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WATER QUALITY OF VISHAV STREAM IN KASHMIR VALLEY, J & K, INDIA

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Abstract
Present study has been carried out at Vishav stream, which is one of the most live and perennial tributaries of River Jhelum of Kashmir valley. Vishav contributes major portion of discharge towards the Jhelum. Due to increase the population and over exploitation of fresh water resources and waste water disposal, the direct or indirect modifications and alterations in creating the physical, chemical and biological characteristics of water have occurred profound and deleterious effects on human health and on the environment as a whole. In present investigation an attempt was made to find out the physico-chemical nature of Vishav stream, so as to have an insight into the level of pollution status in the stream. In order to have reasonable and wholesome information, a detail study of the stream course was conducted on monthly basis and the selection of sites was done keeping in mind different types of habitat features i.e., elevations, fast flowing areas, slow zones, as well as human interferences. Study showed that the deterioration of stream water quality at lower reaches as low transparency, DO and higher concentration of Ca, N, P, Cl etc. all pointing towards the nutrient enrichment.

Key Words: Anthropogenic, catchments area, deterioration, Kashmir valley, Vishav stream.

Introduction
Water is one of the most important natural resources in the world since without it life can't exist. Essentially, all life depends upon the water for being a major component of living organisms and an elixir of life. It is one of the most important commodities which man has exploited than any other resource for the sustain of his life (Kumar *et al.*, 2008). Water pollution has now reached a crisis point specifically in developing world. Almost every water body is polluted to an alarming level. Aquatic ecosystem are not only source of water and resources, such as fish and crop for household and agro industrial uses, but are vital parts of natural environment on which economic systems are parasites and depend for their survival (Rai and Pal, 2001). Thus, estimation of quality of water is extremely important for proper assessment of the associated hazards (Warhate *et al*, 2006).

The valley of Kashmir is well known for its water resources. These water bodies are facing grave pollution problems. A number of indigenous and high quality species are diminishing. To cope up with these problems there is a need of application oriented limnological research so that we are able to better utilize this most important resources of ours.

Most of the limnological studies conducted so far on the Kashmir water bodies are restricted to few famous lakes while a number of important water bodies have been altogether neglected. The given paper contains the work done on a stream named Vishav stream, situated to the south eastern corner of Kashmir Valley. Due to increase in population, over exploitation and waste water disposal, directly or indirectly modify the physical, chemical and biological characteristics of water which has a profound effect on human health and environment as a whole.

In this back drop it was thought worthwhile to workout the physical-chemical features of water of Vishav stream. The Vishav stream has remained untouched by limnogists mainly be far away from the capital city of Srinagar. Different physic-chemical parameters of this important and perennial stream have been investigated.

Materials and Methods
Selection of Sites
This Vishav stream is one of the main live and perennial tributary of river Jhelum. The sources of the Vishav lies in the south eastern corner of Kashmir valley, close to that of the Jhelum. The principal among them being Kaunsernag taking off from large snow beds at an altitude ranging from 4267 mts to 4726 mts above MSL. It has a catchment area of 1230 sqkms. The Vishav stream is the only lifeline for the population of four assembly constituencies. The river drains the entire northern face of the pir panjal between Sundertop and Budilpir and thus has an extensive catchment area which reduces the upper Jhelum to a tiny rivulet. Infact, the Jhelum draws heavily on Vishav

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feeders in the initial stage while passing through volcanic strata in the Pir panjal range, the Vishav formed the famous cataract of Aharbal.

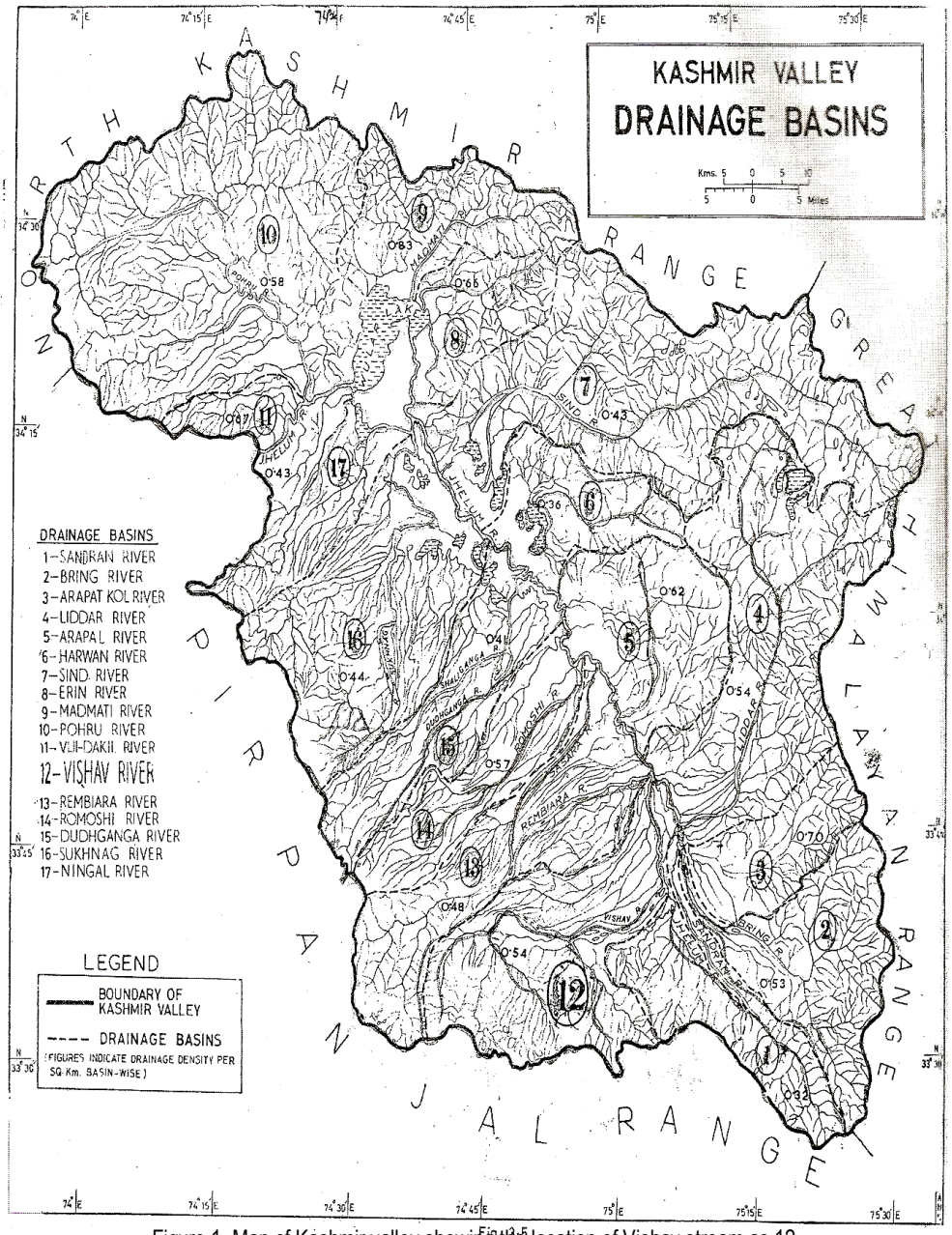

Figure 1. Map of Kashmir valley showing the location of Vishav stream as 12

From Aharbal it flows in a bouldery stage upto Nowpora village, wherefrom slope changes mildly and from village Khudwani it flows in a subtle grade and takes river feature and finally confluences with the river Jhelum at Sangam. The maximum discharge is available in the month of July and August and decreases lowest in the month of December and January.

In the present study an attempt was made to findout the physic-chemical characteristic of the Vishav stream, at four sites-Reshinagar, Nehama, Brazloo and Khudwani, so as to have an insight into the level of pollution in the stream. In order to have reasonable and wholesome information of Vishav stream, a detailed study of the stream course was conducted on monthly basis from January to May 2009. The selection of the sites was done keeping in mind different types of habitat features i.e., elevations, fast flowing areas, slow zones, as well as human interferences.

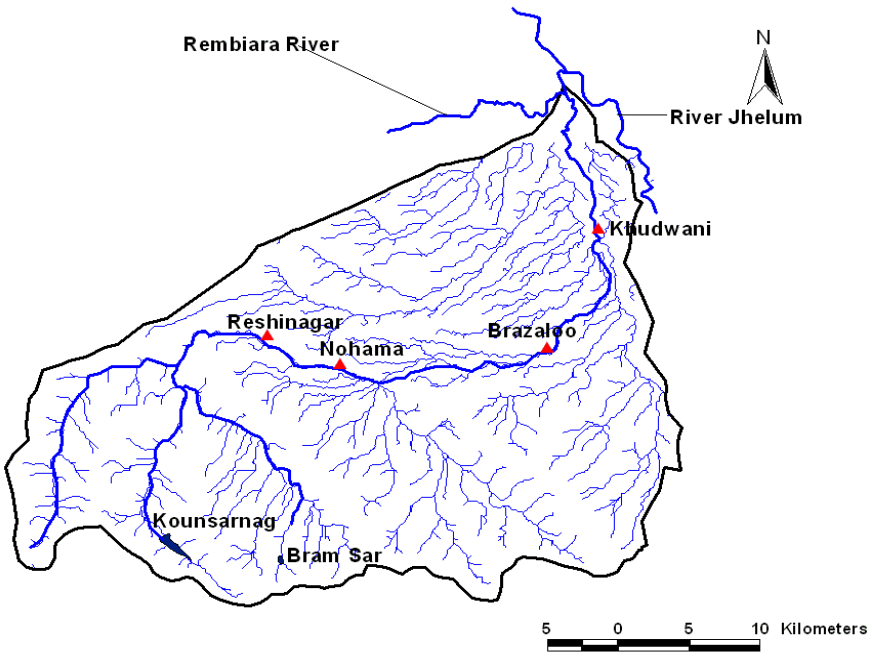

Figure 2: Drainage system of Vishav stream showing selected study areas

Collection of sample and analysis

The water samples were collected from selected sites in one liter polythene bottles. Separate samples were collected for dissolved oxygen in well stopper DO bottles of 300ml capacity. Initial fixation was done in the field and chemical analysis of water samples were carried in laboratory within 24hrs and analysis was done as per APHA (2005), Mackereth et al. (1978), Galterman and Clymo (1969).Some parameters like Transparency, tempt, depth, velocity, were made on spot at sampling sites, while rest of parameters were determined in the laboratory. The methodology used in given in a tabulated form (Table – 1).

Table 1 : Physico-chemical parameters and their methodology

S.No.	Parameters	Unit	Methodology
1	Temperature	Degree Celsius	Celsius Thermometer
2	Velocity	Centimeters/Sec	Sacchi Disc Method
3	Transparency	Meters	Sacchi Disc Method
4	pH		Digital pH meter
5	Conductivity	µs/cm	Digital conductivity meter
6	Carbon Dioxide	mg/ litre	Complexometric titration
7	Alkalinity	mg/ litre	Titrimetry with H_2SO_4
8	Dissolved Oxygen	mg/ litre	Winkler's Method
9	Chloride Content	mg/ litre	Argentometric method
10	Total Hardness	mg/ litre	Tritrimetry with EDTA
11	Calcium Content	mg/ litre	Tritrimetry with EDTA
12	Magnesium Content	mg/ litre	Tritrimetry with EDTA
13	Total Phosphorous	µg/ litre	Stannous Chloride method
14	Orthophosphate Phosphorus	µg/ litre	Stannous Chloride method $Sncl_2$
15	Nitrate-Nitrogen	µg/ litre	Salicylate method
16	Ammonical-Nitrogen	µg/ litre	Phenate method
17	Nitrite-Nitrogen	µg/ litre	Adoni's method

Results and Discussion

The water temperature shows a close proximity with prevailing air temperature. The water temperature gradually increased downstream. The increase in temperature downstream may be attributed to the decrease in altitude; the air temperature subsequently affects the water temperature. Decrease in velocity also results in an increased water temperature (Imevbore, 1970).

Table 2 : Physico-chemical characteristics of water in Vishav stream.

S.	Parameters	Sites	Months				
			January	February	March	April	May
1.	Air Temp.	I	3.5	5.0	10.5	12.0	15.0
		II	5.0	8.5	12.5	13.0	17.5
		III	7.5	11.0	14.0	17.5	20.5
		IV	10.0	13.0	16.5	18.5	23.5
2.	Water Temp.	I	2.5	3.0	5.0	9.5	10.5
		II	2.5	4.0	8.5	10.5	12.5
		III	4.0	6.0	10.5	11.5	13.5
		IV	5.0	8.0	11.5	12.0	15.5
3.	Water Velocity	I	90	105	120	150	170
		II	90	110	130	160	190
		III	60	70	90	100	120
		IV	35	42	45	52	65
4.	Transparency	I	100	100	95	98	90
		II	100	95	85	88	73
		III	90	83	70	67	56
		IV	55	67	50	46	42
5.	pH	I	6.22	6.99	6.39	7.16	7.8
		II	6.29	7.07	7.77	7.75	7.99
		III	6.35	6.83	7.90	8.25	8.55
		IV	6.54	7.92	8.54	8.66	8.69
6.	Conductivity	I	69	94	48	103	99
		II	99	86	68	99	107
		III	109	97	88	103	119
		IV	127	99	79	137	125
7.	Free carbon dioxide (CO_2)	I	2	3	4	6	6
		II	3	3	5	6	7
		III	4	4	6	6	8
		IV	6	6	7	8	9
8.	Alkalinity	I	34	39	42	27	62
		II	36	44	39	44	66
		III	42	56	68	39	50
		IV	60	72	86	45	98
9.	Dissolved oxygen (DO)	I	16.4	14.2	12.7	10.8	9.7
		II	14.8	12.0	12.1	10.3	7.3
		III	13.9	12.1	10.0	9.3	7.1
		IV	8.2	10.2	8.1	6.6	5.8
10.	Chloride content	I	3.96	4.76	6.96	5.97	9.72
		II	5.95	7.94	9.86	6.95	10.44
		III	7.95	9.90	9.94	7.92	11.22
		IV	8.95	8.99	11.9	9.99	14.03
11.	Total Hardness	I	45	65	74	78	88
		II	66	74	86	94	107
		III	69	73	84	98	112
		IV	75	87	108	112	125
12.	Calcium hardness	I	17.6	22.3	30.9	36.7	41.3
		II	20.5	23.9	29.9	37.8	44.9

		III	26.6	39.45	36.57	49.3	56.2
		IV	36.56	23.5	42.16	56.75	61.36
13.	Total phosphate Phosphorous	I	43	49	59	67	70
		II	44	50	63	75	83
		III	46	50	79	83	105
		IV	59	57	93	85	120
14.	Ortho-phosphate phosphorous	I	6.1	7.2	3.7	4.4	8.6
		II	7.9	3.9	5.8	8.71	10.9
		III	6.9	7.0	3.8	6.9	14.7
		IV	8.3	9.12	8.31	12.44	16.77
15.	Nitrate-Nitrogen	I	90	98	105	113	125
		II	97	102	115	129	155
		III	104	109	133	149	179
		IV	125	107	145	180	197
16.	Ammonical-Nitrogen	I	14.93	18.76	20.70	27.35	33.70
		II	16.03	19.57	24.70	37.65	38.43
		III	20.08	23.30	27.73	33.42	42.35
		IV	23.60	32.60	45.73	55.83	63.52
17.	Nitrite-Nitrogen	I	02	03	05	07	10
		II	02	04	08	10	14
		III	03	04	08	12	19
		IV	05	09	12	17	23

Velocity showed a clear temporal and spatial variation. The highest velocity of 190cm/s was recorded at site-II in May, the period when the glaciers and springs thaw had greatly increased adding to the volume of water in streams while lowest velocity 35cm/s at site-IV in January, was due freezing of water at higher altitudes. The current velocity showed a decreasing trend towards lower elevations. Current velocity is directly associated with the volume of water (Hynes, 1970). More the velocity, turbulent would be the flow; less the velocity, streamlines would be the flow. The low transparency at site-IV could be attributed to the runoff from immediate neighborhood being the main contributor to the flow from higher reaches. The reduction in Sacchi transparency was due to high loading of dissolved organic matter incoming sewage from catchments (Zutshi and Vass, 1972).

The pH of different sites of the stream showed considerable variations from near acidic (6.22) to slightly alkaline (8.69). The increased pH may be associated with increase in DO, produced as a result of photosynthesis (Wetzel, 1975). The stream showed increased trend for pH from January to May. The acidic pH is a feature of oligotrophic lakes, while the neutral and alkaline pH is mainly exhibited by eutrophic and mesotrophic lakes. Thus first site could be categorized as oligotraphic, second and third mesotrophic and fourth site as eutrohic. pH is directly dependent on the amount of the CO_2 present (Juday *et al*., 1980) and indirectly proportioned to the photosynthetic activity (Pandit *et al*., 2001). There was increase in conductivity of water in downstream with maximum value at site-IV which was due to high nutrient enrichment (Qadri *et al*., 1981; Bhat and Yousuf, 2004).Carbon dioxide in the stream varied from 2-9mg L^{-1} . The high value of free CO_2 content downstream is also indicative of high degree of pollution (Cole, 1979). The highest CO_2 content was found during summer. The highest mean total alkalinity was noted 72.2 mg L^{-1} at site-IV as against lowest mean value 40.4mg L^{-1} at site-I. Bicarbonates were responsible for imparting alkalinity.

The present investigation revealed that the DO content in stream was observed as 5.8mg L^{-1} to 16.4mg L^{-1} denoting the inverse relationship with the temperature and as well as with free CO_2 (Saxena *et al*., 1966, Agarwal *et al*., 1976). The lowest value of DO at site-IV may be due to increased amount of organic matter which needs oxygen for decomposition, a fact in agreement with the findings of Yousuf and Shah (1988). Low DO indicates the biodegradation of organic matter. Chloride content in water generally increased from site-I to site-IV. The increase in chloride concentration downstream is an indication of growing anthropogenic pressure chloride in water is generally due to salts of sodium, potassium and calcium. The total hardness was dominated by Ca^{2+} and Mg^{2+} and showed fluctuation temporal as well as spatial similar to total alkalinity. The highest concentration of total hardness (125mg L^{-1}) was recorded at site-IV while the lowest 45mg L^{-1} at site-I. The stream showed an increased trend of total hardness towards downstream. Calcium and magnesium showed a similar trend to that of hardness. Calcium content varied between 17.6mg L^{-1} to 61.36mg L^{-1} and magnesium fluctuated from

15.94mg L^{-1} to 27mg L^{-1}. Increase in concentration of Ca^{2+} and Mg^{2+} downstream could be related to human interference in the lower of the stream. Concentration of Ca^{2+} and Mg^{2+} was higher as compared to other cations and the usual expression was $Ca^{2+} > Mg^{++} > Na^{+}, K^{+}$.

The major sources of phosphorous and nitrogen in water are domestic sewage, agricultural effluents containing fertilizer and industrial wastes. The total phosphate phosphorus ranged from 43µgL^{-1} at site-I to 120µgL^{-1} at site-IV. The orthophosphate phosphorous recorded ranged from 6.1µgL^{-1} at site-I to 16.77µgL^{-1} at site-IV. The increased concentration may be due to excessive human interference and increased temperature resulting due to death and decomposition of living biota. The concentration of nitrogen compounds was in the progression of NO_3-N > NH_3-N > NO_2-N. Bhat (2004) also obtained similar results. The mean concentration of NO_3-N ranged from 106µgL^{-1} at site-I to 150µgL^{-1} at site-IV. The higher values at site-IV may be due to application of fertilizer of nitrogen and sewage contamination. An increased trend in concentration of NO_3-N was observed from January to May towards the lower elevation with increase in temperature. It may be due to rapid decomposition of organic matter. The high value of NH_3-N at site-IV is attributed to the consequences of decomposition of organic matter temperature control (Kaul, 1977). The nitrite-Nitrogen concentration was relatively low as compared to nitrate and ammonical nitrogen, owing to the fact that NO_2-N gets oxidized to NH_3-N. NO_2-N was present in low concentration, the maximum mean value of 13.2µg$L^{-1}$was recorded at site-IV as against the minimum mean value of 5.4µgL^{-1} at site-I. The highest value at site-IV as against the minimum mean value of 5.4µgL^{-1} at site-I. The highest value at site-IV may be associated with either oxidation of ammonia or reduction of nitrates and due to large quantities untreated sewage in stream.

Conclusion

The study showed that the deterioration of stream water quality at lower reaches as low transparency, DO and high concentration of Ca, N, P, Cl etc. all pointing towards the nutrients enrichment. Thus Vishav stream is unpolluted at upstream while as downstream it is polluted and main sources of pollution is sewage disposal from catchments area.

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References

Agarwal, D.K., Gour, S.D., Tiwari, I.C., Narayan Swami, N. and Narwash, S.M. (1976). Physico-chemical characteristic of Ganga water in Varanasi. *Ind. J. Env. Hlth.,* **18**: 201-206

APHA, (2005). Standard methods for examination of water and wastewater 21st ed. American Public Health Association, Washington D.C.

Bhat, F.A. and Yousuf, A.R. (2004). Limnological features of some lotic systems of Kashmir: in: Bio-resources, pp. 57-70.

Cole, G.R. (1979). A text Book of Limnology 2nd ed. The Mosley Co. London, New York.

Hynes, H.B.N. (1970). The ecology of running waters. Liverpool University Press Liverpool, England.

Imevbore, A.M.A. (1970). The chemistry of River Niger in Kainji reservoir area. *Arch Hydrobiol*; **67(3):** 412-431

Kaul, V. (1977). Limnological Survey of Kashmir lakes with references to tropic status and conservation. *Int. J. Ecol. Environ. Science*, **3**: 29-44.

Kumar Jitendra, Singh Siddharth and Pal Amit (2008), Water quality of Turamdih and Jaduguda uranium mines and adjacent areas, East Singhbhum, Jharkhand, *J. Ecophysiol. Occup. Hlth.* **8 :** 7-14

Mackereth, F.J. H. Haron, H. and Tulling J.F. (1978). Water analysis, Fresh Water Biol. Assoc. Sci. Publ. no. 36.

Pandit, A. K., Rathore, S. A. and Bhat, S. A. (2001). Limnological features of freshwater of Uri, Kashmir. *J. Res. Dev.,* **1:** 22-29.

Qadri, M.Y., Nagash, S.A., Shah, G.M. and Yousuf, A.R., (1981). Limnology of trout streams of Kashmir, *J. Indian Inst. Sci.,* **63**: 137-141.

Rai, U.N. and Pal, Amit (2001). Algae as indicator and mitigator of toxic metals in aquatic environment, Applied Botany Abstracts, **21 (1)**; 60-71.

Saxena, K.L., Chakras, R.N., Khan A.Q., Chattopadhya, S.N. and Chandra, H. (1966). Pollution Studies of River Ganga near Kanpur. *Environ. Health* **8(4):** 270-285.

Warhate S.R., Yenkie M.K.N., Chaudhari M.D. and Pokale W.K. (2006), Impacts of Mining Activities on Water and Soil, *Journal of Environ. Science and Engg.* **48** (2) : 81 - 88.

Wetzel, R.G. (1975). Limnology. Standard publishers, Philadelphia.

Yousuf, A.R. and Shah, G.M. (1988). Comparative Limnology of some fresh habitats of Kashmir. *Geobios,* **7**: 58-61.

Zutshi, D.P. and Vass, K.K. (1972). Limnology of high altitude Kashmir lakes. *Verh. Int. Verein. Limnol*., **18**: 599-604.