

Studies of Physico-Chemical Status of Some Holy Water Ponds Of Gaya And Bodh Gaya.

Arvind Kr Nag¹, Bihari Singh², Kamal Kishore Singh³ And Kamalaxighosh⁴

*1*Department Of Chemistry, College Of Commerce Arts And Science Patna, India

2, 3 & 4 P.G. Department Of Environmental Science, A.N. College Patna, India.

Corresponding author: Arvind Kr Nag

Abstract :Present Study Deals With The Investigation Related To Physico-Chemical Characteristics Of Water From Some Ritually Important Ponds Of Gaya And Bodhgaya Namely Suryakund Pond(T₁), Ramsagar Pond(T₂), Bisar Pond (T₃) Located At Gaya Whilebudhasarovar Pond(T₄) Located At Bodh Gaya. Water Samples From These Ponds Are Analysed For Various Physico-Chemical Parameters Like Ph, Turbidity, Conductivity, TDS, Total Hardness, Calcium, Magnesium, Chloride, Alkalinity, Iron, Nitrate, Sulphate, Fluoride, Arsenic, BOD, And COD. The Observation Is Very Interesting As Most Of The Physico-Chemical Parameters Recorded Are Within The Permissible Limits. However, Most Of The Water Bodies Under Study Are Not Suitable For Domestic And Drinking Purposes. The Remedial Measures Are Essential To Be Adopted For Domestic Use Of These Water Bodies Of Gaya.

Key Words: Physic-Chemical Characteristics, Water Ponds, Suryakund Pond, Ramsagar Pond, Bisar Pond, Budhasarovar Pond, COD, BOD.

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I. Introduction

Availability Of Water May Seem Abundant But In Actual Availability Is Less Than One Percent Of Global Water Stock, Which May Be Used For Human Consumption¹. Due To Increasing Population The Stress On Fresh Water Is Also Increasing In Form Of Its Demand². Scarcity Of Water And Pollution Load Due To Rising Population Has Drawn The Attention Of Environmentalists For Proper Management Of Water Resources, Particularly The Surface Water. India Is Fortunate To Have A Fair Resource Of Fresh Water In Form Of Its Rivers, Ponds, Lakes, And Waterfalls.

The Religiously Important Gaya City Is The District Headquarters Of Gaya District And Divisional Headquarters Of Magadh Division Of Bihar Province Of India. The Geographical Location Of Gaya Is 24° 46' 60N Latitude And 85° 01' 0longitude, Situated On The Bank Of Revered River The Falgu. It Has An Area Of 50.17 Km² And Population Of 4,63,544 As Per 2011 Census.

The Problem Of Water Scarcity Had Been Afflicting The Region For More Than Two Decades, Which Had Once A Good Number Of Ponds. Deterioration Of The Water Quality Is Now A Global Problem³. The Rain Water Was Being Stored In Small Water Bodies Like Ponds, The Ahar-Pyne Systems In Most Of The Regions Of India From The Very Ancient Times. These Water Bodies Worked As Water Reservoirs For Multi Purposes For The Dependant Population Throughout The Year⁴. Gaya And Bodh Gaya Are The Twin Holy Cities Of India. The River Falgu Is Known Since Prehistoric Times For Performing The Rituals Of “Pind-Daan” Or Oblation. This Is A Holy Ritual Offered By The Hindus To Ensure Peace(Moksha) For The Departed Souls Of Their Ancestors On Its Banks And Different Ponds Of The City. Water Of These Ponds Is Feared To Have Got Polluted Due To Dip Bath Of A Large Number Of Pilgrims Who Come To Perform The “Pind-Dan” At Its Bank. Moreover, These Ponds Become Most Visited Place By The Local Population On The Occasion Of The “Chhath Puja” One The Most Important Religious Festivals Of Bihar And Eastern Region Of India In Which The Sun Is Believed To Be Live God And Is Worshipped First By Offering “Aradh” To Setting Sun And Next Morning To The Rising Sun. Both, These Religious Festivals Fall During And After Monsoon In Between September To November Every Year. People Donot Only Take Dip In These Ponds Rather They Dispose Flowers, Fruits And Other Worship Ingredients Out Of The Religious Belief. These Activities Of Large Number Of Pilgrims And Locals Are Sure To Affect The Quality Of Water Of These Ponds.

II. Material And Method

The Physico-Chemical Characteristic Of Water Is An Important Determinant Of The Aquatic System. Their Characteristics Are Greatly Influenced By Climatic Vegetation And General Composition Of

Water. The Present Study Was Carried Out In The Month Of April 2013 And November 2013 On Water Of Above Mentioned Ponds In Gaya And Bodh Gaya.

Ramsagarpond(T₁)

It Is A Semi-Permanent Type Of Pond In Densely Populated Jaiprakash Nagar Colony Of Gaya City. It Is At A Distance Of One Kilometer From The Famous “Vishnupad Temple” And 4 Km From The Gaya Railway Station.

Surya Kund (T₂)

It Is Located On The West Side Of The “Vishnupad Temple” And Is Regarded As One Of The Most Prominent Ponds For The Rituals By The Pilgrims. According To Popular Beliefs A Holy Dip Into This Pond Sets A Person Free From All Sins, Committed During His Lifetime. There Is A Temple Of The Living God “Sun” On One Side Of Its Bank.

Bisartalab Pond (T₃)

This Tank Is Located On The Southern Side Of The Famous Gandhi Maidan. It Is Also A Semi-Permanent Type Of Pond. It Is Located At 3 Kms From The Railway Station And 3 Kms From The “Vishnupad” Temple.

Budhsarovar(T₄)

Budhsarovar, Located At Bodh Gaya, In The Premises Of Religiously Famous Maha Bodhi Temple Is A Big Pond. The Distance Of Bodh Gaya Is 15 Kms From The Gaya Railway Station.

III. Data Collection And Analysis Of Water

Air Temperature Was Recorded By A Digital Centigrade Thermometer On The Sampling Dates. Water Samples Were Collected For Two Different Seasons, One During The Monsoon In The Month Of August (25/8/2013) And The Second After Completion Of Monsoon, The “Ptripaksh” And The “Chhat Puja” In The Month Of November From The Selected Ponds. Samples Were Collected In Clear Plastic Sample Bottles Taken From The Surface (Maximum 30 Cm Deep) Of The Pond. For BOD Estimation, Water Samples Were Collected Separately In Dark Glass Bottles. Among Physico-Chemical Parameters Like Ph, DO, Total Alkalinity, Conductivity Etc., Some Of Them Were Tested And Measured At The Site Itself While For Other Parameters They Were Tested In The Laboratory Within 24 Hours From The Time Of Sampling.

IV. Analysis Of Water Sample

A Total Of 17 Physico-Chemical And Biological Parameters Of Water Viz. Ph, Turbidity, Conductivity, TDS, Total Hardness, Calcium, Magnesium, Chloride, Alkalinity, Iron, Nitrate, Sulphate, Fluoride, Arsenic, Coliform, BOD, And COD, Were Determined At PG Department Of Environmental Science, A.N. College Patna. All The Parameters Were Analysed Following Standard Methods^{5,6,7}, APHA⁸.

V. Results And Discussion

In The Present Investigation (Table-1) Ph, TDS, Total Hardness, Calcium, Magnesium, Chloride, Iron, Nitrate, Sulphate, Fluoride And Arsenic Were All Near The Desirable Limit, However, The Values Of Turbidity, Conductivity Alkalinity, Biochemical Oxygen Demand And Chemical Oxygen Demand, Coliform Organisms Were High In All The Four Ponds In The Samples Taken Before Monsoon ‘A’ (17/3/2013) And After Monsoon ‘B’ (29/11/2013).

Results Of Physico-Chemical Parameters Of Various Ponds At Gaya And Bodh Gaya (Table-1)

Parameter Of Samples From Different Ponds	Desirable Limit	Permissible Limit In Absence Of Alternate Source	Method Of Testing Parameters	T ₁ Ramsagar Pond		T ₂ Suryakund		T ₃ Bishar Pond		T ₄ Buddha Sarovar	
				A	B	A	B	A	B	A	B
Ph Value	6.5-8.5	No Relaxation	Ph Meter	7.25	7.13	7.39	7.06	7.20	7.11	7.60	7.01
Turbidity, NTU, Max	5.00	10.00	Nephelometer-Ic	9.00	9.00	13.00	13.00	11.0	8.00	8.00	5.00
Conductivity, µmho/Cm	-	-	Conductivity Meter	310.00	510.00	410.00	630.00	365.00	570.00	325.00	430.00
Total Dissolved Solid, Mg/L, Max	500	2000	Conductivity Meter	200.00	332.00	270.00	410.00	285.00	370.00	230.00	280.00

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Total Hardness (As CaCO_3), Mg/L, Max	300.0	600.00	EDTA Method	184.00	191.00	244.00	205.00	248.00	256.00	198.00	179.00
Calcium (As Ca), Mg/L, Max	75.00	200.00	EDTA Method	35.26	47.28	30.45	53.19	38.40	72.13	42.12	34.23
Magnesium (As Mg), Mg/L, Max	30.00	100.00	EDTA Method	23.82	16.38	40.82	19.82	38.25	18.46	26.35	23.64
Chloride (As Cl), Mg/L, Max	250.00	1000.00	Titration	34.08	28.36	46.19	24.16	48.32	37.48	41.15	36.23
Alkalinity (As CaCO_3), Mg/L, Max	200.00	600.00	Titration	240.00	260.00	340.00	240.00	320.00	380.00	260.00	360.00
Iron (As Fe), Mg/L, Max	0.30	1.00	Phenothroli-Ne	0.18	0.29	0.49	0.41	0.38	0.39	0.21	0.36
Nitrates (As NO_3), Mg/L, Max	45.00	No Relaxation	UV-Method	0.23	0.31	0.34	0.18	0.39	0.28	0.27	0.33
Sulphates (As SO_4^{2-}), Mg/L, Max	200.00	400.00	Turbidimetric-C	13.51	10.09	30.06	23.58	22.35	10.28	16.13	18.19
Fluorides (As F), Mg/L, Max	1.00	1.50	SPANDS	0.26	0.26	0.32	0.33	0.27	0.39	0.31	0.29
Arsenic (As As), Mg/L, Max	0.01	0.05	AAS	BDL							
Coliform Organisms, MPN/100ml	-	**	M- Test-Tube Technique	>23.00	>23.00	>23.00	>23.00	>23.00	>23.00	>23.00	>23.00
B.O.D (As O_2), Mg/L	-	3	APHA 5210 B	-	82.00	-	76	-	-	-	-
C.O.D. (As O_2), Mg/L	-	-	APHA 5220	-	179.00	-	142	-	-	-	-

It Was Observed That The Turbidity And Conductivity Was Higher In Surya Kund And Bishar Pond In Comparison To Ramsagar Pond And Budhasarovar. BOD And COD Values Were Very High In All The Four Ponds, While The Coliformorganism Level Had Also Exceeded The Permissible Limits. Thus The Data Of Study Indicates That The Ponds Under Study Indicate That The Ponds Are Highly Polluted And Unfit For Human Consumption. These Water Bodies Are Unsafe Even For The Bathing Purposes.

The Ph Values Were Found To Be In The Range Of 7.05 To 7.60. These Values Are Showing Slightly Alkaline Trend. The Ph Affects The Biological And Biochemical Properties In Waterbody⁹.

The Conductivity Values Had A Very Interesting Pattern, During The Pre-Monsoon Period It Was In The Range Of 310-410 $\mu\text{mho}/\text{Cm}$, But It Was Remarkably High In The Range Of 410-570, After Festival Season And Post-Monsoon Period. The Conductivity Of Water Is Affected By The Presence Of Dissolved Inorganic Solids Such As Calcium, Magnesium, Iron Cations And Sulphate, Nitrate, Chloride Anions.

The BOD And COD Values Were Observed For The Maximum Levels In Ramsagar Pond And Suryakund Pond. In Ramsagar Pond The BOD Value Was 82, While In Suryakund Pond It Was 76. Similarly COD Values For These Two Ponds Were Observed 179 And 142 In Ramsagar Pond And Suryakund Pond Respectively. Dissolved Oxygen Is An Important Parameter In Water Quality Assessment. It Reflects The Physical And Biological Health Of Aquatic Life. BOD Depends On Temperature, Extent Of Biochemical Activities And Presence Of Organic Matter And Thereby The Microbial Population Such As Bacteria And Fungi.

The TDS Value Is Increased Prominently By Sewage Water, Soap And Detergents Used. The TDS Value In All The Four Ponds Ranged From 200-285 For The Pre Monsoon Period And It Increased To The Range Of 332 To 410 In The Post Monsoon Season, However, It Was Only 280 In Budhasarovar Pond. Higher Value Of TDS In Three Ponds Was Due To Maximum Exploitation Of Ponds By The Pilgrims. This Logic Is

Also Supported By The Fact That The Budhasarovar Pond Is Not Used By The Pilgrims For Dip And Disposing Off The Offerings Into It. This May Be The Reason For Lower TDS Value In Comparison To Other Ponds.

VI. Conclusion

The Present Study Leads To The Following Conclusion:

1. All Ponds Under Study Are Polluted But Suryakund Pond And Ramsagar Pond Are Most Polluted.
2. Data Indicates That TDS, BOD, COD, Alkalinity, TDS Were Found To Be In Higher Range Either Near Or Beyond The Desirable Limits.
3. Water Of All These Ponds Is Not Suitable For Human Consumption.

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