



## Physico-chemical studies of water quality in Banganga (Small River) of Shri Mata Vaishno Devi, Katra, J & K

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### Abstract

Banganga is the first major station for a yatries when they undertake their on-foot journey from Katra to Bhawan (Shri Mata Vaishno Devi). The pilgrims reach a small bridge under which flows Banganga, the legendary river associated with the miracles and legends of Mata Vaishno Devi. There is water in the river all through the year. Various physico-chemical and biological parameters were taken into consideration during the course of study, these includes colour, temperature, DO, BOD, COD, pH, total hardness, total suspended solids and Total dissolved solids. Based on the results of this study it has concluded that slight increase of pollutants in downstream of the river was observed in comparison to the upstream, hence it is an alarming position of increasing pollution load in the river.

*Keywords:* Banganga, DO, BOD, COD, TDS

### Introduction

The discharges of huge quantities of horse dung, sewage, effluents and more of the man made activities etc. have been major concern in water pollution. These effluents without proper treatment are discharged into the nearby aquatic bodies in large quantities, causing massive destruction of aquatic flora and fauna by means of suspended solids, immediate depletion in oxygen content, undesirable taste and odour creating substances and by interfering the respiratory metabolism of the animals and aquatic lives. Banganga is the place where an arrow was pierced in to the earth/ground and from where sprouted the Ganga so that the Vaishno Mata and her devotee (some believe it was Hanuman) could drink water and quench their thirst. The river originates from a 200-feet- high cliff in the Samkhal area. The legend goes that after the Goddess Mata Vaishno Devi left the Bhumika Temple, she went to the Trikuta Hills passing through here. At this time, Veer Hanuman felt thirst. The Goddess shot an arrow in to the stone and a holy river was produced, now known as Ban Ganga. It is called Ban Ganga because the Goddess Vaishno Maa washed her hair at this

place. It is about 3-km from Katra. Present days it is stream offshoot of the Ganga and there is a spot where there are steps leading down to the stream. Banganga, is considered a sacred and as in normal Hindu tradition, devotees like to bath in it before proceeding further. There are a couple of Ghats built too, for this purpose. The first one is normally very crowded and the other is comparatively more spacious. By keeping in view the importance of this river, in this investigation, the various physical, chemical and biochemical parameters of the water samples of this river were studied by taking water samples from the three different spots, two of them are bathing ghat (Ghat1 and Ghat2) and the remaining is downstream, after the bathing Ghats.

### Material and Methods

For physico-chemical analysis of water, the samples were collected from three different sites Site 1- Bathing Ghat 1, Site 2, Bathing Ghat 2 and Site 3- Downstream of the Ghats (Photo plate 1-3). The collected samples were stored in cleaned, high density polyethylene (HDPE) bottles. The use of HDPE bottles minimizes container pollution and promotes the sample preservation (Hall GEM, 1998)]. Samples were stored in refrigerator at 4 °C prior to analysis. The physico-chemical parameters

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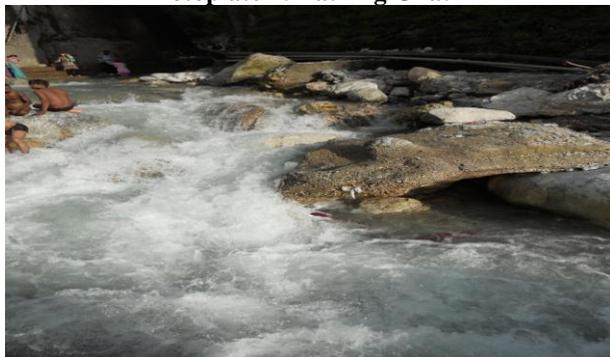
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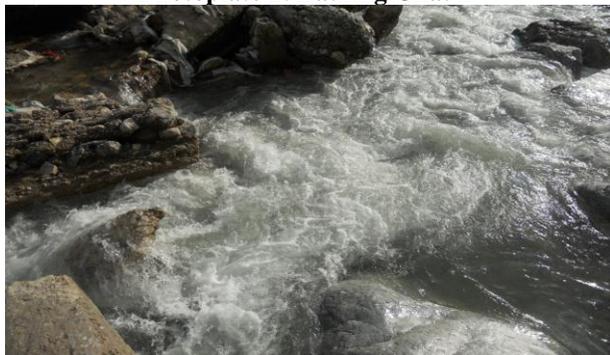
and biological parameters were analyzed following the standard methods of APHA (1998), Trivedi and Goel (1986) and Khanna and Bhutiani (2004). The temperature was recorded at the site with the help of mercury thermometer, pH were measured in the field itself using pH metre and dissolved oxygen was analyzed in the laboratory using Wrinkler's modified iodide-azide method. Chemical oxygen demand (COD) is measured by dichromate reflux method using a ferrion indicator. Hardness of sample is determined by complexometric titrations. This study was performed in the months of Jan – May 2012.



**Photoplate 1: Bathing Ghat 1**



**Photoplate 2: Bathing Ghat 2**



**Photoplate 3: Downstream of the Ghats**

## Result and Discussion

Result of Physico-chemical studies of Banganga river (Nala) at three different sites is recorded in the table 1.

The water sample at Site-1 and Site-2 were transparent in colour and at Site-3 its colour is blackish brown which may be due to release of effluent water of pilgrims. At Site-1 and Site-2 points the samples were found odourless while at Site-3, it has maximum undesirable smell but not toxic. pH value of pure water is 7 while alkalinity or acidity has effect on it. The pH at sample point Site-1 is recorded as 7.2 while at point Site-3 it is maximum i.e. 8.8. At other point Site-2 the value is less than 7.2. The higher value at Site-3 may be due chemicals (alkaline nature) present in effluent water. The total suspended solid (TSS) is a measure of degree of quality of water and its presence is objectionable in river for many reasons. In the present study the total suspended solids ranged between 20-28 mg/L, maximum was 28 mg/L at Site-3 site and minimum was 20 mg/L at Site-1 site. The high level of TDS in the effluent indicates the presence of high concentration of chlorides, sulphates, nitrates, carbonates of Ca and Mg, which contributes to high salinity in water (Pandey et al, 2002). In present investigation, TDS value varies from 2700-4000 mg/L. It is measured by evaporation of water. Hardness in water is due to mainly  $\text{Ca}^{++}$  and  $\text{Mg}^{++}$  ions present in water. The hardness of water measured from 108 mg/L to 250 mg/L. The maximum value observed is at site Site-3. Turbidity and transparency of water are reciprocal to each other. Pure water is fully transparent. Almost all samples collected at point Site-1 to Site-3 are turbid. At sampling point Site-3, turbidity is maximum (57.8) i.e. because of more suspended impurity in effluent water. BOD is a measure of amount of oxygen consumed by microorganism during the decomposition of organic matter present in water sample. In Banganga river BOD of different sites water sample is found slightly in higher range (15.0-30.0 mg/L) which indicates high proportion of organic matter, that causes depletion of dissolved oxygen in water and which are dangerous for aquatic life. Highest level of BOD at sampling site Site-3 indicates that it is most polluted by effluent. COD determines the amount of oxygen required for chemical oxidation

of organic matter using a strong chemical oxidant such as  $K_2CrO_4$  under reflux condition. In Banganga river maximum COD recorded 400 mg/L at Site-3 as it receives high pollution load in comparison to other sites. The lowest COD value observed at site Site-1 which is least polluted. Dissolved oxygen (DO) value is a measure of degree of organic matter present in water sample. Pollution by organic matter and its presence is essential to maintain variety of forms of life in water. The standard for sustaining aquatic life is stipulated at 5 mg/l, a concentration below this adversely affects on aquatic biological life and concentration below 2 mg/l may lead to death for most fishes. In the present study the highest DO value (8.0 mg/l) was found at sampling site Site-1

and lower value (4.2 mg/l) observed at site Site-3 where high effluent discharge.

The MPN (most probable number) test allows detection of presence of coliforms in a water sample and estimation of their numbers. This test consists of three steps a presumptive test, confirm test and completed test. In the present study Presumptive test was performed using five tube method. These test tubes were incubated for 24 to 48 hours and then examined for the presence of coliforms which is indicated by gas and acid production. In Site-1 and Site-2 the MPN count was found to be 6 per 100ml and 7 per 100ml respectively which is within permissible limits. In site -3 it was found to be very high 20/100ml which may be due to horse dung.

**Table: 1 Physico-Chemical properties of water at different sites of Banganga Nala**

S.No.	Parameters	Bathing Ghat-1	Bathing Ghat -2	Downstream of the Ghats
1	Temperature( $^{\circ}C$ )	18	17.8	18.5
2	pH	7.2	7.2	7.8
3	Colour	Transparent	Transparent	Blackish brown
4	T.S.S(mg/L)	20	22	28
5	T.D.S(mg/L)	2700	2900	4000
6	Total hardness(ppm)	108	140	250
7	D.O(mg/l)	8.0	6.0	4.2
8	B.O.D(mg/l)	15	19	30
9	C.O.D(mg/l)	24	25.6	64
10	MPN count of Coliforms	6	7	20

### Conclusion

In the present study, the physico-chemical and biological parameters indicated that there is a pollution load at Site -3 (downstream of the Ghats), it may be due to release of huge quantities of sewage-effluents, horse dung and some of the man made activities are being carried out thus affecting the quality of water at a faster speed. Thus, water quality is deteriorated and therefore stringent action must be taken by Municipal Corporation for its cleaning and to prevent deterioration and to protect the river ecosystem.

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