Environment Conservation Journal 7 (3): 79-84, 2006
(ISSN 0972-3099)

# Study of Water quality of River Suswa Near Raiwala, Uttaranchal

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## Abstract

The present study was performed to estimate the quality of Suswa river at Raiwala. Test for both, physico-chemical and heavy metals were carried out at different sites of the Suswa river near Raiwala.

**Key words** *: Suswa, Pollution, Physi co-chemical, status, water quality*

## Introduction

Suswa is spring fed river confluencing into the river Ganga. The water of the river Suswa is used by the people mainly to meet their daily water requirements. Raiwala is situated at the right bank of this river. The population of Raiwala is approximately 60,000 to 70,000. Recently, few hotels & recreational centers have been set up at Raiwala, just near the river bank. A few meat shop are also situated in Raiwala. The city garbage and the leftout wastes from these meat shops, hotels, restaurants and shopping complexes find their way into the river along with the domestic sewage without any prior treatment. Therefore, the quality of Suswa water gets affected, which needs a continuous monitoring to assess the impact of all the above stated activities. This assessment is a necessary step for sustaining the ecology of the Suswa river. Various scientists have investigated the quality of water of different rivers in this region. But, no such study has been conducted solubility far to assess the water quality of Suswa river. The present paper is an attempt to present the finding of the recent investigation carried out between 2003 and 2004. The may serve as a data base for future investigations. There different sites were selected on the basis of assesibility, uniformity of concentration & well mixed zone. The selected side are as below-

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|---|---|
| 1- Site A- | 5 Kms. upstream from Raiwala town. |
| 2- Site B- | Near Raiwala town |
| 3- Site C- | 5 Kms. downstream from Raiwala town. |

## Materials and Methods

The physico-chemical parameters and heavy metals (Cu, Pb, Cr, and Zn) were estimated by the following the standard methods of APHA (1989) and Trivedy and Goel (1984). The samples from all the three sites were collected on monthly basis, at the same date and time. The test for heavy metals were performed by the atomic absorption spectroscopy method using AA S .

## Result

The heavy metals and physico-chemical parameters are represented in Figure.1and Figure.2a-2f . In the Suswa river at Raiwala, a difference in the fluctuation of water temperature was maximum ($23.65^0C \pm 3.44$) observed at sampling site-B and minimum ($22.65^0C \pm 4.12$) at site-C. The water temperature showed an upward trend from winter season to summer season followed by a downward trend from monsoon season

onwards. A more or less similar trend has been observed in the river Yamuna by Chakrabarty *et al*. (1959). The fluctuation of temperature was well within the limit for survival of fishes. Similar types of fluctuations were reported by Dwivedi *et al.* (1995) in two ponds at Patna.The temperature showed negative relationship with the dissolved oxygen almost throughout the study as also reported by Das and Srivastava (1956a), Dobriyal (1985), Khanna *et al.* (1993) and Chugh (2000). Maximum average dissolved oxygen was recorded (8.74 mg/l ± 0.24) at sampling site- B and minimum (8.01 mg/l ± 0.46) at site-C. The dissolved oxygen reduced gradually from summer to monsoon season due to turbidity, which retarded the photosynthetic activity of aquatic flora.This trend was also reported by Singh *et al.* (1982) in the river Brahamputra of Guwahati. Again the dissolved oxygen increases from monsoon to winter season it was due to the activity of plankton in water, which are found more active when temperature was not too high. Similar trend was also reported by Badola and Singh (1981) in the river Alaknanda, Khanna (1993) in the river Ganga, and Chugh (2000) in river Ganga. It has been recommended that a minimum of 4 mg/l of dissolved oxygen should be maintained in water for healthy growth of fish and other microbial population. Highest values of dissolved oxygen were recorded in river Cauvery by Somashekar *et al*. (1984), and in river Kosi by Bhatt *et al.* (1984).The maximum average velocity was recorded (0.39 m/s ±0.05) at sampling site- B and minimum (0.31 m/s ± 0.02)at sampling site - A . The velocity started increasing after winter season and beyond monsoon season, the velocity started decreasing in winter. In the present study it has been observed that the velocity and the total solids showed positive relationship. Most of Indian rivers showed a similar tendency with respect to fluctuations of total solids (Kudesia and Verma, 1985). The maximum average total solids were noted (907.12 mg/l ± 255.1) at sampling site-C and minimum (745.10 mg/l ± 3.14) at site- A. The total solids were recorded minimum in winter due to gradual sedimentation of the filterable residue, at the bottom and also due to the minimum velocity of the river, which favored effective sedimentation. The total solids were maximum in monsoon season due to increased velocity, which favored soil-erosion. Similar condition was also reported by David (1956) in Bhadra river. The BOD (Biochemical oxygen demand) was observed maximum (0.81 mg/l ± 0.04)at sampling site-B and minimum (0.68 mg/l ± 0.29) in winter season. A negative relationship has been observed between BOD and DO contents. A similar pattern has been reported by Khanna (1993), Chugh (2000). BOD determination is a most useful technique to assess the level of organic pollution in river system. The maximum average value of COD (Chemical oxygen demand) was observed (3.68 mg/l ± 0.87) at sampling site-A and minimum (3.35 mg/l ± 0.65) at site- B. The carbon dioxide content of the water depends upon the temperature of water, depth of water, rate of respiration,and decomposition of organic matter in water. The carbon dioxide content of the water increases with increase in temperature. Free Carbon dioxide average value was observed maximum (3.02 mg/l ± 2.88) at sampling site-C , and minimum (2.37 mg/l ± 0.74) at site-A. Chakrabarty *et al*. (1959) recorded the maximum free $CO_2$ in Jamuna during monsoon at Allahabad. The dissolved oxygen and free carbon dioxide are usually inversely related to one another because of the photosynthetic and respiratory activities of the biota. Conductivity determines the total amount of ionisable salts in water. It is due to ionization of dissolved inorganic solids. The fluctuations in conductivity were caused mainly by variations in the ionic precipitations and the diluting effect of rains (Welch, 1948).In the present study maximum conductivity was observed (0.22siemens/cm ± 0.01) at sampling site-B and minimum (0.04 siemens/cm± 0.008) at site-C. The maximum turbidity was found (12.47 JTU ± 18.23)at sampling site-C. At sampling site-B the average value of turbidity was found minimum(10.99 JTU ± 19.56). The turbidity and total solids were closely interrelated with one another and cause common effect upon the river and aquatic life as also stated by Verma *et al.* (1984). Bhatt *et al.* (1984) attributed that during monsoon months, the river water contained large amount of silt, fine sand particles, organic matter and clay. According to Basu *et al.* (1973), the

measurement of pH has great importance because chemical and biochemical reactions in an aquatic body take place at a particular pH. The maximum average value of pH was recorded (8.11 ± 0.08) at sampling site-C,and the minimum observed (7.52 ± 0.42) at site-A. Meshram (1996) reported lower pH values during summer and higher pH during rainy season.The oxidation-reduction potential (Eh) and oxidation-reduction index ($rH_2$) showed its higher values during summer and monsoon, while lower during winters. Similar observations were also reported by Gautam (1990).The maximum value of alkalinity was observed (291.12 mg/l ± 32.43) at sampling Site C and minimum (275.33 mg/l ± 39.78) sampling site A.Similar types of findings were observed by Venkateshwarlu and Jayanti (1968) in the river Sabarmati. pH and alkalinity showed a positive correlation with one another as suggested by Freiser and Fernando (1966) in the ionic equilibria in analytical chemistry. According to Hays and Anthony (1958), the decomposition of organic matter leads to the high alkalinity of the waters. The maximum and minimum values of hardness were recorded (264.25 mg/l ± 21.73) and (247.32 mg/l ± 19.02) at sampling site A and B respectively. Hardness showed a negative relationship with chloride Chopra and Patrick (1994) observed positive relationship between chloride and hardness in river Ganga at Rishikesh. Hardness showed a positive relationship with alkalinity while Chopra and Patrick (1994) observed negative relationship in river Ganga at Rishikesh.Maximum amount of calcium in Suswa was found as (69.49mg/l ± 13.73) at site A and minimum (64.66 mg/l ± 7.73) at site B. pH and calcium showed positive relationship to one another. The value of magnesium was observed maximum (48.13 mg/l ± 4.17) at site C and minimum (37.33 mg/l ± 3.82) at site B. Singhai (1986) reported a positive correlation between magnesium and total hardness as also observed in present study. Maximum value of chlorides was observed (20.14 mg/l ± 6.58) at site B and minimum (17.99 mg/l ± 1.35) at site B. Chloride is one of the important chemical indicator of pollution. . Sengar *et al.* (1985) and Raina *et al.* (1984) also showed significant levels of chloride content.The observed low value of phosphorus are not to be taken as indication of low productivity.In the present study all the heavy metals as Lead, Copper, Chromium and Zinc were taken for observation and revealed that all heavy metals are having partial or some how positive relation with velocity and negative relation with plankton life. Concentrations of all the heavy metals in different seasons were quite favorable for the biota and not in favorable to the water quality as suggested by Mathur (1982). Heavy metals get contaminated into aquatic systems as a result of various natural activities (weathering of soils and rocks from volcanic eruptions) and from a variety of human activities involving the mining, processing or use of metals or substances.

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**Fig.1 The graph of different Heavy Meatals of River Suswa at three sampling site in the year 2003-2004**

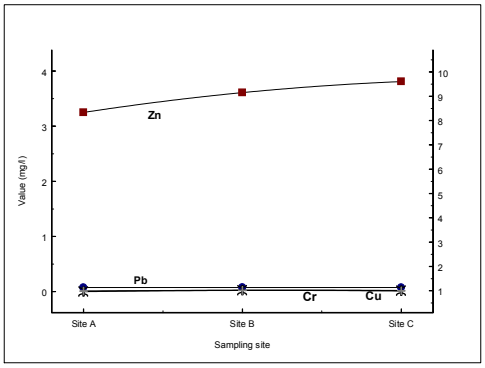
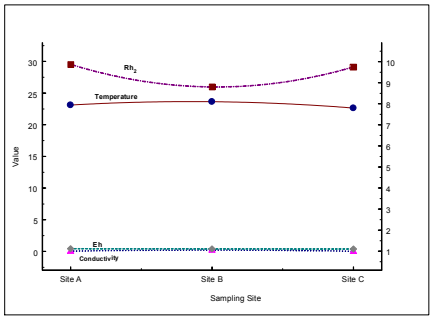
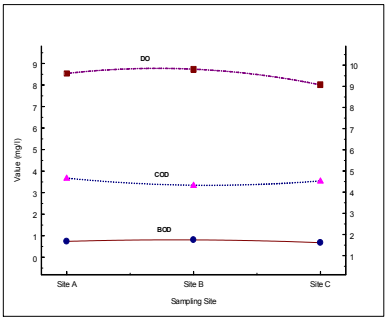


**Fig.1 The graph of different Physico- chemical Parameters of River Suswa at three sampling site in the year 2003-2004**




**a**

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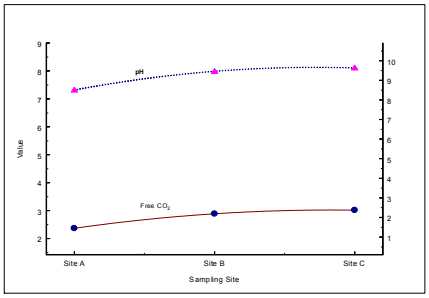


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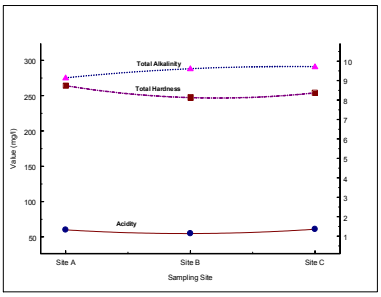


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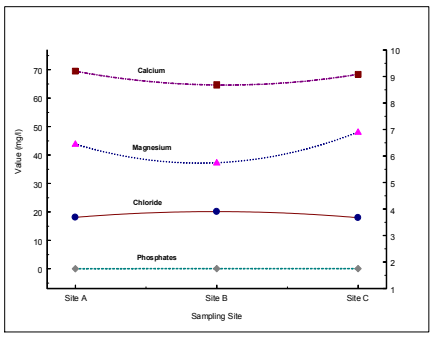


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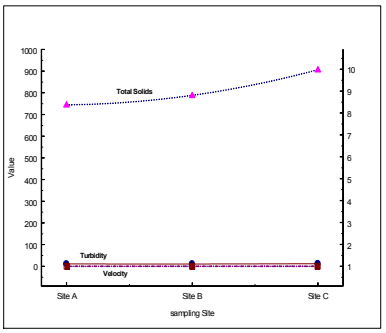


**f**