the minimum value of PO_4^{3-} was 0.05 and the mean value of PO_4^{3-} was 0.72.

Bhandarkar and Bhandarkar, (2013) studied the seasonal variation of physic-chemical properties in some freshwater lotic ecosystems in Gadchiroli district Maharashtra and found that the maximum value of temperature was 29.47 ± 2.332 and the minimum value of temperature was 23.95±0.73, the maximum value of pH was 8.05 ± 0.29 and the minimum value of pH was 7.175 ± 0.10, the maximum value of transparency was 76.26 ± 6.78 and the minimum value of transparency was 35.65 ± 0.285, the maximum value of TDS was 450 ± 129.09 and the minimum value of TDS was 80 ± 16.32, the maximum value of DO was 9.875 ± 1.192 and the minimum value of DO was 5.95 ± 0.310, the maximum value of total hardness was 143.0 ± 37.25 and the minimum value of total hardness was 83.75±11.814, the maximum value of CO_2 was 4.47 ± 0.221 and the minimum value of CO_2 was 1.67 ± 0.35, the maximum value of total alkalinity was 203.5 ± 82.43 and the minimum value of total alkalinity was 112 ± 14.165, the maximum value of BOD was 23.5 ± 10.700 and the minimum value of BOD was 3.17 ± 0.722, the maximum value of COD was 32.4 ± 7.17 and the minimum value of COD was 7.12 ± 1.890. Namdeo *et al.* (2013) studied the hydrobiology of a Tropical Reservoir with special reference to seasonal flux in certain Physic–chemical parameters and found that the value of maximum value of temperature was 32.3^{o}C and the minimum value of temperature was 21.3^{o}C, the maximum value of transparency was 118 and the minimum value o transparency was 63.7, the maximum value of turbidity was 185.4 and the minimum value of turbidity was 166, the maximum value of pH was 8.13 and the minimum value of pH was 7.8, the maximum value of electrical conductivity (EC) was 244 mg/l and the minimum value of EC was 219 mg/l, the maximum value of total alkalinity was 140 mg/l and the minimum value of total alkalinity was 85.5 mg/l, the maximum value of dissolved oxygen (DO) was 11.1 and the minimum value of DO was 5.7 mg/l, the maximum value of biochemical oxygen demand (BOD) was 1.9 mg/l and the minimum value of BOD was 0.4 mg/l. Vishwakarma, *et al.* (2013) studied the assessment of water quality of Betwa river, Madhya Pradesh, and found that the maximum value of temperature was 32.3^{o}C and the minimum value of temperature was 17^{o}C, the maximum value of pH was 8.9 and the minimum value of pH was 5, the maximum value of hardness was 54.8 mg/l and the minimum value of hardness was 14.2 mg/l, the maximum value of dissolved oxygen (DO) was 12.3 mg/l and the minimum value of BOD was 14.6 mg/l and the minimum value of BOD was 2.1 mg/l, the maximum value of COD was 82.5 m/l and the minimum value of COD was 8.4 gm/l.

Agarwal and Agarwal, (2013) studied the linear regression and correlation analysis of water quality parameter of river Kosi at district Rampur, India and found that the maximum value of alkalinity was 162 mg/l and the minimum value of alkalinity was 130 mg/l, the maximum value of BOD was 5.8 mg/l and the minimum value of BOD was 5 mg/l, the maximum value of COD was 36.5 mg/l and the minimum value of COD was 32.8 mg/l, the maximum value of DO was 7.2 mg/l and the minimum value of DO was 6.4 mg/l, the maximum value of TS 9.35 and the minimum value of TS was 394.Kumar and Bahadur, (2013) studied the water quality of river Kosi and Rajera system at Rampur (India) and found that the maximum value of temperature was 33.5 and the minimum value of temperature was 18.9, the maximum value of pH was 7.9 and the minimum value of pH was 7.3, the maximum value of TS was 387 and the minimum value of TS was 325, the maximum value of conductivity was 514 and the minimum value of conductivity was 366, the maximum value of turbidity was 75 and the minimum value of turbidity was 25, the maximum value of hardness was 209 and the minimum value of hardness was 184, the maximum value of chloride was 25.3 and the minimum value of chloride was 18.1, the maximum value of alkalinity was 197 and the minimum value of alkalinity was 91, the maximum value of DO was 6.7 and the minimum value of 6.2, the maximum value of BOD was 6.0 and the minimum value of BOD was 5.5, the maximum value of COD was 40.0 and the maximum value of COD was 32.8.

Sahu, *et al.* (2013) studied the Impact of urban wastes on the physic-chemical characteristics of river Gomti at Lucknow and found that the value of pH lies between higher and lower limits of 8.2 and 7.0 respectively, the value of temperature lies between maximum and minimum limits of 31^{o}C and 15^{o}C respectively, the maximum value of DO was 7.8 mg/l and the

minimum value of DO was 0.9 mg/l, the maximum value of COD was 61.12 mg/l and the minimum value of COD was 12.1 mg/l, the maximum value of SO_4^{2-} was 18 mg/l and the minimum value of SO_4^{2-} was 9.6 mg/l, the maximum value of alkalinity was 260 mg/l and the minimum value of alkalinity was 201 mg/l, the maximum value of F^- was 0.86 and the minimum value of F^- was 0.31. Gangwar, *et al.* (2012) studied the assessment of physic-chemical properties of river Ramganga at Bareilly and found that the maximum value of temperature was 35.9°C and the minimum value of temperature was 20.4°C, the maximum value of pH was 8.8 and the minimum value of pH was 8.1, the maximum value of TS was 396 mg/l and the minimum value of TS was 330 mg/l, the maximum value of turbidity was 72 NTU and the minimum value of turbidity was 22NTU, the maximum value of hardness was 219 mg/l and the minimum value of hardness was 192 mg/l, the maximum value of alkalinity was 202 mg/l and the minimum value of alkalinity was 96 mg/l, the maximum value of DO was 6.3 mg/l and the minimum value of DO was 5.7 mg/l, the maximum value of BOD was 3.8 mg/l and the minimum value of BOD was 5.8 mg/l, the maximum value of COD was 33.5 mg/l and the minimum value of COD was 41.0 mg/l.

Verma, *et al.* (2012) studied the determination of physic-chemical characteristics of four canals of Allahabad region and its suitability for irrigation and found that the maximum value of pH was 7.2 and the minimum value of pH was 7.6, the maximum value of temperature was 32°C and the minimum value of temperature was 23.8°C, the maximum value of electrical conductivity (EC) was 1559.37 µmho/cm and the minimum value of EC was 556.25 µmho/cm, the maximum value of alkalinity was 146 mg/l and the minimum value of alkalinity was 65.4 mg/l, the maximum value of TDS was 1035 mg/l and the maximum value of TDS was 356 mg/l, the maximum value of DO was 4.8 mg/l and the minimum value of DO was 2.1 mg/l. Shivayogimath, *et al.* (2012) studied the water quality evaluation of river Ghataprabha, India and found that the maximum value of temperature was 29.5°C and the minimum value of temperature was 25.15°C, the maximum value of turbidity was 17.48 NTU and the minimum value of turbidity was 4.85 NTU, the maximum value of conductivity was 439.38 µmhos/cm and the minimum value of conductivity was 187.89 mg/l, the maximum value of pH was 7.21 and the minimum value of pH was 843,the maximum value of DO was 7.59 mg/l and the minimum value of DO was 4.36 gm/l the maximum value of total alkalinity was 7.59 mg/l and the minimum value of total alkalinity was 72.38 gm/l, the maximum value of hardness was 160 mg/l and the minimum value of hardness was 67.70 mg/l, the maximum value of TDS was 254 mg/l and the minimum value of TDS was 116.48 mg/l, the maximum value of COD was 88.58 mg/l and the minimum value of COD was 20.4 m/l, the maximum value of BOD was 21.60 mg/l and the minimum value of BOD was 2.6 mg/l. Agarwal and Saxena, (2011) studied the assessment of pollution by physic-chemical water parameters using regression analysis of Gangan river at Moradabad and found the maximum value of alkalinity was 250 mg/l and the minimum value of alkalinity was 55, the maximum value of BOD was 63 mg/l and the minimum value of BOD was 33 mg/l, the maximum value of COD was 33 mg/l and the minimum value of COD was 9 mg/l.

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