

Bacterial Population in Narmada River flowing from Omkareshwar to Badwani

Shailendra Sharma, Taniya Sengupta, Kapil Sunar

Department of Biotechnology, Shri Umiya Girls College, Mandleswar, (M.P.) India.

Abstract: A study was conducted with the objectives to isolate and identify the bacterial population in the water of the Narmada River. Samples were collected from six stations. The confluences of Narmada form the major outlets of domestic sewage and industrial effluents into the water. The presence of large numbers of Gram negative bacteria within the water is a matter of concern. The present finding indicates the urgency of detailed investigations on the aspects, especially with reference to pathogenic organisms. The paper discusses these aspects in detail.

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Introduction

River water has very rich biodiversity of bacteria because of the large quantity of dissolved organic matter present in water. Bacterial population is one of the major problems with respect to fresh water pollution. Due to the effect of temperature on the rate of a chemical reaction, one would predict that all bacteria would continue grow at lower pace as the temperature is reduced, until the system freezes. Bacterial number ranges from a few to many millions in a millimetre of water depending upon the source and the level of contamination. Inshore water of Narmada particularly the regions from Omkareshwar to Badwani are the examples of highly degraded environment because of anthropogenic perturbations and sewage discharge from various city.

The Narmada River is situated in the central part of India and is the fifth largest river in the Indian subcontinent. It forms the traditional boundary between North India and South India and flows westwards over a length of 1,312 km (815.2 mi) before draining through the Gulf of Cambay (Khambat) into the Arabian Sea, 30 km (18.6 mi) west of Bharuch city of Gujarat.[1] It is one of only three major rivers in peninsular India that runs from east to west (largest west flowing river) along with the Tapi River and the Mahi River. It flows through the states of Madhya Pradesh (1,077 km (669.2 mi)), Maharashtra, (74 km (46.0 mi)) – (35 km (21.7 mi)) border between Madhya Pradesh and Maharashtra and (39 km (24.2 mi) border between Madhya Pradesh and Gujarat and in Gujarat (161 km (100.0 mi)). The Narmada basin, hemmed between Vindya and Satpuda ranges, extends over an area of 98,796 km² (38,145.3 sq mi) and lies between east longitudes 72 degrees 32' to 81 degrees 45' and north latitudes 21 degrees 20' to 23 degrees 45' lying on the northern extremity of the Deccan Plateau. The basin

covers large areas in the states of Madhya Pradesh (86%), Gujarat (14%) and a comparatively smaller area (2%) in Maharashtra. In the river course of 1,312 km (815.2 mi) explained above, there are 41 tributaries, out of which 22 are from the Satpuda range and the rest on the right bank are from the Vindhya range.

The present paper deals with the pathogenic bacteria load of the river water collected from six stations namely Omkareshwar, Moretakka, Mandleshwar, Maheshwar, Khalghat and Badwani. According to Zinged (1999), excess organic loading, often associated with the release of untreated or partially treated domestic waste water is largely responsible for this degradation. Some bacteria such as *Pseudomonas*, *Vibrio* and *Salmonella* Species are responsible for many of diseases caused to fish and humans. Bacteria are usually considered not as the source, but as the major consumers of dissolved organic matter.

Key (1935) estimated that 15 % of the organic matter in sea water could be used by bacteria. Some bacteria are pathogenic though there are a large number of them, which are useful in medicine and industry. Mostly, Gram negative bacteria are responsible for patho-physiology or endotoxic shocks. Inshore bacteria fulfil the most valuable role of breakdown to the vast amount of sewage and other solids. In the present study, an attempt was made to study the bacterial flora present in Narmada River.

Material and methods:

The water samples were collected in the year 2010 from six stations Omkareshwar, Moretakka, Mandleshwar, Maheshwar, Khalghat and Badwani. Temperature was recorded at the sampling sites with a mercury filled Celsius thermometer. pH was recorded by pH meter and samples were brought to laboratory in sterilized bottles for further process.

Nutrient agar (HiMedia) was used for the enumeration of bacteria. Further microbial tests were conducted for identification of bacteria. Gram staining was also conducted. The bacteria were enumerated on sterilized nutrient agar by standard dilution pour plate method. Bacteria were identified from isolated colonies through morphology and staining reactions, culture characteristics and biochemical reactions.

The parameter such as temperature and pH were estimated following standard methods, APHA (2002).

Results and discussions:

The data on the hydrological parameters are given in Table 01. The temperature of water does not show much variation. It only varies from 30°C to 33°C and pH remained between 7.91 and 8.65. Data on total bacterial count of the water samples are presented in Table 02.

Moretakka shows the highest bacterial count among all six selected stations having 438000 cfu/ml

and the lowest number was 128000 cfu/ml in the Barwani station. Purushothaman (1994) had estimated 389 to 5352 cfu/ml in sea water on the coast of Thiruvanthapuram. In this case, there has been a factor which adversely affected the bacteria, the effluents from adjoining industrial establishments. Added to this is the large quantity of sewage and other effluents brought through numerous creeks into the water, Zingde (1999), which provide ample nutrition for the heterotrophic bacterial population.

The present study indicates extremely high levels of bacterial populations in the Narmada River indicating adverse effects of pollution and deterioration of the environment through the organic and inorganic pollutant that enter the water. The presence of large number of Gram negative bacteria in the water is a matter of concern. The present findings indicate the urgency of detailed investigations on these aspects, especially with reference to the pathogenic organisms in this region.

Table 01: Temperature and pH of the Water.

Sr. No	Stations	Temperature (°C)	pH
1	Omkareshwar	31	8.18
2	Moretakka	33	8.09
3	Mandleshwar	32	7.91
4	Maheshwar	33	8.22
5	Khalghat	30	8.65
6	Barwani	31	8.18

Table 02: Bacterial Population (CFU/ml) in Narmada River

Sr. No	Stations	CFU/ml
1	Omkareshwar	129000
2	Moretakka	438000
3	Mandleshwar	204000
4	Maheshwar	296000
5	Khalghat	132000
6	Barwani	128000

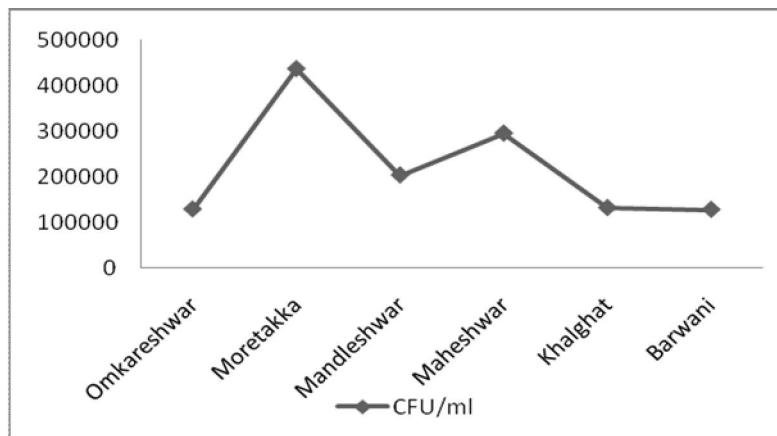


Figure 01: Bacterial population in Narmada River

Table 03(a): Result of Biochemical test

Sr. No	Genera	Name of test					
		Indole	Methyl Red	Voges-Proskauer	Citrate Utilization	Urease Production	H ₂ S Production
1	<i>Escherchia</i>	+	+	-	-	-	-
2	<i>Klebsiella</i>	-	-	+	+	+	-
3	<i>Pseudomonas</i>	-	-	-	+	-	-
4	<i>Vibrio</i>	-	-	-	+	+	-
5	<i>Enterobacter</i>	-	-	+	+	+	+
6	<i>Proteus</i>	+	+	-	-	+	+
7	<i>Salmonella</i>	-	+	-	-	-	+

Table 03(b): Results of TSI Slant

Sr. No	Genera	Reaction		Gas Production	H ₂ S Production
		On Slant	In Butt		
1	<i>Escherchia</i>	Acidic	Acidic	+	-
2	<i>Klebsiella</i>	Acidic	Acidic	+	-
3	<i>Pseudomonas</i>	Alkaline	Alkaline	-	-
4	<i>Vibrio</i>	Acidic	Acidic	-	-
5	<i>Enterobacter</i>	Alkaline	Black	-	+
6	<i>Proteus</i>	Alkaline	Black	-	+
7	<i>Salmonella</i>	Alkaline	Acidic	-	+

Acidic- Yellow colour, Alkaline- Red Colour, Black- H₂S Production

Table 05: Bacterial genera isolated from Narmada River

Sr. No	Genera	Stations					
		Omkareshwar	Moretakka	Mandleshwar	Maheshwar	Khalghat	Badwani
1	<i>Escherchia</i>	√	√	√	√	√	√
2	<i>Klebsiella</i>	×	√	×	×	√	√
3	<i>Pseudomonas</i>	√	√	√	√	×	√
4	<i>Vibrio</i>	√	×	√	√	×	√
5	<i>Enterobacter</i>	√	√	√	√	√	√
6	<i>Proteus</i>	×	√	×	×	×	×
7	<i>Salmonella</i>	×	×	√	√	×	×

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