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Bacteriological characteristics of raw water of the river Tawi near Sitlee water treatment plant, Jammu

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Abstract

Bacteriological analysis of raw water of the river Tawi, near Sitlee water treatment plant, has shown the seasonal presence of *Kiebsiella, Citrobacter, Escherichia* and *Pseudomonas*. Total bacterial count (MPN) recorded summer (April, May), monsoon and post-monsoon (June- October) increase and winter (November, December, February) decrease. It varied between 92 and >180 during both the years of study. MPN index above 10 /100 ml. indicates that raw water is not suitable for drinking purposes and comes under the category of unsatisfactory. It needs proper treatment before supplied to the consumers.

Keywords:- *River Tawi water, Bacteriological, MPN*

Introduction

Growing population, increasing living standards, rapid industrialization and wide sphere of human activities, have resulted in steady increase in the demand for water resources. This requires regular water monitoring to ensure supply of clean water to meet the consumers' demands. According to WHO, about 600 million cases of diarrhea and 46,00,000 childhood deaths are reported per year because of contaminated water and lack of sanitation. Although some work on physico-chemical characteristics of water of the river Tawi has been attempted by Zutshi (1992), but there is no report on bacteriological characteristics of water of the river. The river Tawi, an important tributary of the river Chenab, having its origin in the middle Himalayas, below Seoj Dhar peak at Kalikund near Bhaderwah, is a major source of potable water supply prior to the inhabitants of Jammu city since 1916 when Dhaonthly was the only supply point. At present, water supply from this river for Jammu city is from Sitlee, Dhaonthly and Gorkha Nagar treatment plants. In order to assess the water quality of the river Tawi, two years study was undertaken and has been described.

Materials and Method

Presumptive Coliform Count (MPN): MPN count of coliform organisms was done by Multiple Tube method (Senior, 1989; APHA, 1998).

Confirmed phase: Submitted all presumptive tubes showing growth, any amount of gas, or acidic reaction within 24 hrs. of incubation to the confirmed phase. Calculated the MPN value from the number of positive BGLB tubes (Senior, 1989; APHA, 1998).

Completed phase: Using aseptic technique (Senior. 1989: APHA 1998), streaked one each MacConkey agar plate, from each tube of positive BGLB showing gas.

Faecal Coliform Count (MPN): MPN count of faecal coliform was done by multiple tube method.

Biochemical Tests: To confirm the presence of various coliform bacteria, the following biochemical tests (IMViC) (Senior, 1989: APHA, 1998) were conducted (Table. 1):

Results and Discussion

The results of various bacteriological characteristics of water have been tabulated in Table 2 and 3 and depicted in Fig. 1.

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Qualitative Composition:

In the raw water of the river Tawi. near Sitlee water treatment plant, *Klebsiella. Citrobacter, Escherichia* and *Pseudomonas* showed their seasonal qualitative presence, during both the years. During the first year, *Klebsiella* was observed only once (June), *Pseudomonas* four times (September - November and July), E*scherichia* ten times (August, October - May and July) and *Citrobacter* eleven times (August - June). During the second year, *Citrobacter* showed its presence five times (November, December, April, May and July); *Klebsiella* six times (August, September, January and February, May and June); *Escherichia* seven times (August - October, December, March, April and July) and *Pseudomonas* eight times (October. November, January - March and May - July) (Table 1). Qualitative seasonal presence of these microbes in lotic waters has also been reported by Gupta and Gupta (1999), Gaur *et al.* (2000), Koshy and Nayar (2000), Fokmare and Musaddiq (2001), Singh *et al.* (2001), Srivastava (2002), Bhadra *et al.* (2003), Tavlor (2003) and Sharma (2004). Entrv of these microbes in river Tawi may result from inflow of sewage and human and animal excreta in the upstream region (Taylor, 2003) and surface runoff during rains (Taylor, 2003), Re-growth of some microbes present in sediments of river, derived from faecal pollution and enriched organic matter, may also account for the presence of these microbes in the river Tawi (Taylor, 2003).

Table 1: Biochemical tests (IMViC) to confirm the presence of various coliform bacteria

Organism	Indole	Motility	TSI	MR	Urease	Citrate	PPA	H_2S	Dry Filter Paper/ Oxidase
Escherichia	+	+	+	+	-	-	-	-	-
Klebsiella	-	-	+	-	+	+	-	-	-
Citrobacter	+	+	+	+	-	+	-	+	-
Proteus	+	+	+	-	+	+	+	+	-
Pseudomonas	-	-	-	-	-	-	-	-	+

Table 2: Monthly variations in qualitative composition of microbes in the rver Tawi near Sitlee water treatment complex, Jammu

Month	2000	2001
August	*Escherichia, Citrobacter*	*Escherichia, Klebsiella*
September	*Citrobacter, Pseudomonas*	*Escherichia, Klebsiella*
October	*Citrobacter, Pseudomonas, Escherichia*	*Pseudomonas, Escherichia*
November	*Citrobacter, Pseudomonas, Escherichia*	*Pseudomonas, Citrobacter*
December	*Citrobacter, Escherichia*	*Citrobacter, Escherichia*
January	*Citrobacter, Escherichia*	*Pseudomonas, Klebsiella*
February	*Citrobacter, Escherichia*	*Pseudomonas, Klebsiella*
March	*Citrobacter, Escherichia*	*Pseudomonas, Escherichia*
April	*Citrobacter, Escherichia*	*Citrobacter, Escherichia, Klebsiella*
May	*Citrobacter, Escherichia*	*Pseudomonas, Klebsiella, Citrobacter*
June	*Citrobacter, Klebsiella*	*Pseudomonas, Klebsiella*
July	*Escherichia, Pseudomonas*	*Citrobacter, Escherichia, Pseudomonas*

Quantitative Analysis:

In the Tawi water, MPN index per 100 ml., during the first year, ranged between 92 (December) to >180 (August - October, April - July). During the second year, MPN range was between 92 (November, December, February) to >180 (August, April - July). A very high bacterial count, seen in the river Tawi raw water, has also been reported from lotic waters by Bhosle and Rao (2001), Fokmare and Musaddiq (2001), Singh *et al.* (2001), Begum *et al.* (2003), Rajurkar *et al.* (2003), Thakur *et al.* (2003), Bankar and Deshmukh (2004) and Sharma (2004). Microbial enrichment in lotic waters is caused by discharge of sewage and entry of human (open defecation) and animal excreta and other decomposing organic matters (animal slaughtering and washing of stomach and other internal parts) at various places (Begum *et al.*, 2003). This indicates that bacteria, always and under all conditions. remain in water body and this signifies the organic pollution. Summer (April, May) microbial highest count may be attributed to bacterial survival and increased production under warm conditions and is in conformity with the findings of Gaur *et al.* (2000), Singh *et al.* (2001) and Bhadra *et at.* (2003). High temperature and increased surface runoff in catchment areas mav account for monsoon (June - September) increase in MPN count in the river Tawi (Table 3). Comparison of MPN per 100ml with National and International Standards (BIS, 1991; WHO, 1992) reveals that the water quality exceeds the allowable limits of drinking water standards.

Table 3: Monthly variations of microbes (MPN/100 ml) in the rver Tawi, near Sitlee water treatment complex, Jammu

Month	2000	20001
August	>180	>180
September	>180	161
October	>180	161
November	161	92
December	92	92
January	161	161
February	161	92
March	161	161
April	>180	>180
May	>180	>180
June	>180	>180
July	>180	>180

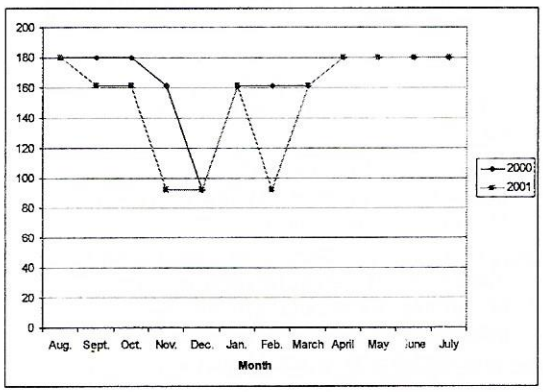

Fig. 1 : Monthly quantitaive variations of microbes (MPN/100 ml) in the rver Tawi, near Sitlee water treatment complex, Jammu

Table 4: Comparison of water quality of the river Tawi, near Sitlee water treatment complex, Jammu with National and International standards

Parameter	PCC/100 ml		WHO	Ac	Al	BIS	Ac	Al
	Ist Year	2nd Year		0	10		0	10
River Tawi	92->180	92->180						
British Ministry of Health		Excellent 0/100		Satisfactory 1-3/100				
		Suspicious 4-10/100		Unsatisfactory >10/100				

PCC: Presumptive Coliform Count Ac: Acceptable Al : Allowable

The water quality remained unsatisfactory during both the years. as per British Ministry of Health, 1957 classification (Table 4).

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