Structural and Functional Characteristic of Algae on Waste Water Treatment of Pandu River (Ganga), To Check Biodegradability of Crude Oil in Ganga (National Policy of Central Government of India)

Dr Seema Dwivedi

***Abstract*—** The global population is increasing continously in third world countries that already suffer from water. In india 500 million population Directly and indirectly depend on the river Ganga for life itself. The article analyzes methods for the to identify water quality and to implement method of role of algae in waste water treatment in river pandu which is tributary of Ganga . The river Pandu are polluted caused by the draning of ash slurry and effluents thrown by number of industries including some unit of ordinance and Panki Thermal Power Plant . Water may be contaminated with organic,inorganic,biodegradable or non biodegradable pollutants,metallic ions,heavy metals or pesticide etc. The effluents discharged into the river are highly toxic and contain toxic metals.Oxygen budget of the river is quite poor declining nil at times. Algal community of the river is composed of only 33 genera 40 species and most of the species reported are well document pollution tolerant forms. The Goverment of india has taken action on ganga action plan 3rd in feb 2014 on 524 different schemes. Befor 2 action plan have been failed. In ganga action plan 3rd the government of india reopen waterway 1 from haldia to Allahabad in india so my work is going on process on "to check biodegradability of crude oil in ganga" in future..

***Keywords*—** PPTP, COD, BOD, RIVER PANDU, GANGA.

I. Introduction

According to the report stated by World Bank Sponsored Study , high concentration of pollutants in the Ganga are contributing 22-32% of total health issues in Uttar Pradesh (U.P) in india.The dumping and mixing of sewage ,regional waste and domestic waste endures the problem. Residents of more than 50 villages situated along the Pandu river, a tributary of Ganga which passes through Kanpur, are polluted. This river are being polluted caused by the draining of ash slurry from Panki Power Thermal Plant and effluents thrown by a number of industries including some units of Ordinance into river Pandu.Next to air we breath ,water is undoubtedly the most important thing in our life.It is a resource worth conserving and used judiciously.It is estimated than in near future ,the arid countries will face a major water crisis and most of the world's reliable water resources may become highly polluted and contaminated to be used as a water resources.

Water may be contaminated with organic,inorganic,biodegradable or non biodegradable pollutants,metallic ions,heavy metals or pesticide etc . Besides these ,it may be polluted with biological pollutants such as bacteria,viruses,cysts'pathogenic and non pathogenic organism and toxic planktons. In developing countries,contaminated water is the root cause of 80% ailments and 33% deaths.The root cause of water pollution in india is unwise management, neglect and over exploitation of the resources. All the major cities of india ,mostly located on the river banks, discharge their wastes into the rivers and sometimes into the sea or even in oceans –turning them into open sewers. In addition to it, they also receive urban and agricultural wastes of their respective catchments area,which further impairs their water quality .Various international institutes and countries are collaborating with Indian government in its river pollution control program .All these plans and projects are under way to abate and resolve the pollution problem by depolluting the rivers.The present study on river Pandu is relevant to the same ideology

II. Literature Review

India is a developing country that fulfils its people's fresh water demand mainly by rivers .since past ,rivers have been the hubs of human activity all over the world as the cradle of human civilization .They, however,drew the attention of man from ecological or pollutional point of view only a few decades back.

In india , studies on river ecology and pollution gained momentum around 1940 when Biswas [1] studied the algal cology of the river Hooghly at Calcutta(Kolkata).Later Roy [2] studied the pollution ecology of the same river Hoghly at patta,West Bengal.Iyengar and Venkataraman [3] studied the ecology and seasonal succession of algae specially of diatoms in river cooum at Madras(Channai),Ganapati and chako [4] investigated the effect of paper mill pollution on the water

Dr Seema Dwivedi, Gautam Buddha University

quality of river Godavary at Rajahmundry.Chakraborty [5] studied planktons and ambient water characteristics in river Yamuna at Allahabad .Later Mohan and Sarkar[6] undertook a preliminary study on the pollution of river Yamuna.Laxminarayana [7] invstigated the water quality of river ganga at Varanasi and studied algal plankton ,their seasonl growth and succession.Ray and David [8] assessed the impact of industrial wastes and sewage upon chemical and biological composition water and fisheries of river ganga at Kanpur. Bhargava [9] investigated the water quality of river Ganga ,Yamuna, and kali in uttar Pradesh.

Only a few studied have made on the river Pandu.Impact of fertilizer factory wastes on the water quality of the river Pandu has been assessed by Arora and Routh [10] where as Kaur studid the impact of waste effluents on the ecology of river Pandu.Tiwari [11] made observations on the periphytic community of the same river Pandu

III. Sources Of Pollution In River Pandu

River Pandu – a small perennial tributary of the river Ganga flows on the southern outkirt of the Kanpur through its Panki industrial Area (PIA) and eventually mergs with the river Ganga in south – west of Kanpur in Fatehpur district .

The preliminary survey of the river at its Kanpur frontage revealed that is polluted by five major drains carrying sewage,sullage and industrial wastes. While passing through PIA,it receives effluents from diverse industries of the area mainly Panki thermal power plant ,Duncans industries Limited,L.P.G Bottling Plant,Ordinance factory,Lohia Machines Limited and some more industries manufacturing chemicals and synthetic dyes.

Besides these point sources of pollution ,the other sources polluting the river may be enumerated as Run- off water from agriculture as well as urban catchment areas during rains and floods,Night soil from the unsewered area of the nearby localities,fooder wastes ,Indiscriminate defaecation etc.

IV. Sampling Sites : Materials And Methods

The sampling sites are:

Station 1 It is situated slightly upstream of the confluenc point of the Panki Thermal power plant drain with the river.

Station 2 It is situated approximately 0.25 km.downstream of the confluence point of PTPP drain with the river

Station 3 It is situated approximately 20 kms, further down steam of station 3.River flow low ,flanked on both the sides by agriculture fields.At this sites ,river reach is accessible by a road bridge by the side of a distributor of lower Ganga canal.

Station 4 It is situated further approximately 15 kms.down stream of station 4 beneath the Kanpur – Hamirpur road bridge in Naubsta area.

Station 5 It is situated further 30 kms. Downstream under the road bridge over the river in Kanpur-Aung stretch of the Sher Shah Suri Marg.

V. Analytical Procedure

Samples collected periodically have been subjected to following analysis as

1.Chmical 2.Algal 3. Degradation of crude oil (Work is going on)

1.Chemical analysis: Parameter taken into account are listed below.They heve been assessed either titrimetrically or spectrophotometrically except pH, conductivity and total solids.

1. Hydrogen ion concentration(pH): At the sampling sites it has been asssed by the pH indicator solution While in the laboratory by electronic pH meter using glass electrodes and standard buffer solutions.pH measurement reflect the nature of the pollutants as well as the intensity of the pollution. All reported values fall in the alkaline range indicating that the river water is alkaline , value ranged from 6.6±0.13 to 9.3±0.12.

MONTH	STATION 1	STATION 2	STATION 3	STATION 4	STATION 5
January	8.0±0.10	8.8±0.03	9.0±0.09	8.0±0.27	7.8±0.11
July	7.2±0.19	7.5±0.21	7.4±0.19	7.3±0.10	7.7±0.00

2. Conductivity: Specific conductivity measurement is an index of the amount of ionisable salts/electrolytic pollution Spcific conductance of river water ranged from 80 to 993 µmhos-^{cm}.The minimum values has been noticed at station 1 and maximum at atation 4.In general vlues were low in winter and higher in summer.

3. Total solids : Total solid concentration markedly varied at different station.Station 2,3 and 5 have reported higher values of solids as compared to station 5 .Lowest value, however, has been noticed at station 1.The values ranged from 80.0±1.4 mg-^{1} to 1020.0±1.4 mg-^{1}.

4. Dissolved oxygen: Except station 1 anf 5 which registered comparatively higher D.O concentration ranging from 3.8±0.26 mg-^{1} to 7.5±0.80mg-^{1}, rest of the stations showed oxygen-stressed condition of the river.During the years maximum concentration has invariably been noticed at station 1 in January while nill D.O. has has been noticed at station at stations 2,3 and 4 during summers

5. Biological oxygen demand: In the water, B.D.O. values range from 4.2±0.71 to 78.2±1.46 mg-^{1} at different stations during the year. Variation have been noticed regarding the appearance of peaks and minima which appeared at different stations at different months.

6. Chemical oxygen demand: Quality and quantity of the pollutants discharged inti the river had a great impact on the chemical oxygen demand value at different stations of the river.It renged from a minimum of 12.76 ±1.16 mg^{-1} to maximum of 348.0±2.44 mg $^{-1}$.

MONTH	STATION 1	STATION 2	STATION 3	STATION 4	STATION 5
January	15.4±1.55	222.0±1.00	248.0±1.06	96.0±2.37	62.0±1.40
July	12.76±1.16	114.0±1.06	66.0±1.58	70.0±1.32	40.8±1.20

7. Total hardness: Total hardness values varied with the station and also showed pronounced seasonal fluctuation.During year it fluctuated from a minimum of

324±0.23 mg^{-1} to a maximum of 960.0±077 mg^{-1} .In general ,high values of hardness have been noticed at all stations except station 1 which showed slightly lower values.

MONTH	STATION 1	STATION 2	STATION 3	STATION 4	STATION 5
January	150±0.70	884±0.31	677±0.20	300±0.55	221.1±0.40
July	120±0.16	625.5±0.51	726.4±0.73	260±0.37	228.2±0.23

8. Chloride: A considerable variation has been recorded in the chloride contents of the river water at different stations and in different seasons.It ranged from 10.0±0.15 to 158.0±0.27 mg^{-1}.

9. Phosphate: Fairly high concentration of phosphate has been noticed in the river.It ranged between a minimum of 0.16±0.01 to 3.9±0.03 mg^{-1}

VI. Algal Community Of The River Includes Both Planktonic And Periphytic Community

A) Planktonic community: The investigation of river water revealed a meek algal spectrum in terms of both, algal population and species composition .A total of 40 species belonging to 30 genera have been reported . Out of these 15 belonged to bacillariophyceae, 15 to chlorophyceae and 10 to Cyanophyceae.Their distribution also varied at different station probably due to fluctuating quality and quantity of the waste discharged into the river.

Algal community of the river.

Class	Number of Genera	Number of species
Bacillariophyceae	**13**	**15**
Chlorophyceae	**14**	**15**
Cyanophyceae	**6**	**10**
Total	**33**	**40**

Algal composition and relative abundance of each at different station of the river:

ALGA	RELATIVE ABUNDANCE %				
	Station 1	**Station 2**	**Station 3**	**Station 4**	**Station 5**
Bacillariophycae					
Asterionella formosa.	**0.13**	-	**0.03**	**0.10**	**0.09**
Diatoma elongatum	**0.18**	-	-	-	**0.08**
Fragilaria capucina	-	-	-	**0.07**	**0.07**
Chlorophyceae					
Chlorella vulgaris	**7.4**	**22.0**	**25.0**	-	-
Cladophora glomereta	-	**48.2**	**33.6**	**19.7**	**9.22**
Spirogyra sp.	**21.0**	**0.90**	**13.0**	**20.0**	**1.7**
Cyanophyceae					
Nostoc sp.	**1.08**	-	-	-	-
Oscillatoria tenuis	-	**66.0**	-	-	-

VII. The Role Of Algae In Waste Water Tratment Of Pandu River

Now a days the world is facing problems with a wide variety of pollutants and contaminants from various developmental activities.The over population in the world has resulted in an increase in the area of polluted water.Mostly third world countries(including India) are facing many problems regarding water. According to the report stated by World Bank Sponsored Study , high concentration of pollutants in the Ganga are contributing 22-32% of total health issues in Uttar Pradesh (U.P.)in india.The dumping and mixing of sewage ,regional waste and domestic waste endures the problem

Algae are reported and acknowlged as playing a very important role in natural water purification process [12].Algae can be used to treat both municipal and industrial wastewater.Algea play a major role in aerobic treatment of waste in the secondary treatment process .Algae-based wastewater treatment system are mainly used for nutrient removal (nitrogen and phosphorous).

Algae also play important role in removing heavy metals and toxic compounds.In other cases ,algae also play a role in the removal of pathogens in the tertiary treatment stage.

VIII. Advantages Of Algae In Water Treatment

There are many advantages 1.Low energy requirement 2.Very low cost treatment 3.Production of algal biomass 4. Reduction in sludge formation.

Experimental set-up : The waste water treated with culture of Chlorella vulgaris and Scenedesmus bijuga.Now this experiment is going in process.

IX. Biodegradation Of Crude Oil Of Ganga Water (Includung Pandu River)

The Goverment of india has taken action on ganga action plan 3rd in feb 2014 on 524 different schemes befor 2 action plan have been failed. In ganga action plan 3rd the government of india has taken action to reopen the waterway 1 from haldia to Allahabad in india for transportation ,touching cities like Kolkata and Varanasi.The world bank is expected to support the project with an initial assistance of $50 million.

According to government the development of this water way is excepted to offer a supplementary mode of transport at a time when railways and roadways are already saturated. Thermal power plant, cement, fertiliser, edible oil and crude oil company of india are keen on the development of this mode . So my future work is going on "to check biodegradability of crude oil in ganga" .

Conclusion: 1. The main polluting sources of the river are industries of the Panki industrial area, Kanpur and municipal waste of the southern Kanpur area. 2.Main pollutants are residual ash slurry, from panki thermal plant ,nitrogenous and non nitrogenous wastes from Duncan,s Industry Ltd. 3. River is excepted to a pollution load for beyond its assimilating capacity. 4.Algal spectrum of the river is quite poor as compared to other perrinial river. 5.Diatoms dominated the algal community structure at grossly polluted station 2 of the river. 6.Algal diversity decline with rise in intensity of pollution in water .

Thus it my be concluded that pollution of the river has attained alarming dimensions,adversely affecting its algal community which serves as natural oxygenator of the river. The effluents have exerted an algistatic effect on the river algae, and that is why the self-recuperating capacity of the river is quite low

REFERENCES

[1] Biswas, K. "The role of common algal communities of the river Hoogly on the drinking water, Calcutta. 150 th Ann. Vol. Royal Bot." (1942): 189-206.

[2] Roy, Himansu Kumar. "Plankton ecology of the river Hooghly at Palta, West Bengal." *Ecology* (1955): 169-175. http://dx.doi.org/10.2307/1933222

[3] Iyengar, MO Parthasarathy. *The ecology and seasonal succession of the algal flora of the river Cooum at Madras with special reference to the Diatomaceae*. 1951.

[4] Ganapati, S. V., et al. "The ecology of solar sewage drying beds in the Pirana Sewage Farm at Ahmedabad." *Hydrobiologia* 26.1-2 (1965): 242-270.

[5] Chakrabarty, R. D., P. Roy, and S. B. Singh. "A Quantitative study of the plankton and the physicochemical conditions of the river Jumna at Allahabad in 1954-55." *Indian J. Fish* 6.1 (1959): 186-203.

[6] Mohan, C., and H. L. Sarkar. "Preliminary studies on the pollution of the river Jamuna." *Bull. CPHERI1* (1961): 76-82.

[7] Laxminarayana, J. S. S. "Studies on phytoplankton of river ganga Varanasi, India." *Part-II Phytolankton in* (1965).

[8] Ray, P., and A. David. "Effect of industrial wastes and sewage upon the chemical and biological composition and fisheries of the river Ganga at Kanpur." *Environ. Hlth* 8 (1966): 307-339.

[9] Bhargava, D. S. "Water quality in three typical rivers in UP—Ganga, Yamuna and Kali." *Thesis presented to the Indian Institute of Technology, Kanpur, India* (1977).

[10] Arora, H. C., and Tapan Routh. "Treatment of slaughterhouse effluents by anaerobic contact filter." *IAWPC Technical Annual VI & VII* (1980): 67-78.

[11] Tiwari, D., J. M. Patrick, and S. Singh. "Algal dynamics of the river Ganga at Kanpur." *Phykos* 5 (2001): 115-126.

[12] Han, S. Q., Z. H. Zhang, and S. H. Yan. "Present situation and developmental trend of wastewater treatment and eutrophication waters purification with alga technology." *Agro-Environment and Development* 63.1 (2000): 13-16.