Recent Research in Science and Technology 2013, 5(1): 63-67
ISSN: 2076-5061
Available Online: http://recent-science.com/

Physicochemical analysis of hot water springs of Sikkim-Polok *Tatopani,* Borong *Tatopani* and Reshi *Tatopani*

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Abstract

Fenced by the geo-political features all around, Sikkim sits magnificently in the lap of The Himalayas with Mount Khanchengdzonga signifying the peaks of divinity and cultural proximity. Sikkim is the natural ecological host to many Hot springs of geothermal characteristics. Hot Springs of Sikkim are regarded as ethical and holistic elements having importance of locale panacea. Hot springs are any natural geothermal spring or a natural discharge of groundwater with elevated temperature with respect to the surrounding. The characteristics or the suitability of these hot springs for human use is determined by its chemical constituents. Most of the Hot Springs is rich in several kinds of chemicals and minerals. Presence of these chemicals and minerals along with higher temperature of these hot springs determine its balneotherapeutic properties. The average temperature of the studied Hot springs being 60°C according to Kent classification as "Scalding" can be regarded as the best ecological niche for thermophilic microorganisms. These Hot springs are supposed to cure off many bone related diseases like arthritis and is also equivalently used in treatment of skin infections and diseases. For curing the Gastrointestinal and bowel associated diseases, water from these hot springs is also drunk. Hence a complete detailed study of the chemicals and the physical properties of the three Hot springs of Sikkim were studied. 30 different physicochemical parameters of the water samples collected from these study areas were analyzed using the ICPMS Spectroscopic methods and Kit method. Physical properties like colour, conductivity, turbidity etc. and chemical parameters like the quantification of anions, cations, trace elements and other chemical constituents of the *Tatopani* were analysed. A comparison with W.H.O. standards showed that the water sample of Polok and Borong *Tatopani* water is suitable for drinking purposes whereas Reshi *Tatopani* water showed higher concentration of TDS (i.e. 608mg/l).

Keywords: Sikkim, Hot Springs, *Tatopani*, physiochemical analysis, ICPMS.

INTRODUCTION

Sikkim is one of the India's *numero uno* tourist destinations and is well known for its hospitality, adventure, mountain treks and orchids. There are numerous natural hot springs at Sikkim; located at various locations like *Polok, Reshi, Borong, Takrum, Yume Samdong, Yumthang, Zee, Shagyong Phedok* and *Tholug Kang* of Sikkim [11]. The Hot springs of Sikkim are locally called as *Tatopani/Tsha-Chu*. The Hot springs of Sikkim are medically as well as sociologically important [1-5]. They are ancient and have a lot of aesthetic value since ages [1, 3]. It is believed that the water from these Hot springs can cure several diseases [7, 8, 10] and therefore, play important role in social medicine, religious customs and practices [1-3]. Every year patients suffering from various arthritis problems, gastrointestinal and bowel associated diseases and skin diseases, visits these areas to cure themselves [1-3]. The earth's geology determines the fate and composition of the hot springs [9].

The present investigation involves the physical and chemical analysis of the water samples collected from the three Hot springs of Sikkim i.e., *Polok*, *Borong* and *Reshi*, were selected for physiochemical analysis. These Hot springs are located near the river basin Teesta and Rangeet [13]. The temperatures of these hot springs were between 45-70°C in the month of April. These Hot springs are mainly used as a source of bathing and drinking purposes to cure gastrointestinal and general skin infections. Recently the Hot springs are getting polluted due to influx of tourists and maintenances of poor gavages facilities in and around the hot springs ponds. So the physiochemical parameters of these three hot springs of Sikkim were studied and analyzed during the month of April.

MATERIALS AND METHODS

The water samples of the Hot springs (Polok, Borong and Reshi *Tatopani*) were collected from South and East District of Sikkim. The water samples were collected in thermal stainless steel container (Thermo Flask), in the month of April and were immediately bought to the laboratory in sterile conditions.

The collected samples were stored at 4°C in Environmental Chamber. The pH, temperature, Dissolved oxygen and Conductivity of the water samples were measured in the field by using the potable Orion 5 Star bench top and other physiochemical parameters were analyzed in the laboratory using as per the APHA standards.

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RESULTS AND DISCUSSION

Hot springs are any natural geothermal spring or a natural discharge of groundwater with elevated temperature with respect to the surrounding. When silica or other minerals encounters with the ascending pressurized hot water then they are carried on the earth's surface through the volcanic rocks and as the atmospheric temperature cools it down, layers of geyserites develops around the spring. Owing to the presence of the limestone, Calcium Carbonate saturated water forms Travertine on crystallization. Lucent visuals can be noticed around the hot springs as various types of geological components of physical abiotic and biotic matter like micro flora forms distinct stratums around the hot springs. These abiotic and biotic matters determine the characteristics of any hot springs as well as its suitability for human use. Therefore, in the present study we studied several physical and chemical parameters of water from these hot springs.

pH: This is the most important chemical property which relates to the acidity or basicity of the test substance which is a measure of free hydrogen ion and hydroxyl ions in the water [6]. Due to various dissolved chemical constituents, pH acts as an important indicator of water. According to the APHA standards for drinking water, a pH range of 6.5–8.5 is recommended. The maximum value of pH was recorded as 8.0 at the ponds of Polok *Tatopani* and the minimum value of pH was recorded as 7.4 at the ponds of Reshi *Tatopani*. In general the pH was within the limits of the standard values (Table 1, 2 & 3). As per the findings it was observed that the water was slight alkaline in nature which might be due to the presence of the dissolved salts in the water. Thus, the Hot spring water was potable as per the APHA standards. The water which flows from the source is directly consumed and as the pH is within the limits it can be rendered as safe.

Conductivity: Electrical Conductivity is the ability of a solution to conduct electricity or medium for transfer for electric current. It is the reciprocal of electrical resistivity (ohms). Therefore conductivity is used to measure the concentration of dissolved solids which have been ionized in a polar solution such as water. The maximum value of conductivity measured at 25°C was recorded as 1180 µmhos at the ponds of Reshi *Tatopani* and the minimum value was recorded as 240 µmhos at the ponds of Borong *Tatopani* (Table 1, 2 & 3). Due to the presence of high amounts of minerals in the water, the Hot springs showed higher conductivity value.

Turbidity: This is the measure of suspended minerals, microorganisms, plankton and dissolved organic and inorganic substances [6]. It was found that the turbidity values of all the ponds or source were within the limits prescribed by WHO (Table 1, 2 & 3). Usually the turbidity values were higher in ponds due to human activities and therefore not recommended to drinking. People drink water from direct source or dripping from and this water has least turbidity as compared to the bathing ponds. Therefore, for gastrointestinal associated diseases people use water from source directly.

Total dissolved solids (TDS): Total dissolved solids (TDS) is a measure of the combined content of all inorganic and organic substances contained in a liquid in molecular, ionized or micro granular suspended form. The Highest Desirable Limit of TDS is 500 mg/l and the Maximum Permissible Limit of TDS of drinking water is 2000 mg/l. The observation shows that the TDS is within the permissible range as prescribed by WHO. The water has dissolved solids and it also depends on the exit of the water from the source point of the aquifer. In case of Borong and Reshi, the source point is beneath the sulfataric mud region whereas at Polok it drips from the rock above the soil. Thus there can be significant amount of variation in the TDS measurement. The values of TDS are represented in Table 1, 2 and 3**.**

Total suspended solids (TSS): A total suspended solid (TSS) is a measure of the quality of the water. The non-filterable residues which get trapped in filter membranes are regarded as suspended solids. These residues present in water might be health hazards if present in higher concentrations. The observation shows that the TSS is within the permissible range as prescribed by WHO (Table 1, 2 & 3).

Alkalinity as $CaCO_3$: This is a measure of the capacity of water to neutralize acids. The predominant chemicals present in Hot water springs are carbonates, bicarbonates and hydroxide compounds of calcium, sodium and potassium [6]. The bicarbonate ion is usually prevalent. Total alkalinity values for the investigated samples were found to be above the WHO limits of 250 mg/l but they were within the Maximum Permissible Limit (MPL). The maximum value of Alkalinity was recorded as 459 mg/l at the ponds of Reshi *Tatopani* and the minimum value was recorded as 78 mg/l at the ponds of Borong *Tatopani* (Table 1, 2 & 3).

Total Hardness as $CaCO_3$: When the ground water passes through the fissures or cracks of the earth and due to geothermal heat comes to the earth's surface, it passes through many mineral deposits like limestone, carbonate and bicarbonate salts of Calcium and Magnesium. Total Hardness is defined as the total hardness effect due to the calcium and magnesium present as bicarbonate salts. The maximum value of Total Hardness as $CaCO_3$ was recorded as 255 mg/l at the ponds of Reshi *Tatopani* and the minimum value was recorded as 31 mg/l at the ponds of Borong *Tatopani* (Table 1, 2 & 3).

Phenolic Compounds: These are the toxic byproducts found in water if there is any industrial contamination. It was found that phenolic compound were present at undetectable amount. Thus, it can be regarded as safe as per WHO standards (Table 1, 2 & 3). Usually the phenolic substances are absent in most of the Hot springs all over the world and similarly till date no reports of the presence of phenolic compounds have been detected in the water of three hot springs of Sikkim. As the water is used both for drinking and bathing purposes, hence seasonal monitoring of the phenolic compounds needs to be done to prevent any sort of health hazards.

Chlorides: The chloride concentration of the water indicates possible pollution or contamination of the water from human sewage, animal manure or industrial wastes [6]. As, the Hot water springs are very sacred and religious place, hence the possible biological fecal contamination is negated. The possible reason for the presence of chloride ions are the salts of chloride with metals or inorganic compounds. Although chloride concentration varies in all the samples, all fall within the maximum concentrations recommended by WHO for drinking water. The maximum value of Chlorides was recorded as 103 mg/l at the ponds of Reshi *Tatopani* and the minimum value was recorded as 12 mg/l at the ponds of Borong *Tatopani* (Table 1, 2 & 3). The chloride salts acts as an important component in the Hot springs as it helps in the balneotherapy of an individual and also it might have an impact on the gastrointestinal and bowel associated problems.

Fluorides: Fluoride compounds are salts of inorganic compounds found in minerals, soil or rocks. Fluoride exposure leads to flourosis which is a dental degrading disease and might also lead to bone anomalies accompanied by weakening of the bones. The maximum value of Fluorides was recorded as 5.8 mg/l at the ponds of Polok *Tatopani* and the minimum value was recorded as 1.6 mg/l at the ponds of Reshi *Tatopani* (Table 1, 2 & 3). All the values obtained were above the permissible limit and hence possess a serious concern. The presence of excess fluoride is a major health concern and ways of regulating has to be ensured for the safety and health. Fluoride in small amounts is helpful and can be assumed to cure mycosis related fungal skin infections as it is an important antifungal component.

Nitrate: Nitrates are regarded as the highly oxidized form of nitrogen compounds and it is commonly present in surface and groundwater as it is the end product of aerobic decomposition of organic nitrogenous matter [6]. It is a dangerous indicator of pollution and especially in children less than six months ages who drink water containing nitrate can develop symptoms like shortness of breath and blue baby disease [6]. The maximum value of Nitrate was recorded as 3.4 mg/l at the ponds of Reshi *Tatopani* and the minimum value was recorded as 0.05 mg/l at the ponds of Borong *Tatopani* (Table 1, 2 & 3). The nitrate ions in the investigated samples were within the permissible limit given by WHO. Thus it is safe and can be rendered as potable and also will not pose any serious health hazard during bath in the ponds.

Sulfates: Sulfate is a very common chemical substance that occurs naturally in drinking water and is present in compounds with inorganic elements. Excess sulfate concentration in water can cause diarrhoea whereas it is also very beneficial when applied superficially to skin. The maximum value of Sulfate was recorded as 20.7 mg/l at the ponds of Reshi *Tatopani* and the minimum value was recorded as 3.6 mg/l at the ponds of Borong *Tatopani* (Table 1, 2 & 3). All the samples were within the permissible limits. Sulfates are important chemicals which renders the property of balneotherapy. It helps in the muscle relaxation and also heals the skin diseases. The sulfates are important chemotherapeutic agents which act as antiseptics and as natural drugs.

Metals, Heavy Metals and Trace Elements: Zinc imparts an undesirable astringent taste to water at a taste threshold concentration of about 4 mg/litre (as zinc sulfate). All the water samples had levels below the recommended levels set by WHO which is 5µg/l. Most groundwater contains some iron because it is common in many aquifers and it is found in trace amounts in practically all sediments and rock formations [6]. WHO recommends that the iron content of drinking water should not be greater than 0.3mg/l. Cadmium is highly toxic non-essential metal. It accumulates in the kidneys of mammals causing kidney dysfunction. This can get biomagnified through the web of food chain and excess concentration can cause kidney damage and skeletal deformities [6]. Lead is a non-essential and highly toxic cumulative trace element in man [6]. Lead concentration damages the central nervous system, the brain and kidney [6]. Nickel though an essential trace element is toxic in large amounts. Toxicity with Ni is enhanced in presence of Co, Cu, Fe and Zn in drinking water [6]. Now as the metals, heavy metals and trace elements are least detected they ensures the safe potability of the water and also is safe for bathing purposes. Thus, Hot springs of Sikkim which have been studied in our survey are generally safe from health point of view and also are good regions for the practice of Medical Tourism. All the samples were within the permissible limits (Table 1, 2 & 3).

Table 1. Physicochemical Analysis of Polok *Tatopani*.

Sl No	Test Parameters	Test Method	Unit	Polok *Tatopani* Pond A	Polok *Tatopani* Pond B	Norms as per ISO:10500,1991 HDL	MPL
1	a)Colour:	IS:3025-1986 Clauses-5	Hazen	01	01	---	1
	b)Odour:			U	U	---	
2	Taste:			A	A	---	2
3	Turbidity	APHA 20th Edition 4500 H+B	mg/l	<1	<1	5.0	3
4	pH Value	APHA 20th Edition 2130 B	mg/l	8.0	7.8	6.5-8.5	4
5	Total Dissolve Solid	APHA 20th Edition 2540C	mg/l	398	400	500	5
6	Alkalinity as $CaCO_3$	IS:3025(part-23)- 1986	mg/l	349	353	200	6
7	Iron as Fe	APHA 20th Edition 3500 Fe B	mg/l	<0.1	<0.1	0.30	7
8	Calcium as Ca	APHA 20th Edition 3500-Ca B	mg/l	08	07	75	8
9	Magnesium as Mg	APHA 20th Edition 3500-Mg B	mg/l	05	04	30	9
10	Sulphate as So_4	IS:3025(Part-24)-1986	mg/l	12.9	11.6	200	10
11	Chloride as CL	APHA 20th Edition 4500-CL-B	mg/l	62	63	250	11
12	Nitrite as NO_3	Annual Book of ASTM Standard. 1985	mg/l	1.8	1.7	45	12
13	Total Hardness as $CaCo_3$	APHA 20th Edition 2340C	mg/l	39	42	300	13
14	Copper as Cu	APHA 20th Edition 3111B	mg/l	<0.05	<0.05	0.05	14
15	Manganese as Mn	APHA 20th Edition 3111B	mg/l	00.10	00.10	0.10	15
16	Fluoride as F	APHA 20th Edition 4500FD	mg/l	05.80	05.78	01.00	16
17	Phenolic Compounds	APHA 20th Edition5530C	mg/l	<0.001	<0.001	0.001	17
18	Mercury as Hg	APHA 20th Edition 3111B	mg/l	<0.001	<0.001	0.001	18
19	Cadmium as Cd	APHA 20th Edition 3111B	mg/l	<0.01	<0.01	00.01	19
20	Selenium as Se	APHA 20th Edition 3111B	mg/l	<0.01	<0.01	00.01	20
21	Hexavalent Chromium	APHA 20th Edition 3500 CrB	mg/l	<0.01	<0.01	00.05	21
22	Arsenic as As	APHA 20th Edition 3114C	mg/l	0.004	0.004	00.01	22
23	Cyanide as CN	APHA 20th Edition 4500 CN-F	mg/l	<0.05	<0.05	00.05	23
24	Lead as Pb	APHA 20th Edition 3111B	mg/l	<0.05	<0.05	00.05	24
25	Zinc as Zn	APHA 20th Edition 3111B	mg/l	<0.05	<0.05	05.00	25

26	Aluminum as Al	APHA 20th Edition 3111D	mg/l	<0.05	<0.05	00.08	26
27	Boron as B	APHA 20th Edition 4500-BC	mg/l	<1	<1	01.00	27
28	TSS (Total Suspended Solid)	APHA 20th Edition 2540D	mg/l	<10	<10	-	28
29	Conductivity at 25° C	APHA 20th Edition 2510B	µmhos	850	850	-	29
30	Phosphate	APHA 20th Edition 3500 Fe B	mg/l	<0.05	<0.05	-	-

The water sample was taken in sterile Thermal steel containers from the source bathing ponds when the water was completely settled for 5 hours and had no human intervention or activities. Abbreviations with their original meaning: U=Unobjectionable; A=Agreeable; NR=No Relaxation; HDL=Highest Desirable Limit; MPL=Maximum Permissible Limit; mg/l=milligram per litre

Table 2. Physicochemical Analysis of Borong *Tatopani*.

Sl No	Test Parameters	Test Method	Unit	Borong *Tatopani* Pond A	Borong *Tatopani* Pond B	Norms as per ISO:10500,1991 HDL	MPL
1	a)Colour:	IS:3025-1986 Clauses-5	Hazen	1	1	---	---
	b)Odour:			U	U	---	---
2	Taste:			A	A	---	---
3	Turbidity	APHA 20th Edition 4500 H+B	mg/l	<1	<1	5.0	10.0
4	pH Value	APHA 20th Edition 2130 B	mg/l	7.8	7.7	6.5-8.5	NR
5	Total Dissolve Solid	APHA 20th Edition 2540C	mg/l	112	115	500	2000
6	Alkalinity as $CaCO_3$	IS:3025(part-23)- 1986	mg/l	78	75	200	600
7	Iron as Fe	APHA 20th Edition 3500 Fe B	mg/l	<0.1	<0.1	0.30	1.00
8	Calcium as Ca	APHA 20th Edition 3500-Ca B	mg/l	7	8	75	200
9	Magnesium as Mg	APHA 20th Edition 3500-Mg B	mg/l	2	3	30	100
10	Sulphate as So_4	IS:3025(Part-24)-1986	mg/l	3.4	3.6	200	400
11	Chloride as CL	APHA 20th Edition 4500-CL-B	mg/l	12	12	250	10000
12	Nitrite as NO_3	Annual Book of ASTM Standard. 1985	mg/l	0.05	0.05	45	NR
13	Total Hardness as $CaCo_3$	APHA 20th Edition 2340C	mg/l	31	31	300	600
14	Copper as Cu	APHA 20th Edition 3111B	mg/l	<0.05	<0.05	0.05	1.5
15	Manganese as Mn	APHA 20th Edition 3111B	mg/l	<0.05	<0.05	0.10	0.3
16	Fluoride as F	APHA 20th Edition 4500FD	mg/l	3.96	3.97	01.00	1.5
17	Phenolic Compounds	APHA 20th Edition5530C	mg/l	<0.001	<0.001	0.001	0.002
18	Mercury as Hg	APHA 20th Edition 3111B	mg/l	<0.001	<0.001	0.001	NR
19	Cadmium as Cd	APHA 20th Edition 3111B	mg/l	<0.01	<0.01	00.01	NR
20	Selenium as Se	APHA 20th Edition 3111B	mg/l	<0.01	<0.01	00.01	NR
21	Hexavalent Chromium	APHA 20th Edition 3500 CrB	mg/l	<0.01	<0.01	00.05	NR
22	Arsenic as As	APHA 20th Edition 3114C	mg/l	0.002	0.002	00.01	NR
23	Cyanide as CN	APHA 20th Edition 4500 CN-F	mg/l	<0.05	<0.05	00.05	NR
24	Lead as Pb	APHA 20th Edition 3111B	mg/l	<0.05	<0.05	00.05	NR
25	Zinc as Zn	APHA 20th Edition 3111B	mg/l	<0.05	<0.05	05.00	15
26	Aluminum as Al	APHA 20th Edition 3111D	mg/l	<0.03	<0.03	00.08	0.2
27	Boron as B	APHA 20th Edition 4500-BC	mg/l	<1	<1	01.00	5
28	TSS (Total Suspended Solid)	APHA 20th Edition 2540D	mg/l	<10	<10	-	-
29	Conductivity at 25° C	APHA 20th Edition 2510B	µmhos	240	238	-	-
30	Phosphate	APHA 20th Edition 3500 Fe B	mg/l	<0.05	<0.05	-	-

The water sample was taken in sterile Thermal steel containers from the source bathing ponds when the water was completely settled for 5 hours and had no human intervention or activities. Abbreviations with their original meaning: U=Unobjectionable; A=Agreeable; NR=No Relaxation; HDL=Highest Desirable Limit; MPL=Maximum Permissible Limit; mg/l=milligram per litre.

Table 3. Physicochemical Analysis of Reshi *Tatopani*

Sl No	Test Parameters	Test Method	Unit	Reshi *Tatopani* Pond A	Reshi *Tatopani* Pond B	Norms as per ISO:10500,1991 HDL	MPL
1	a)Colour:	IS:3025-1986 Clauses-5	Hazen	1	1	---	---
	b)Odour:			U	U	---	---
2	Taste:			A	A	---	---
3	Turbidity	APHA 20th Edition 4500 H+B	mg/l	<1	<1	5.0	10.0
4	pH Value	APHA 20th Edition 2130 B	mg/l	7.4	7.4	6.5-8.5	NR
5	Total Dissolve Solid	APHA 20th Edition 2540C	mg/l	612	608	500	2000
6	Alkalinity as $CaCO_3$	IS:3025(part-23)- 1986	mg/l	459	463	200	600
7	Iron as Fe	APHA 20th Edition 3500 Fe B	mg/l	<0.1	<0.1	0.30	1.00
8	Calcium as Ca	APHA 20th Edition 3500-Ca B	mg/l	61	61	75	200
9	Magnesium as Mg	APHA 20th Edition 3500-Mg B	mg/l	25	25	30	100
10	Sulphate as So_4	IS:3025(Part-24)-1986	mg/l	21.2	20.7	200	400
11	Chloride as CL	APHA 20th Edition 4500-CL-B	mg/l	103	109	250	10000
12	Nitrite as NO_3	Annual Book of ASTM Standard. 1985	mg/l	3.4	3.5	45	NR
13	Total Hardness as $CaCo_3$	APHA 20th Edition 2340C	mg/l	257	255	300	600

14	Copper as Cu	APHA 20th Edition 3111B	mg/l	<0.05	<0.05	0.05	1.5
15	Manganese as Mn	APHA 20th Edition 3111B	mg/l	<0.05	<0.05	0.10	0.3
16	Fluoride as F	APHA 20th Edition 4500FD	mg/l	1.6	1.6	01.00	1.5
17	Phenolic Compounds	APHA 20th Edition5530C	mg/l	<0.001	<0.001	0.001	0.002
18	Mercury as Hg	APHA 20th Edition 3111B	mg/l	<0.001	<0.001	0.001	NR
19	Cadmium as Cd	APHA 20th Edition 3111B	mg/l	<0.01	<0.01	00.01	NR
20	Selenium as Se	APHA 20th Edition 3111B	mg/l	<0.01	<0.01	00.01	NR
21	Hexavalent Chromium	APHA 20th Edition 3500 CrB	mg/l	<0.01	<0.01	00.05	NR
22	Arsenic as As	APHA 20th Edition 3114C	mg/l	0.006	0.006	00.01	NR
23	Cyanide as CN	APHA 20th Edition 4500 CN-F	mg/l	<0.05	<0.05	00.05	NR
24	Lead as Pb	APHA 20th Edition 3111B	mg/l	<0.05	<0.05	00.05	NR
25	Zinc as Zn	APHA 20th Edition 3111B	mg/l	<0.05	<0.05	05.00	15
26	Aluminum as Al	APHA 20th Edition 3111D	mg/l	<0.03	<0.03	00.08	0.2
27	Boron as B	APHA 20th Edition 4500-BC	mg/l	<1	<1	01.00	5
28	TSS (Total Suspended Solid)	APHA 20th Edition 2540D	mg/l	<10	<10	-	-
29	Conductivity at 25° C	APHA 20th Edition 2510B	µmhos	1180	1180	-	-
30	Phosphate	APHA 20th Edition 3500 Fe B	mg/l	<0.05	<0.05	-	-

The water sample was taken in sterile Thermal steel containers from the source bathing ponds when the water was completely settled for 5 hours and had no human intervention or activities. Abbreviations with their original meaning: U=Unobjectionable; A=Agreeable; NR=No Relaxation; HDL=Highest Desirable Limit; MPL=Maximum Permissible Limit; mg/l=milligram per litre.

CONCLUSION

The *Tatopani* is a sacred place with many religion based values and faith associated beliefs. Spring waters are a common source of water used for drinking and other domestic purposes in the mountain regions. But the Hot springs are the geothermal heated spring waters which has immense amount of importance with regards to the microbiology and earth science related to it. As, these water from the *Tatopani* is supposed to cure many diseases, hence the chemical composition of this thermal water should be known for its beneficial use. Also, the spring goers directly drink the water coming from a source fissure at *Polok*, hence the potability of the water has to be determined. There is was no drastically change in pH value in the observed Tatopani bathing ponds. The value of fluoride also showed higher in all the three *Tatopani,* higher fluoride may cause fluorosis. Our present findings showed that the seasonal variations in the physiochemical parameters of Polok, Borong and Reshi *Tatopani* have to be done in future to know about the changes in the chemical constituents of the water sample. Study if Hot springs is a very important aspect to relate their balneotherapeutic property and enhance the Medical Tourism of the state.

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