Research Paper

Physico-chemical and Bacteriological investigation on the River Nethravathy of Dakshina Kannada District, Karnataka state in India

Biotechnology

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ABSTRACT   *River Nethravathy is a medium, perennial river, for most of the year, the river bed remains flowing thinly. The abundance of water during June to December off-sets the balance of water for all irrigation wells along the length of the river and prompted it as the chief source of drinking water Western Ghats, one of the 18 biodiversity hot spots of the world, together with the West Coast, form an important ecological region. Nethravathy is regarded as sacred river and people of Dakshina Kannada district worship it with supreme reverence. In the present investigation the water quality was studied by direct measurement of physico-chemical properties.*

Introduction

Water is the elixir of life on planet earth; it is equally fundamental for humans and ecosystems. Our planet is the only one in the solar system where liquid water can exist. The most fundamental role of water is as the blood stream of the biosphere. Water is nature's free bounty to mankind. It is the basic need for life. Improved quality of this basic need would enhance the quality of life of majority of our people, since drinking water is essential pre-requisite for quality of life everywhere in the world. Health of rural people and domestic animals directly depend on quality of water available to them. Quality of water has been attributed to affect the supply and keeping quality of several food materials and products like milk, milk products, meat, and fish and so on. The growing awareness among the urban population about potable drinking water has led to modern dimensions in the area of drinking water microbiology. Thus "pure" water has become a valued commodity. It is one of the most important gifts of nature. It is a prime natural resource, a basic human need and a precious natural asset. Water resources have been the most precious and widely exploited gifts of nature, since man evolved. Water is not merely one of the five elements of the ancient saying but it is one of the basic resources of civilizations and forms the life line of all living organisms on earth. Of the total amount of about 1500 millions km3 of water in the hydrosphere, 95% occurs in sea, 4% is frozen as snow, ice and hail in mountains while only 1% is available for human activities. It is confined in ground water, rivers, lakes, soil profile, atmospheric and biological system (Sharma and Kaur, 1998).

The population explosion in the world has resulted in an increase in the area of polluted soil and water. As the number of people continues increasing day by day it also brings with it a growing pressure on air, water and land resources. In order to cater to the demands of the people, the rapid expansion of industries, food, health care, vehicles, etc. is necessary. But it is very difficult to maintain the quality of life with all these new developments, which are unfavourable to the environment in which we live, if proper management is not applied. Matsuoka and Shirai (1996) noticed that the pollution loads of suspended solids, COD, total phosphorous and total nitrogen showed significant increase in raining days in a river flowing through a city in mile Prefecture, Japan Uno and lakes. Paffoni and Krier (1996) analyzed the reasons for heavy fish mortalities that occurred in the river Seine, after severe storm events, caused by a combination of a low rate, a high river temperature and significant discharges of excess sewage water resulting in a dissolved oxygen

decrease. Sabahita *et al.,* (1998) conducted a study to evaluate the quality of Tunga river water and adjoining ground water. Soil samples from the river bank were collected to assess the permeability of pollutants and its contamination properties. This study indicated that the groundwater is polluted near the river than the farthest distance.

The quality of Parvati River (India) water was assessed to study its suitability for drinking purposes, by Tejraj and Praveen (1998). Since the river is situated in the forest area, the death and decay of vegetation and animals in and around the river site contribute to pollution. Dissolved Oxygen (DO) was less at the bottom of the river as compared to surface layer, due to biological activities and presence of decayed organic material. BOD and COD were higher in the bottom layer as compared to surface, indicating that hypolimnionic zone of the river is more polluted than that of the surface layer.

In the present investigation we studied the various physico-chemical characteristics include colour, appearance, temperature (Water and Atmosphere), topography of the river, turbidity, Biological oxygen demand (BOD), Chemical oxygen demand (COD), Dissolved Oxygen, nitrate, sulphates, phosphates, total hardness as $CaCO_3$ Total alkalinity, sodium, potassium, Oil and grease, periodical analysis of heavy metals like iron, manganese, aluminum, nickel, cobalt, chromium, total dissolved solids of the river Nethravathy starting from Kajoor at the foot hills of Western Ghats to the downstream of Dondole of Belthangady Taluk of Dakshina Kannada Dist., Karnataka state in India..

Materials and Methods:
Sampling stations
The present study area covered a stretch of 25 km. of the river Nethravathy starting from Kajoor at the foot hills of Western Ghats to the downstream of Dondole of Belthangady Taluk of Dakshina Kannada Dist., Karnataka state in India. The river receives untreated domestic sewage discharge at some locations. The human and animal excreta along with agricultural wastes were brought into the river with run off waters.

The sampling locations selected for the study are as follows:
A. Station-I (S1)
It is apparently an uncontaminated area known as Kajoor. This site receives natural run off only. Serene forests, agricultural and horticultural yards are found on either side of the banks. This station located very close to the range of Western Ghats.

B. Station-II (S2)
It is also pollutant non-discharge area at a place called Nidigal. The downstream of the river Nethravathy at this location, has been chosen for sample collection. The river bank is having intensive plantations of Coconut, Arecanut and Musa. The river bed is also widely used for the cultivation of vegetables, in summer season. It is slightly disturbed by cattle's, human activities like washing clothes, bathing and for other daily needs. This station receives inconsistent discharge of domestic sewage.

C. Station-III (S3)
This location is situated at bathing ghat near Dharmasthala, a famous pilgrimage centre in India. This part of the river is used for anthropogenic activities like bathing, washing clothes, and washing of vehicles. Occasionally people come to the river for performing last rites.

D. Station -IV (S4)
This is the downstream of a village called Dondole. Here the river is less contaminated, as it flows in between huge rocks. Even the river banks here are thatched by dense vegetation. Three samples are collected from each station at three different depths of 12 inches viz. S -1 A, S -1 B and S -1 C.

Sample collection
Physico-chemical analysis was done twice in a month to know the quality of river water from all the four designated sampling stations. Suitable standard methods of APHA (1995) were used for physico-chemical analysis. The study period was divided into three seasons; pre monsoon (February to May), monsoon (June to September), post monsoon (October to January). Water samples were collected from each of the four stations from July 2004 to June 2007, periodically once in a month.

Sampling procedure and analysis of various physico-chemical parameters:

3. a Sampling and storage
Certain physical parameters like air and water temperature and pH were recorded at the spot of collections. For the estimation of dissolved oxygen (DO), samples were collected in separate sterilized 300ml BOD bottles at each site and fixed immediately using Winkler's reagent and later analyzed in the laboratory. In addition to this raw sample, samples acidified with sulphuric acid and nitric acids were collected in three separate sterile polythene bottles of 500 ml each. Sample with Nitric acid was used for analysis of metals after reducing the volume to 50 ml. Sample with sulphuric acid was used for the analysis of BOD and raw samples for immediate analysis in the laboratory for acidity, alkalinity and inorganic anions. All the samples were properly labeled and kept and transported in an ice box to the laboratory for further analysis of various physico-chemical parameters. In all the cases, the final results were calculated by taking an average of at least three consecutive readings.

3. b Analysis of physico chemical characteristics of water
Most of the physico-chemical parameters were analyzed using the standard methods given in APHA (1995) except where mentioned. Physico-chemical analysis is the prime consideration to assess the quality of water for its best usage. The following physico-chemical parameters were determined as shown in Table 1.

Table 1. Physico-chemical parameters, methods and references

Sl. No	Parameter	Method	Reference
1.	Air Temperature	Thermometric	Gupta, (1999)
2.	Water Temperature	Thermometric	Gupta, (1999)
3.	Turbidity	Nephelometric turbidity meter	APHA (1995)
4.	pH	Universal pH paper and global digital pH meter (DPH-500)	Trivedy et al., (1998)
5.	Dissolved solids	Evaporation and weighing method	APHA (1995)
6.	Sulphates	Nephelometric method	APHA (1995)
7.	Total Hardness	EDTA Titrimetric method	APHA (1995)
8.	Alkalinity	Titrimetric method	APHA (1995)
9.	Nitrate nitrogen	Phenol disulphonic method	Saxena, M.M. (1990)
10.	Dissolved oxygen	Winkler's method with Azide modification	APHA (1995)
11.	BOD	Standard method with dilution	APHA (1995)
12.	COD	Dichromate open reflux method	APHA (1995)
13.	Phosphate	Stannous chloride method	APHA (1995)
14.	Sodium	Flame photometric method	Saxena, M.M. (1990)
15.	Heavy metals		
	a. Iron	Atomicabsorption spectro-photometer method	APHA (1995)
	b. Manganese		
	g. Nickel		
	i. Chromium		
	j. Mercury		

Microbial enumeration
The total microbial count in representative water samples, using the standard serial dilution and nutrient agar- plate counting techniques (Lorch *et al.*, 1995). The same was inoculated on to Sabouraud Dextrose Agar (SDA) to which 0.5ml antibacterial agent was incorporated. The plates were incubated at 30°C for 24 h and the colony counting done thereafter using electronic colony counter and the colony forming units (CFU) per ml of the original broth culture determined. Twenty different isolated colonies (six from each sample) were inoculated into the synthetic mineral salt media (SMS media) containing Anthracene at a concentration of 5mg/ml of acetone in 50 ml media. The procedure was repeated to check the activity against Naphthalene at same concentration. The activity was monitored for every 24 hours up to three days. The isolates showing maximum degradation were identified and taken for further analysis.

Results and discussion:
The permissible levels of various parameters in drinking water quality standards prescribed by Bureau of Indian Standards (BIS) and World Health Organization (WHO) are presented in Table 2.

Table 2: Drinking water quality standards (BIS and WHO)

Sl. no	Parameters	BIS (1998)		WHO (1998)	
		P	E	P	E
1.	pH	6.5	9.2	6.5	8.5
2.	Electrical conductivity	1000	2250	-	-
3.	Turbidity	5	25	5	25
4.	Dissolved Oxygen	4	6	4	6
5.	Chlorides	250	1000	200	600
6.	Calcium	75	200	75	200
7.	Total hardness	300	600	-	-
8.	Magnesium	30	100	50	150
9.	Total alkalinity	200	600	200	600

10.	BOD	2	3	-	3
11.	COD	-	10	-	10
12.	Total Solids	500	1000	300	600
13.	Free CO_2	-	-	-	-
14.	DOM	-	-	-	-
15.	Sulphates	200	400	200	400
16.	Phosphates	-	-	-	-
17.	Sodium	-	-	-	-
18.	Potassium	-	-	-	-
19.	Iron	0.3	1.0	0.3	1.0
20.	Nitrites	-	-	-	-
21.	Nitrates	10	45	10	45
22.	Lead	0.05	0.05	0.05	0.05
23.	Copper	0.05	1.5	0.05	1.0
24.	Zinc	5	15	-	15
25.	Cadmium	0.01	0.01	0.01	0.01
26.	Cobalt	-	-	-	-
27.	Nickel	-	-	-	-

All the parameters are in mg/L except pH, Electrical conductivity (μmho/cm) and Turbidity (NTU).

P = Permissible limit, E = Excessive limit.

The various physico- chemical parameters viz., atmospheric temperature, water temperature, turbidity, pH, free carbon dioxide, dissolved oxygen, biological oxygen demand, chemical oxygen demand, total hardness, sodium, potassium, total alkalinity, nitrate, sulphate, phosphate, iron, manganese, aluminium, nickel, cobalt, chromium, total dissolved solids have been evaluated and the results are presented in table 3, 4, 5 and 6.

The Air temperature ranged from a minimum of 28.6°C and a maximum of 34.6°C at S2 during May 2005 and April 2007 respectively. The values recorded during July 2004 to June 2007. The water temperature at all the four sampling stations during July 2004 to June 2007, the study period, showed spatial as well as seasonal variations according to the climate conditions and it ranged from a minimum temperature of 24°C at S1 during December 2005 in the post monsoon season while the maximum of 28.4°C was recorded at S2 during May 2006 in the pre monsoon season have been presented in table 3, 4, 5and 6. The turbidity values ranged from a minimum of 2.2 NTU at S2 and S3 during March and April 2007 respectively to a maximum of 36 NTU at S3 during July 2005. Season wise average values fluctuated from a minimum of 3.22 NTU at S1 during pre monsoon season and a maximum of 27.65 NTU at S4 during monsoon season.

During the present study period (July 2004 to June 2007), pH at all stations was generally observed to be neutral to alkaline and ranged from a minimum of 6.2 at S3 during March 2005 and November 2006 and a maximum of 7.88 at S4 during May 2005 (Table 3 to 6). Free CO2 values fluctuated from a minimum of 0.0 mg/L to a maximum of 0.72 mg/L at S3 during April 2005 (Table 3-6). If the yearly average is taken into consideration, high values are recorded at S3 (0.33 mg/L) during July 2004-05 and lowest at S1 (0.0 mg/L). In the present investigation, DO values fluctuated from a minimum of 4.6 mg/L at S3 during April 2005 to a maximum of 9.4 mg/L at S1 during July 2004. Studies done by Paffoni and Krier (1996) revealed that excess sewage water results in a decrease in dissolved oxygen. The present investigation also finds a similar observation i.e., the maximum value recorded at S3 contaminated with anthropogenic activities.

BOD is the prime parameter to give an idea of the biodegradability of any sample and self purification capacity of rivers and streams. Ordinary domestic sewage may have a BOD of 200 mg/L. Any effluent to be discharged into natural water bodies of water should have BOD less that 30 mg/L. Drinking water usually has a BOD of less than 1 mg/L and water is considered fair up to 3 mg/L of BOD. But when BOD value reaches 5 mg/L, the water is doubtful in purity. The BOD values in the present study, ranged from a minimum of 0.04 mg/L at S1 during July 2004, December 2004 and January 2005 to a maximum of 2.87 mg/L at S3 during April 2005 and COD values fluctuated from a minimum of 0.22 mg/L at S1 during September, October 2004, August and September 2006 to a maximum of 3.24 mg/L at S3 during April 2005 (Table 3-6). And the total hardness content fluctuated from a minimum of 40.0 mg/L at S4 during July 2006 to a maximum of 80.0mg/L at S3 during April 2005.

Total alkalinity values fluctuated between a minimum 18.0 mg/L at S1 during December 2005, November 2006 and maximum of 29.8 mg/L at S3 during August 2004, September 2005. From the three yearly averages are taken into consideration and it was noted that 20.58 mg/L is the lowest value recorded at S1 between July 2005 to June 2006 and maximum of 28.68 has been recorded at S3 between July 2004 to June 2005.

The content of nitrate in the present study varied between a minimum of 1.04 mg/L at S1 during December 2006 and a maximum of 4.36 mg/L at S3 during September 2004 and sulphate content ranged between a minimum of 11.4 mg/L at S4 during September, October, November 2004, August, September 2005, July, August 2006 and a maximum of 18.40 mg/L at S3 during April 2005 (Table 3-6). Phosphate is an essential nutrient for the growth and development of flora in any ecosystem. Phosphates concentration of above 2 ppm can be considered as an indicator of pollution (Ahipathy, 2002). The levels of phosphate in river Nethravathy at different locations during three years of study are presented in table 3-6. The monthly values of phosphates ranged from a minimum of 0.04 mg/L at S1 to a maximum of 0.82 mg/L at S3 during April 2005. Sodium concentration in the present study varied from a minimum of 10.2 mg/L at S2 during October 2004 to a maximum of 25.8 mg/L at S3 during April 2005 and Potassium content fluctuated from a minimum of 5.48 mg/L at S1 during June 2007 to a maximum of 11.88 mg/L at S3 during March 2005 (Table 3-6).

An attempt has been made to quantitatively assess the various heavy metals i.e., Iron (Fe), Manganese (Mn), Aluminium (Al), Nickel (Ni), Cadmium (Cd), Cobalt (Co) and Chromium (Cr). It is observed that heavy metal load of the river Nethravathy is below detectable level in the present study in all the stations studied. This could be attributed to the fact that the river stretch under study is not contaminated with industrial discharges. At last the Total dissolved solids in the present investigation varied between a minimum of 18mg/L at S2 during May 2006 and a maximum of 45mg/L at S3 during August 2004 (Table 3-6).

Table 3. Physico-chemical parameters of station-I (July 2004 to June 2007)

	Parameters	AT	WT	TUR	pH	CO_2	DO	BOD	COD	TH	Na^+	K^+	T.Al	NO_3^-	SO_4^{2-}	PO_4^{3-}	Fe	Mn	Al	Ni	Co	Cr	TDS
	July-04	31.0	27.0	29.3	7.20	00	9.40	0.04	0.26	46	14.6	8.24	23.6	1.06	12.8	0.06	-	-	-	-	-	-	35
	Aug-04	31.0	26.2	21.0	6.94	00	8.86	0.06	0.24	42	14.8	7.28	22.6	1.22	13.8	0.08	-	-	-	-	-	-	32
	Sept-04	32.0	26.0	16.4	6.96	00	8.88	0.06	0.22	48	14.6	7.28	22.4	2.88	13.4	0.08	-	-	-	-	-	-	38
	Oct-04	30.0	26.0	8.4	6.92	00	8.20	0.24	0.22	46	14.8	7.26	22.4	2.4	12.4	0.08	-	-	-	-	-	-	24
	Nov-04	30.0	25.0	8.8	6.94	00	8.40	0.24	0.24	48	15.8	7.24	22.8	2.2	12.4	0.08	-	-	-	-	-	-	21
	Dec-04	31.0	26.0	10.2	6.82	0.0	8.80	0.06	1.24	58	16.8	8.66	18.8	2.14	14.4	0.22	-	-	-	-	-	-	27
	Jan-05	32.0	25.0	8.0	7.20	0.0	8.80	0.16	1.24	66	16.6	7.66	18.2	1.16	14.4	0.22	-	-	-	-	-	-	28
	Feb-05	30.0	26.8	4.6	7.20	0.0	8.44	0.60	1.26	60	16.8	6.40	20.2	1.14	12.6	0.04	-	-	-	-	-	-	24
	Mar-05	31.2	26.5	2.8	6.98	0.0	7.80	1.22	1.62	66	15.8	8.4	20.4	2.00	12.0	0.08	-	-	-	-	-	-	25
	Apr-05	30.0	26.4	2.8	7.80	0.0	6.44	1.40	1.60	68	15.6	8.22	20.6	1.16	12.8	0.08	-	-	-	-	-	-	22
	May-05	32.0	25.2	6.4	7.40	0.0	6.40	1.66	2.10	64	15.4	8.26	20.4	1.44	12.4	0.08	-	-	-	-	-	-	24
	Jun-05	30.0	25.0	24.6	7.40	0.0	8.86	0.08	1.00	44	18.6	7.44	24.2	1.48	14.6	0.24	-	-	-	-	-	-	28
	July-05	31.0	25.2	28.4	7.80	0.0	9.24	0.06	1.00	48	12.6	7.62	20.6	2.48	14.0	0.26	-	-	-	-	-	-	38
	Aug-05	30.0	25.0	22.6	7.20	00	9.22	0.04	0.24	52	14.82	7.62	20.6	3.04	14.8	0.32	-	-	-	-	-	-	39
	Sept-05	31.0	25.4	18.0	7.40	0.0	9.20	0.04	0.72	58	14.6	7.60	22.0	3.08	14.2	0.30	-	-	-	-	-	-	30
	Oct-05	30.0	25.0	10.2	6.90	00	8.2	0.06	0.68	48	14.8	7.20	22.4	3.06	14.2	0.08	-	-	-	-	-	-	32
	Nov-05	31.0	25.0	10.4	6.90	00	8.86	0.08	0.74	48	14.8	6.20	22.0	2.08	14.0	0.08	-	-	-	-	-	-	22
	Dec-05	31.0	24.0	10.8	7.40	0.0	8.88	0.44	0.98	42	12.8	7.00	18.0	3.06	14.2	0.22	-	-	-	-	-	-	28
	Jan-06	31.4	25.2	9.2	7.28	0.0	8.86	0.08	0.66	62	16.0	7.62	18.2	2.22	14.4	0.32	-	-	-	-	-	-	24
	Feb-06	31.0	25.0	6.8	7.24	0.0	8.20	0.62	1.28	64	16.2	7.10	20.0	1.28	12.4	0.04	-	-	-	-	-	-	21
	Mar-06	30.2	26.4	6.4	7.24	0.0	7.42	1.24	1.60	64	15.8	7.40	20.4	1.48	13.8	0.08	-	-	-	-	-	-	24
	Apr-06	31.0	26.8	3.2	7.84	0.0	6.40	1.40	1.60	66	16.2	7.22	20.0	2.32	13.4	0.08	-	-	-	-	-	-	27
	May-06	32.0	26.2	3.0	7.44	0.0	6.32	1.66	1.92	66	15.54	7.28	18.2	2.30	12.4	0.08	-	-	-	-	-	-	25
	Jun-06	31.2	24.2	20.4	6.80	00	8.84	0.20	0.82	46	18.6	6.44	24.6	3.34	12.4	0.24	-	-	-	-	-	-	24
	July-06	31.0	24.2	32.0	6.94	00	9.20	0.06	0.24	42	14.8	7.28	22.6	3.08	12.4	0.24	-	-	-	-	-	-	36
	Aug-06	32.0	26.0	26.0	6.96	00	9.20	0.06	0.22	48	14.6	7.24	22.4	3.24	12.4	0.32	-	-	-	-	-	-	42
	Sept-06	30.0	25.0	20.0	6.92	00	9.28	0.06	0.22	46	14.8	6.26	22.4	3.12	14.4	0.32	-	-	-	-	-	-	34
	Oct-06	30.0	26.0	12.0	7.40	0.0	8.20	0.24	1.04	44	18.6	6.60	24.2	2.06	14.6	0.24	-	-	-	-	-	-	33
	Nov-06	30.0	24.3	14.0	7.40	0.0	9.20	0.44	1.22	42	12.8	6.84	18.0	2.08	14.0	0.24	-	-	-	-	-	-	24
	Dec-06	31.0	25.2	10.8	7.28	0.0	9.28	0.08	0.68	62	16.0	7.04	18.2	1.04	14.8	0.32	-	-	-	-	-	-	22
	Jan-07	31.4	25.0	8.2	7.24	0.0	8.2	0.62	1.20	64	16.2	7.40	20.0	2.24	14.4	0.30	-	-	-	-	-	-	25
	Feb-07	30.0	25.0	3.4	7.20	0.0	8.44	0.60	1.26	60	16.8	7.44	20.2	1.22	12.6	0.04	-	-	-	-	-	-	21
	Mar-07	30.2	26.1	2.3	7.24	0.0	7.42	1.24	1.90	64	15.8	7.60	20.4	2.26	12.4	0.22	-	-	-	-	-	-	28
	Apr-07	31.0	25.4	2.4	7.80	0.0	6.44	1.40	1.88	68	15.6	7.62	20.6	2.32	14.4	0.32	-	-	-	-	-	-	27
	May-07	32.0	24.6	4.8	7.34	0.0	6.32	1.66	2.20	65	15.54	7.60	18.2	2.4	14.2	0.24	-	-	-	-	-	-	24
Months	Jun-07	31.8	24.2	19.8	7.21	00	8.2	0.20	0.82	46	15.8	5.48	24.6	2.98	14.5	0.29	-	-	-	-	-	-	27.8
	Avg	30.87	25.43	12.45	7.22	0.0	8.28	0.51	1.01	54.75	15.56	7.30	20.98	2.16	13.47	0.17	-	-	-	-	-	-	27.77
	Min	30°C	24.0	2.0	6.8	0.0	6.32	0.04	0.22	42	12.6	5.48	18.0	1.04	12.0	0.04	-	-	-	-	-	-	21
	Max	32°C	27.0	32.0	7.84	0.0	9.40	1.66	2.2	68	18.60	8.66	24.6	3.34	14.8	0.32	-	-	-	-	-	-	42

All the parameters are expressed in mg/L except temperature (°C), pH and TUR (NTU)

AT= Atmospheric temperature, WT= Water temperature, TUR= Turbidity, CO_2= Free carbon dioxide, DO= Dissolved oxygen, BOD= Biological oxygen demand, COD= Chemical oxygen demand, TH= Total hardness, Na+= Sodium, K+= Potassium, T.Al= Total alkalinity, NO3-= Nitrate, SO42-= Sulphate, PO43-= Phosphate, Fe= Iron, Mn= Manganese, Al= Aluminium, Ni= Nickel, Co= Cobalt, Cr= Chromium, TDS= Total dissolved solids

Table 4. Physico-chemical parameters of station-II (July 2004 to June 2007)

	Parameters	AT	WT	TUR	pH	CO_2	DO	BOD	COD	TH	Na^+	K^+	T.Al	NO_3^-	SO_4^{2-}	PO_4^{3-}	Fe	Mn	Al	Ni	Co	Cr	TDS
	July-04	32.0	25.0	30.2	6.9	0.12	6.98	0.76	1.42	60	17.6	6.24	27.6	3.08	14.6	0.07	-	-	-	-	-	-	40
	Aug-04	32.0	25.2	26.0	6.7	0.14	6.82	0.88	1.68	68	18.5	7.28	26.8	3.12	14.8	0.08	-	-	-	-	-	-	42
	Sept-04	32.4	25.6	18.0	6.6	0.22	6.64	0.96	1.88	58	18.4	7.24	27.6	4.14	14.8	0.06	-	-	-	-	-	-	35
	Oct-04	32.8	26.0	10.2	6.82	0.0	8.80	0.68	1.24	48	10.2	8.24	18.4	4.16	12.8	0.07	-	-	-	-	-	-	34
	Nov-04	32.8	26.2	9.0	6.95	0.00	6.66	0.84	1.74	58	16.4	8.20	24.6	3.16	14.8	0.14	-	-	-	-	-	-	32
	Dec-04	32.6	25.0	10.8	6.90	0.00	6.80	0.94	1.86	60	16.4	9.20	24.6	3.18	14.8	0.28	-	-	-	-	-	-	30
	Jan-05	32.2	25.2	10.0	6.88	0.00	6.66	0.94	1.48	62	16.8	9.22	24.8	2.17	14.8	0.24	-	-	-	-	-	-	26
	Feb-05	30.4	26.0	4.8	6.84	0.14	6.66	1.2	1.88	74	17.64	9.14	24.2	2.18	12.6	0.06	-	-	-	-	-	-	26
	Mar-05	31.4	28.4	2.8	7.04	0.18	6.44	2.2	2.36	78	17.0	9.24	24.6	2.18	14.0	0.08	-	-	-	-	-	-	30
	Apr-05	33.0	27.2	3.2	6.96	0.24	5.40	2.50	2.72	74	18.5	8.40	24.6	2.14	14.8	0.08	-	-	-	-	-	-	27
	May-05	28.6	28.2	6.6	6.80	0.26	5.42	2.54	2.74	70	18.40	8.46	24.8	2.12	14.8	0.08	-	-	-	-	-	-	21
	Jun-05	32.0	26.0	26.0	6.88	00	7.24	0.26	1.22	60	16.4	5.84	27.6	3.16	15.8	0.16	-	-	-	-	-	-	22
	July-05	30	25.0	32.0	7.22	0.10	6.98	0.76	1.82	60	16.8	6.00	24.6	3.26	15.8	0.18	-	-	-	-	-	-	34
	Aug-05	31	25.0	26.0	6.8	0.10	6.82	0.84	1.56	68	16.44	6.20	26.8	4.27	18.0	0.34	-	-	-	-	-	-	39
	Sept-05	30	24.5	20.6	7.22	0.22	6.64	0.80	1.64	58	16.20	6.88	27.60	4.24	14.0	0.30	-	-	-	-	-	-	37
	Oct-05	32	25.0	12.0	7.40	0.00	6.60	1.96	2.42	68	14.4	7.12	26.6	3.18	16.4	0.04	-	-	-	-	-	-	36
	Nov-05	32.8	25.0	10.8	6.88	0.00	6.60	1.94	2.44	58	16.0	6.98	24.8	2.16	15	0.14	-	-	-	-	-	-	33
	Dec-05	32	25.0	12.0	7.22	0.00	6.80	2.45	2.80	60	16.0	9.22	24.0	2.44	16.8	0.24	-	-	-	-	-	-	29
	Jan-06	32.2	25.0	10.0	6.8	0.00	6.64	2.59	2.60	62	16.4	9.20	24.8	2.62	16.2	0.22	-	-	-	-	-	-	25
	Feb-06	32.6	25.2	6.2	7.2	0.00	5.42	1.94	2.56	70	17.64	9.68	24.6	3.00	14.8	0.16	-	-	-	-	-	-	26
	Mar-06	31.0	27.2	6.0	7.02	0.12	5.47	1.24	2.40	73	16.84	9.20	22.0	2.88	14.8	0.22	-	-	-	-	-	-	20
	Apr-06	31.4	28.0	3.8	7.44	0.26	5.35	2.44	2.62	72	17.75	9.24	20	2.10	14.8	0.18	-	-	-	-	-	-	21
	May-06	32.4	28.4	3.6	6.82	0.28	5.40	2.64	2.72	70	17.05	8.24	20	2.64	14.0	0.21	-	-	-	-	-	-	18
	Jun-06	32.0	26.1	24.0	6.88	0.30	6.40	0.84	1.82	64	16.80	7.34	27	3.22	16.6	0.28	-	-	-	-	-	-	22
	July-06	30.0	26.0	32.8	6.97	0.27	6.40	0.88	1.66	74	16.0	8.48	24	3.42	16.7	0.16	-	-	-	-	-	-	26
	Aug-06	31.0	25.4	28.0	7.02	0.31	5.30	0.84	1.78	72	16	8.15	25	4.02	16.4	0.22	-	-	-	-	-	-	40
	Sept-06	32.0	26.0	22.0	7.0	0.36	5.30	0.90	1.88	72	16.4	9.50	26.1	4.00	16.3	0.20	-	-	-	-	-	-	39
	Oct-06	31.0	26.8	14.0	6.99	0.29	6.49	1.54	2.32	75	16.20	9.89	24.8	4.24	15.62	0.29	-	-	-	-	-	-	28
	Nov-06	30.0	25.1	10.0	7.04	0.18	5.96	2.20	2.40	73	16.8	9.62	24.6	3.10	16.07	0.59	-	-	-	-	-	-	34
	Dec-06	31.0	25.2	12.0	7.26	0.22	6.15	2.29	2.58	69	17.0	8.46	25.0	3.00	15.92	0.46	-	-	-	-	-	-	32
	Jan-07	31.5	26.0	8.4	7.05	0.26	6.00	2.32	2.74	72	17.25	6.21	24.11	2.88	16.46	0.51	-	-	-	-	-	-	33
	Feb-07	32.0	26.5	3.8	7.17	0.32	5.45	2.86	3.00	70	17.08	8.44	24.26	2.20	14.0	0.30	-	-	-	-	-	-	30
	Mar-07	34.0	26.8	2.6	7.00	0.25	6.44	2.16	2.48	78	16.62	8.66	25.34	2.60	15.8	0.18	-	-	-	-	-	-	24
	Apr-07	34.6	27.6	2.2	6.92	0.33	6.56	2.49	2.68	78	17.58	9.00	25.69	2.10	16.1	0.19	-	-	-	-	-	-	22
Months	May-07	33.0	28.0	4.8	7.08	0.14	6.03	2.54	2.60	79	17.46	8.42	25.00	1.48	15.85	0.23	-	-	-	-	-	-	20
	Jun-07	31.0	25.6	20.0	6.98	0.35	6.49	0.94	1.88	70	16.93	6.38	25.36	1.98	16.2	0.48	-	-	-	-	-	-	32
	Avg	31.74	26.06	13.47	6.99	0.16	6.33	1.62	2.18	67.63	16.71	8.14	24.78	8.93	15.12	0.21	-	-	-	-	-	-	29.27
	Min	28.6	24.5	2.2	6.6	0.0	5.30	0.26	1.22	48	10.20	5.84	18.4	1.48	12.60	0.04	-	-	-	-	-	-	18
	Max	34.6	28.4	32.8	7.44	0.36	8.80	2.86	3.0	79	18.5	9.89	27.6	4.27	18.00	0.34	-	-	-	-	-	-	42

All the parameters are expressed in mg/L except temperature (°C), pH and TUR (NTU)

AT= Atmospheric temperature, WT= Water temperature, TUR= Turbidity, CO_2= Free carbon dioxide, DO= Dissolved oxygen, BOD= Biological oxygen demand, COD= Chemical oxygen demand, TH= Total hardness, Na+= Sodium, K+= Potassium, T.Al= Total alkalinity, NO3-=

Nitrate, SO_4^{2-}= Sulphate, PO_4^{3-}= Phosphate, Fe= Iron, Mn= Manganese, Al= Aluminium, Ni= Nickel, Co= Cobalt, Cr= Chromium, TDS= Total dissolved solids

Table 5. Physico-chemical parameters of station-III (July 2004 to June 2007)

	Parameters	AT	WT	TUR	pH	CO_2	DO	BOD	COD	TH	Na^+	K^+	T.Al	NO_3^-	SO_4^{2-}	PO_4^{3-}	Fe	Mn	Al	Ni	Co	Cr	TDS
	July-04	32.4	26.6	36.0	7.02	0.28	5.66	1.28	1.80	66	22.4	9.23	29.6	3.28	15.60	0.44	-	-	-	-	-	-	44
	Aug-04	31.0	26.8	28.0	6.88	0.24	5.64	1.34	1.90	66	22.6	9.28	29.8	4.32	15.20	0.42	-	-	-	-	-	-	45
	Sept-04	33	26.8	20.2	6.49	0.28	5.66	1.38	1.92	64	22.6	9.20	28.8	4.36	15.22	0.48	-	-	-	-	-	-	37
	Oct-04	33	26.4	12.0	6.42	0.28	5.62	1.48	2.00	64	20.6	9.24	28.0	4.32	15.20	0.48	-	-	-	-	-	-	32
	Nov-04	33	26.4	10.2	6.44	0.22	5.60	1.68	2.36	68	21.6	9.20	28.2	3.28	15.20	0.46	-	-	-	-	-	-	33
	Dec-04	33.2	26.2	12.0	6.57	0.26	5.62	1.86	2.84	72	22.6	11.0	28.6	3.22	15.22	0.48	-	-	-	-	-	-	30
	Jan-05	33.2	26.2	10.6	6.26	0.32	5.60	1.66	2.44	74	22.8	11.28	28.6	2.60	15.20	0.52	-	-	-	-	-	-	27
	Feb-05	33.2	26.2	6.2	6.24	0.34	5.54	2.12	2.60	76	23.8	11.42	28.8	2.58	13.80	0.28	-	-	-	-	-	-	27
	Mar-05	33.6	27.2	3.2	6.20	0.64	5.32	2.54	3.22	78	24.8	11.88	28.6	2.48	15.20	0.48	-	-	-	-	-	-	21
	Apr-05	34	27.6	3.6	6.42	0.72	4.60	2.87	3.24	80	25.8	10.92	28.8	2.68	15.24	0.42	-	-	-	-	-	-	22
	May-05	29	28.2	6.8	6.40	0.18	5.60	1.94	2.64	76	25.0	10.00	26.8	1.24	15.24	0.48	-	-	-	-	-	-	20
	Jun-05	33.2	26.2	20.0	6.8	0.20	6.24	1.22	1.74	58	20.6	8.24	29.6	1.98	16.24	0.54	-	-	-	-	-	-	22
	July-05	32	25.8	36.0	7.02	0.26	5.94	1.78	2.34	68	21.4	8.27	29.6	2.84	18.24	0.58	-	-	-	-	-	-	32
	Aug-05	31.0	26.6	28.4	7.04	0.27	5.68	1.92	2.48	64	22.8	8.24	29.6	3.48	18.40	0.82	-	-	-	-	-	-	40
	Sept-05	32.0	26.2	22.0	6.48	0.26	5.66	1.34	1.90	66	22.4	8.22	29.8	4.00	18.00	0.42	-	-	-	-	-	-	38
	Oct-05	32.4	26.0	14.0	6.28	0.26	5.60	1.44	2.02	64	22.6	9.22	28.8	4.24	15.2	0.48	-	-	-	-	-	-	29
	Nov-05	33	26.4	10.0	6.22	0.28	5.44	1.42	2.08	69	23.6	10.22	26.8	4.10	15.20	0.62	-	-	-	-	-	-	28
	Dec-05	33	26.8	12.2	6.24	0.28	5.66	1.66	2.44	68	23.6	10.0	26.4	3.22	15.22	0.62	-	-	-	-	-	-	29
	Jan-06	33	26.5	10.0	6.24	0.26	5.56	1.62	2.28	70	23.6	10.04	26.4	2.48	15.20	0.66	-	-	-	-	-	-	24
	Feb-06	32	26.4	6.4	6.28	0.38	5.22	2.62	3.04	74	24.6	11.80	26.2	3.00	13.4	0.28	-	-	-	-	-	-	23
	Mar-06	32.6	26.2	6.2	6.45	0.42	5.20	2.64	3.08	76	24.8	11.22	26.4	2.42	15.22	0.48	-	-	-	-	-	-	28
	Apr-06	32.4	27.0	3.8	6.43	0.42	5.20	2.70	3.08	76	24.8	11.28	26.4	2.68	16.2	0.42	-	-	-	-	-	-	24
	May-06	32.8	27.4	3.4	6.44	0.42	5.28	2.75	3.12	76	24.2	10.20	24.0	3.00	14.2	0.48	-	-	-	-	-	-	22
	Jun-06	31.2	26.0	25.2	7.2	0.28	6.24	1.24	1.72	58	20.0	9.20	29.0	2.20	16.20	0.64	-	-	-	-	-	-	30
	July-06	31.4	25.4	32.6	7.44	0.20	5.90	1.28	1.68	60	21.0	9.22	28.6	3.22	16.32	0.66	-	-	-	-	-	-	41
	Aug-06	31.0	25.2	28.0	7.86	0.28	5.60	1.34	2.42	60	22	9.20	26.6	4.28	16.30	0.66	-	-	-	-	-	-	40
	Sept-06	32.0	26.0	20.0	7.4	0.20	5.66	1.34	2.40	66	22.4	9.32	26.8	4.30	16.20	0.64	-	-	-	-	-	-	38
	Oct-06	30.4	25.4	14.2	7.20	0.24	5.66	1.48	2.48	68	22.6	9.22	28.0	3.26	16.2	0.64	-	-	-	-	-	-	32
	Nov-06	33	26.0	10.0	6.20	0.28	5.44	1.42	2.4	69	24.6	9.54	26.8	3.66	16.0	0.64	-	-	-	-	-	-	29
	Dec-06	32	26.0	10.0	6.94	0.26	5.66	2.66	3.04	64	22.6	8.44	22.4	2.88	16.24	0.62	-	-	-	-	-	-	28
	Jan-07	33	26.4	8.0	7.54	0.20	5.52	1.64	2.32	72	22.0	10.8	26.4	2.48	16.0	0.64	-	-	-	-	-	-	27
	Feb-07	32	26.4	4.2	6.20	0.36	5.20	2.64	3.02	78	24.4	10.0	26.0	2.84	15.0	0.48	-	-	-	-	-	-	27
	Mar-07	32	26.8	2.2	6.80	0.44	5.22	2.59	3.00	72	24.0	11.2	20.0	3.44	15.2	0.62	-	-	-	-	-	-	21
	Apr-07	32.4	27.0	2.4	6.84	0.40	5.24	2.64	3.02	74	24.0	11.22	20.4	2.48	14.2	0.42	-	-	-	-	-	-	22
Months	May-07	32.8	28.1	4.6	6.6	0.42	5.24	2.63	3.02	74	22.2	11.04	22.0	4.00	16.2	0.66	-	-	-	-	-	-	27
	Jun-07	31	26.7	22.0	6.42	0.18	5.62	1.47	2.15	72	22.1	8.86	26.8	2.88	16.2	0.68	-	-	-	-	-	-	30.5
	Avg	32.28	26.48	14.0	6.66	0.31	5.53	1.91	2.50	69.4	22.98	9.91	27.06	3.15	15.69	0.53	-	-	-	-	-	-	29.58
	Min	29°C	25.2	2.3	6.20	0.18	4.60	1.22	1.68	60	20.0	8.22	20.0	1.24	13.40	0.42	-	-	-	-	-	-	20
	Max	34°C	28.2	36	7.86	0.72	6.24	2.87	3.24	80	25.8	11.88	29.8	4.36	18.40	0.82	-	-	-	-	-	-	45

All the parameters are expressed in mg/L except temperature (°C), pH and TUR (NTU)

AT= Atmospheric temperature, WT= Water temperature, TUR= Turbidity, CO2= Free carbon dioxide, DO= Dis[solved oxygen, BOD= Biological oxygen demand], COD= Chemical oxygen demand, TH= Total hardness, Na^+= Sodium, K^+= Potassium, T.Al= Total alkalinity, NO_3^-= Nitrate, SO_4^{2-}= Sulphate, PO_4^{3-}= Phosphate, Fe= Iron, Mn= Manganese, Al= Aluminium, Ni= Nickel, Co= Cobalt, Cr= Chromium, TDS= Total dissolved solids

Table 6. Physico-chemical parameters of station-IV (July 2004 to June 2007)

	Parameters	AT	WT	TUR	pH	CO_2	DO	BOD	COD	TH	Na^+	K^+	T.Al	NO_3^-	SO_4^{2-}	PO_4^{3-}	Fe	Mn	Al	Ni	Co	Cr	TDS
	July-04	31	26.0	34.0	6.90	00	8.28	0.24	0.82	44	15.60	7.22	23.4	2.24	11.6	0.08	-	-	-	-	-	-	36
	Aug-04	31.0	26.2	20.0	6.90	0.0	8.30	0.24	0.82	50	14.68	7.14	23.6	3.26	11.8	0.06	-	-	-	-	-	-	33
	Sept-04	32.8	26.6	20.4	6.92	0.02	8.32	0.22	0.80	52	14.62	7.20	23.2	3.28	11.4	0.08	-	-	-	-	-	-	30
	Oct-04	33.2	26.8	14.0	6.96	0.00	8.62	0.28	0.88	62	14.66	7.28	24.2	4.24	11.4	0.08	-	-	-	-	-	-	28
	Nov-04	33.4	26.4	10.4	6.98	0.00	8.36	0.26	0.90	66	14.40	8.26	23.8	3.20	11.4	0.08	-	-	-	-	-	-	27
	Dec-04	33.2	26.2	10.6	6.98	0.00	8.38	0.24	0.88	60	14.42	8.20	23.8	3.14	12.4	0.08	-	-	-	-	-	-	27
	Jan-05	33.6	26.4	10.2	6.90	0.00	8.68	0.22	0.88	62	14.40	8.46	23.4	2.18	12.6	0.06	-	-	-	-	-	-	24
	Feb-05	33	26.6	6.0	6.94	0.0	7.68	1.22	1.78	56	16.6	8.44	22.4	2.18	11.8	0.08	-	-	-	-	-	-	28
	Mar-05	33.2	27.6	3.8	7.60	0.0	7.72	2.24	2.80	68	14.60	8.60	22.8	2.14	11.8	0.08	-	-	-	-	-	-	22
	Apr-05	33.2	28.0	3.4	7.60	0.0	7.00	2.26	2.84	68	14.64	9.00	22.8	2.18	11.4	0.06	-	-	-	-	-	-	21
	May-05	33.8	28.2	6.2	7.88	0.0	7.20	2.24	2.82	64	14.66	8.96	20.4	2.16	11.4	0.08	-	-	-	-	-	-	29
	Jun-05	32	26.2	28.0	7.40	00	8.20	0.26	0.90	58	14.44	7.00	24.6	2.12	14.6	0.08	-	-	-	-	-	-	38
	July-05	30.0	26.0	34.0	6.8	0.0	8.32	0.22	0.88	48	14.40	7.20	23.4	2.22	14.8	0.08	-	-	-	-	-	-	42
	Aug-05	31.2	26.8	28.6	6.9	0.02	8.32	0.26	0.82	56	14.44	7.24	24.6	3.26	14.6	0.08	-	-	-	-	-	-	34
	Sept-05	33	26.0	20.0	6.8	0.02	8.42	0.26	0.80	54	14.40	7.56	24.2	3.28	14.6	0.08	-	-	-	-	-	-	33
	Oct-05	33	26.8	16.0	7.2	0.00	8.34	0.26	1.86	58	14.42	7.88	23.2	3.00	11.8	0.08	-	-	-	-	-	-	28
	Nov-05	33.2	26.4	8.8	7.22	0.00	8.64	0.24	1.84	58	14.00	8.00	24.6	2.22	11.8	0.14	-	-	-	-	-	-	21
	Dec-05	33.4	25.2	12.0	7.20	0.00	8.66	0.24	1.82	60	14.22	8.44	24.6	2.40	11.6	0.14	-	-	-	-	-	-	22
	Jan-06	33.4	26.6	10.2	7.22	0.00	8.68	0.28	1.86	66	14.62	8.42	22.6	2.20	11.6	0.18	-	-	-	-	-	-	20
	Feb-06	33.4	26.2	6.6	7.20	0.00	8.60	1.20	1.84	66	14.60	8.24	23.6	2.18	11.6	0.06	-	-	-	-	-	-	24
	Mar-06	33.8	27.2	6.0	6.88	0.00	6.60	2.24	2.82	70	18.60	7.84	20.6	3.00	11.4	0.08	-	-	-	-	-	-	28
	Apr-06	34.2	27.6	3.6	6.90	0.00	6.22	2.28	2.94	78	18.00	8.20	20.8	2.16	11.4	0.06	-	-	-	-	-	-	22
	May-06	30	28.0	3.8	7.80	0.00	6.24	1.24	1.80	70	16.4	7.24	18.1	2.14	12.4	0.08	-	-	-	-	-	-	25
	Jun-06	32.4	26.8	26.0	7.66	00	8.20	0.24	0.82	42	16.64	7.00	24.4	2.18	12.6	0.20	-	-	-	-	-	-	29
	July-06	30.0	25.2	34.0	7.40	0.0	8.30	0.26	0.88	40	14.64	7.54	23.4	3.22	14.6	0.28	-	-	-	-	-	-	38
	Aug-06	31.4	26.4	26.0	6.60	0.02	8.22	0.22	0.92	66	14.60	8.54	24.64	3.24	14.4	0.32	-	-	-	-	-	-	40
	Sept-06	33	26.0	22.0	6.80	0.02	8.40	0.20	0.80	64	14.20	8.20	24.4	3.28	14.4	0.32	-	-	-	-	-	-	36
	Oct-06	32.2	26.0	14.0	7.00	0.00	8.64	0.20	0.84	54	14.0	8.00	24	4.00	12.0	0.24	-	-	-	-	-	-	34
	Nov-06	33.2	26.0	12.0	7.20	0.00	8.60	0.28	0.86	64	14.0	7.44	24	3.26	14.6	0.22	-	-	-	-	-	-	30
	Dec-06	33	25.2	12.0	7.62	0.00	8.60	0.20	0.84	56	14.20	7.22	24.6	2.66	14.0	0.32	-	-	-	-	-	-	24
	Jan-07	33.4	26.5	8.0	7.00	0.00	8.60	0.24	0.82	64	14.60	7.88	22.6	2.18	14.0	0.08	-	-	-	-	-	-	22
	Feb-07	33.2	26.8	3.6	7.20	0.00	7.60	1.24	1.82	66	14.6	8.00	20	2.16	12.4	0.08	-	-	-	-	-	-	26
	Mar-07	33.6	27.0	2.4	6.84	0.00	6.64	1.26	1.88	64	18.6	7.88	20	2.34	12.8	0.14	-	-	-	-	-	-	24
	Apr-07	34.2	27.2	2.4	6.94	0.00	6.24	1.28	1.92	74	18	8.22	20	2.12	11.6	0.12	-	-	-	-	-	-	22
Months	May-07	33.8	27.4	4.6	7.80	0.00	7.22	1.28	1.90	62	14.4	7.2	20	2.14	12.6	0.12	-	-	-	-	-	-	20
	Jun-07	32.0	25.6	24.0	7.84	0.00	6.20	0.21	0.82	72	14.0	6.88	24.2	2.20	11.50	0.30	-	-	-	-	-	-	29
	Avg	32.70	26.55	14.09	7.16	0.002	7.92	0.74	1.46	60.61	15.13	7.83	22.91	2.64	12.65	0.13	-	-	-	-	-	-	28.08
	Min	30°C	25.2	2.4	6.60	0.0	6.20	0.20	0.8	40	14.0	6.88	18.1	2.12	11.4	0.06	-	-	-	-	-	-	20
	Max	34.2°C	28.2	34.0	7.88	0.02	8.68	2.28	2.94	78	18.6	9.00	24.64	4.24	14.8	0.32	-	-	-	-	-	-	42

All the parameters are expressed in mg/L except temperature (°C), pH and TUR (NTU)

AT= Atmospheric temperature, WT= Water temperature, TUR= Turbidity, CO_2= Free carbon dioxide, DO= Dissolved oxygen, BOD= Biological oxygen demand, COD= Chemical oxygen demand, TH= Total hardness, Na^+= Sodium, K^+= Potassium, T.Al= Total alkalinity, NO_3^-= Nitrate, SO_4^{2-}= Sulphate, PO_4^{3-}= Phosphate, Fe= Iron, Mn= Manganese, Al= Aluminium, Ni= Nickel, Co= Cobalt, Cr= Chromium, TDS=

Total dissolved solids

Among all, the microorganisms from sample collected at station 3 showed better activity against both Anthracene and Naphthalene (Table 7 and 8). All the six isolates from this sample were identified. Three bacterial isolates were identified on the basis of their cultural and biochemical characteristics and with reference to Bergey's Manual of Determinative Bacteriology (1992). The bacterial isolates were *Pseudomonas spp.*, *Bacillus spp.* and *Flavobacterium spp.* Three fungal isolates *Aspergillus spp.*, *Penicillium spp.* and *Candida spp.* were also identified.

Table 7: Activity of microorganisms from S₃ on Anthracene

Strains isolated	Incubation Time		
	24 hrs	48 hrs	72 hrs
Pseudomonas spp.	+	++	+++
Bacillus spp.	-	+	++
Flavobacterium spp.	+	+	++
Aspergillus spp.	+	++	++
Penicillium spp.	-	+	++
Candida spp.	+	++	-

- : No inhibitory zone +: < 10 mm   ++:   10-14   mm
+++   : 15-20 mm

Table 8: Activity of microorganisms from S3 on Naphthalene

Strains isolated	Incubation Time		
	24 hrs	48 hrs	72 hrs
Pseudomonas spp.	-	++	+++
Bacillus spp.	-	+	++
Flavobacterium spp.	+	++	-
Aspergillus spp.	+	++	++
Penicillium spp.	+	+	++
Candida spp.	+	+	++

- : No inhibitory zone +: < 10 mm   ++:   10-14   mm
+++   : 15-20 mm

Conclusion:

Water is an integral constituent of life and is one of the most important natural resources. The present domain of life existing on the earth has evolved from water. A multiple of life forms particularly all living things are totally dependent on water to carry out their vital functions. As a consequence of this, the stations have been put under severe ecological stress and are being threatened. This is due to dumping of solid and liquid wastes into the water system. It is very much true in case of the River Nethravathy. The present study area covered a stretch of 25km. of the river Nethravathy starting from Kajoor at the foot hills of Western Ghats to the downstream of Dondole of Belthangady Taluk of Dakshina Kannada Dist., Karnataka state in India. The river receives untreated domestic sewage discharge at some locations. The human and animal excreta along with agricultural wastes were brought into the river with run off waters. All these discharges have polluted the river to some extent at some points, particularly during summer. To get an overall ecological picture of this river, four stations were selected for the physico chemical analysis based on the considerations such as topography, nature of the river bed, the water flow, catchments area and

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