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A Study On Bacteriological Water Analysis Of Rishikund, Sitakund And Rajgir Hot Spring Sites Of Bihar, India

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ABSTRACT

Sitakund, Rishikund and Rajgir hot spring site is a sulphur containing hot spring site. Bacteriological water analysis is a method of analyzing water to estimate the numbers of bacteria present. It is a micro biological analytical procedure which uses sample of water and form these samples determine the concentration of bacteria.

The Biological parameters were analyzed as per WHO, APHA. The bacteriological parameter included SPC (standard plate count), MPN (most probable number). Bacterial contamination of drinking water sources is the most common health risk. The water sample were collected from three selected hot spring site Rishikund, Sitakund&Rajgir during period (October 2014 to June 2016) within and interval of four months. All the results were compared with WHO, APHA, BIS and found that water is potable.

Keywords – APHA, BIS, WHO, SPC, MPN.

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1. Introduction

Rishikund and Sitakund hot spring site present in Munger district of Bihar state where as Rajgir hot spring site present in Nalanda district of Bihar state. Groundwater is the primary source of water for domestic, agricultural uses in many countries and its contamination has been recognized considered as most serious problem in world. A spring is discharge of ground water appearing at the ground surface as a current of flowing water. However, due to anthropogenic activities in Sitakund and Rishikund hot spring these water bodies are under constant threat resulting in ecologically adverse condition.

Rishikund, Rajgir, and Sitakund hot spring sites are physiologically as well as sociologically important[1]. It is sulphur containing hot spring, it is believed that water from this hot spring can cure several diseases various gastrointestinal and bowel associated and skin related diseases to cure themselves [2,3,4].

Hot ground water can be used to drive turbines electricity. The energy extracted form earths called geothermal energy[5].

2. Sampling Method

The water samples collected from selected sites of Rajgir, Rishikund and Sitakund hot spring site in a pre-cleaned sterilized polythene bottle without any air bubble. All bacteriological quality parameters estimated by the standard method given by APHA[6]. The sample were kept at incubator at 37 - 42 ℃ for 48 hr after collection. The SPC and MPN determined using Nutrient agar media and Mac-conkey broth respectively.

3. Results and Discussion

Rishikund hot water spring sites

1. SPC (Standard Plate Count): SPC of water samples at two selected hot spring sites of 1st central kund and Karelia point during study period (Oct 2014 – June 2016) varies from 30 cfu │ml to 50 cfu │ml and 0 cfu │ml to 20 cfu │ml. all concentration lies within permissible range 500 cfu │ml (U.S.E.P.A.)[7]- 2012.

Presence of bacterial growth density due to the presence of both human as well as animal activity near site.

2. MPN (Most Probable Number): MPN count of water sample at selected hot spring sites of Rishikund namely 1st central kund and Karelia point site during selective period ≤ 2 MPN │ml to 2 MPN │ml. All concentration lies within permissible limit as per WHO[8], BIS[9], C.P.C.B[10].

Presence of bacterial growth density due to presence of animal excreta or faces activity near sites.

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Sitakund hot water spring sites

1. SPC (Standard Plate Count): SPC of water samples at three selected hot spring sites of Sitakund– Sitakund main site, Hand pump site and Bardah village hot water site during selective period varies from 90 cfu | ml to 140 cfu | ml, 40 cfu | ml to 50 cfu | ml and 480 cfu | ml to 730 cfu | ml. all selected sampling sites lies within permissible range (USEPA - 500 cfu | ml).

Due to frequent access of man and animal to the site at Bardah village get contaminated not suited for drinking purpose.

2. MPN (Most Probable Number): M.P.N. count of water samples at selected hot spring sites of Sitakund during selective period varies from ≤ 2 MPN | 100 ml to 7 MPN | 100 ml, ≤ 2 MPN | 100 ml to 2 MPN | 100 ml, ≤ 2 MPN | 100 ml to 12 MPN | 100 ml. All the concentration lies within permissible range as per WHO, BIS, CPCB.

Rajgir hot water spring sites

1. SPC (Standard Plate Count): Standard plate count of water samples at Vishwamitrakund, Brahmkund and Makhdumkund during selective study period varies from 30 cfu | ml to 40 cfu | ml, 60 cfu | ml to 130 cfu | ml and 30 cfu | ml to 40cfu | mlrespectively. Presence of more SPC at Brahmkund due to bathing of tourist at the kund.

2. MPN (Most Probable Number): M.P.N. count of water samples at selected hot spring sites of Rajgir during study period between Oct.-14 to June – 2016 varies from ≤ 2 MPN | 100 ml to 4 MPN | 100 ml, 4 MPN | 100 ml to 7 MPN | 100 ml, and ≤ 2 MPN | 100 ml to 2 MPN | 100 ml. All the concentration lies within permissible limit.

Table – 1: Bacteriological data of water samples at Vishwamitrakund Rajgir.

Parameter	SPC	Bacteria/Growth	MPN count	Bacteria / Growth
Oct-14	Nil	No growth	≤ 2 MPN | 100 ml	No growth
Feb-15	40 cfu | ml	Growth	2 MPN | 100 ml	Growth
Jun-15	Nil	No growth	≤ 2 MPN | 100 ml	No growth
Oct-15	30 cfu | ml	Growth	4 MPN | 100 ml	Growth
Feb-16	Nil	No growth	≤ 2 MPN | 100 ml	No growth
Jun-16	Nil	No growth	≤ 2 MPN | 100 ml	No growth

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Table – 2: Bacteriological data of water samples at Brahmkund site Rajgir.

Parameter	SPC	Bacteria/Growth	MPN count	Bacteria / Growth
Oct-14	60cfu | ml	Growth	4 MPN | 100 ml	Growth
Feb-15	130cfu | ml	Growth	7 MPN | 100 ml	Growth
Jun-15	Nil	No growth	≤ 2 MPN | 100 ml	No growth
Oct-15	90 cfu | ml	Growth	6 MPN | 100 ml	Growth
Feb-16	110 cfu | ml	Growth	7 MPN | 100 ml	Growth
Jun-16	110cfu | ml	Growth	6 MPN | 100 ml	Growth

Table – 3: Bacteriological data of water sample at Makhdumkund Rajgir.

Parameter	SPC	Bacteria/Growth	MPN count	Bacteria / Growth
Oct-14	40cfu | ml	Growth	2 MPN | 100 ml	Growth
Feb-15	Nil	No growth	≤ 2 MPN | 100 ml	No growth
Jun-15	30 cfu | ml	Growth	2 MPN | 100 ml	Growth
Oct-15	Nil	No growth	≤ 2 MPN | 100 ml	No growth
Feb-16	Nil	No growth	≤ 2 MPN | 100 ml	No growth
Jun-16	Nil	No growth	≤ 2 MPN | 100 ml	No growth

Table – 4 : Bacteriological data of water sample at 1st Central kund spring sites at Rishikund.

Parameter	SPC	Bacteria/Growth	MPN count	Bacteria / Growth
Oct-14	Nil	No growth	≤ 2 MPN | 100 ml	No growth
Feb-15	30 cfu | ml	Growth	2 MPN | 100 ml	Growth
Jun-15	40 cfu | ml	Growth	2 MPN | 100 ml	Growth
Oct-15	Nil	No growth	≤ 2 MPN | 100 ml	No growth
Feb-16	50 cfu | ml	Growth	2 MPN | 100 ml	Growth
Jun-16	Nil	No growth	≤ 2 MPN | 100 ml	No growth

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Table – 5: Bacteriological data of water sample at Karelia point hot water spring site, Rishikund.

Parameter	SPC	Bacteria/Growth	MPN count	Bacteria / Growth
Oct-14	Nil	No growth	≤ 2 MPN | 100 ml	No growth
Feb-15	Nil	No growth	≤ 2 MPN | 100 ml	No growth
Jun-15	Nil	No growth	≤ 2 MPN | 100 ml	No growth
Oct-15	Nil	No Growth	≤ 2 MPN | 100 ml	No Growth
Feb-16	20 cfu | ml	Growth	2 MPN | 100 ml	Growth
Jun-16	Nil	No growth	≤ 2 MPN | 100 ml	No growth

Table – 6: Bacteriological data of water sample at Sitakund main hot water site, Sitakund.

Parameter	SPC	Bacteria/Growth	MPN count	Bacteria / Growth
Oct-14	Nil	No growth	≤ 2 MPN | 100 ml	No growth
Feb-15	100 cfu | ml	Growth	2 MPN | 100 ml	Growth
Jun-15	140 cfu | ml	Growth	≤ 2 MPN | 100 ml	Growth
Oct-15	Nil	No growth	4 MPN | 100 ml	No growth
Feb-16	130 cfu | ml	Growth	≤ 2 MPN | 100 ml	Growth
Jun-16	90 cfu | ml	Growth	≤ 2 MPN | 100 ml	Growth

Table – 7: Bacteriological data of water sample at Hand pump site, Sitakund.

Parameter	SPC	Bacteria/Growth	MPN count	Bacteria / Growth
Oct-14	Nil	No growth	≤ 2 MPN | 100 ml	No growth
Feb-15	50 cfu | ml	Growth	2 MPN | 100 ml	Growth
Jun-15	40 cfu | ml	Growth	≤ 2 MPN | 100 ml	Growth
Oct-15	Nil	No Growth	≤ 2 MPN | 100 ml	No Growth
Feb-16	Nil	No growth	≤ 2 MPN | 100 ml	No growth
Jun-16	Nil	No growth	≤ 2 MPN | 100 ml	No growth

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Table – 8: Bacteriological data of water sample at Bardah village reservoir site, Sitakund.

Parameter	SPC	Bacteria/Growth	MPN count	Bacteria / Growth
Oct-14	Nil	No growth	≤ 2 MPN | 100 ml	No growth
Feb-15	480 cfu | ml	Growth	4 MPN | 100 ml	Growth
Jun-15	660 cfu | ml	Growth	9 MPN | 100 ml	Growth
Oct-15	Nil	No Growth	≤ 2 MPN | 100 ml	No Growth
Feb-16	620 cfu | ml	Growth	11 MPN | 100 ml	Growth
Jun-16	730 cfu | ml	Growth	12 MPN | 100 ml	Growth

4. **Conclusions:** The overall conclusion it is concluded that the eight hot spring sites selected in Rajgir, Rishikund and Sitakund region of Bihar state, the two sites Brahmkund of Rajgir and Bardah village of Sitakund have above concentration of SPC in some season due to dilution of water in raining, and also human activities like bathing & washing clothes.

The growth of bacteria is observed in all spring site but it is below permissible limit, so, it is well suited for drinking purposes. However, Bardah village reservoir site has more concentration of SPC & MPN count. So, it is not well suited for drinking purposes.

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