



## Physico Chemical analysis of Sitapat pond and its Comparison with tap water quality of Dhar town for Potability status

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### Abstract

The assessment of some physico-chemical and bacteriological parameter of a water body for its suitability of drinking purpose has been carried out during 2007- 2008 in six selected stations of Sitapat pond and five tap water stations of different areas from the town. The result show severe deterioration in the quality of pond water and after treatment of water supply in tap water of the town.

**Keywords:** Assessment, physico-chemical, bacteriological, deterioration, tap water.

### Introduction

The water is one of the nature's free gifts to the human beings. It is an essential for survival of each organism. The life sustains on water as one of the element, therefore qualitatively safe and adequate quantum as well as esthetically acceptable water should be made available. Majority of water available on the earth is saline in nature, only small quantity exists as fresh water has become a scare commodity due to our exploitation and pollution making them unfit for use (Dwivedi and Pandey)<sup>1</sup>. The physico-chemical characteristics of an aquatic body not only reflect the type and experiments done primarily on Sitapat pond and secondary on tap water samples from different areas of Dhar town. Keeping this object in view is that treated water potability status but pipe lines degradation can affects the water quality. Diversity of aquatic biota but also the water quality and pollution status.

### Material and Methods

The Dhar district is situated between 22°1'14" and 23°9'49" North and the meridians of 44°28'27" and 75° 42' 43" east the area of Dhar town is 49 sq. kms geographically it is divided by Vindhya hills in two parts of northern plateau of Malwa and Southern plateau of Nimar. The district enjoys its pleasant climate.

Sitapat pond is situated about 4.50 km. away from Dhar town and is approachable by Dhar- Salkanpur Road. This pond constructed in 1984 is very large pond water to the whole town for drinking purpose. The catchments area of the pond is 2.85 sq. miles. The length of pond is 570 meters and maximum height of pond Earthen = 16.28 meter, top width of pond Earthen = 3.0 meter. Tap water samples were collected from 4 different directions and middle portion of the town i.e. i.

Prakash Nagar (East side), ii. Salkanpur Road (Southern side), iii. Nangaon (Northern side), iv. Po-chaupati (West side) and M.G. Road (Middle of the town). Water samples were collected from pond and tap water in plastic bottles seasonally during 2007-08 physico-chemical parameters were analyzed as per the standard method described in APHA<sup>2</sup> and Trivedi and Goel<sup>3</sup>.

### Result and Discussion

The physico-chemical quality of water in Sitapat pond is depicted in table-1, 2 and of tap water table-3. The maximum water level was observed in July and August while the minimum water level was observed in May and June. The colour of the pond was dusky in rainy season and winter season it was highly green due to algal population and in the summer season it was light green due to less quantity of water and dryness of algae. The Salkanpur road sample was found affected by some damage pipelines. The taste of the water found slightly salty at some stations due to higher concentration of salts and it is an indication of hardness.

**Turbidity:** The turbidity of all the stations was higher than the desirable limit of BIS<sup>4</sup>. The turbidity value was minimum (18.3NTU) in the winter season and maximum (43.5NTU) in the summer season high turbidity is due to the silting of soil and other man made activities around the pond.

Turbidity values were found to be higher than that of the standard permissible limit of BIS<sup>4</sup> and WHO<sup>5</sup>. The maximum turbidity value was observed in rainy season due to mixing of runoff water and minimum in winter season it should be due to settlement of particles.

**Table-1 (a)**  
**Seasonal variation (year wise) in physico-chemical and bacteriological characteristics of sitapat Pond- 2007**

S. No.	Parameters	Station-1			Station-2			Station-3		
		Rainy	Winter	Summer	Rainy	Winter	Summer	Rainy	Winter	Summer
1	Taste	TL	TL	TL	TL	TL	TL	TL	TL	SS
2	Colour	Dusky	Dark Green	Light Green	Dusky Green	Dark Green	Light colour	Dusky	Dark Green	Colour less
3	Turbidity	38.5	18.5	22.6	38.9	22	24.4	43.5	23.3	25.4
4	pH	7.2	7.4	7.8	7.1	7.3	7.8	6.8	7.0	7.2
5	Specific conductivity	362	345	380	448	442	465	491	482	540
6	TDS *	235	229	256	460	441	490	490	480	505
7	Total Hardness*	136	142	157	175	187	200	182	200	220
8	Total Alkalinity*	180	188	195	170	178	195	195	240	245
9	Chloride *	208	219	227	221	236	250	226	247	260
10	Fluoride *	0.88	0.93	0.95	0.88	0.91	0.95	0.89	0.92	0.98
11	Nitrates *	1.98	2.0	1.96	2.1	2.5	2.0	2.2	2.6	2
12	Sulphates *	46.0	58	32.0	38.6	49.2	34.4	40.8	59.4	35.4
13	Phosphate*	2.12	2.07	2.16	2.15	2.11	2.21	3.1	2.89	3.4
14	DO*	5.5	5.7	5.3	7.3	7.70	7.1	5.8	5.11	5.1
15	BOD *	4.8	4.6	4.32	3.70	3.61	3.72	3.7	3.6	3.9
16	COD*	24	26	18	22	25	19	32.1	35.0	30.1
17	Bacteriological Total coli.	45	22	80	50	40	85	20	45	150
18	Bacteriological Faecal coli.	10	14	34	20	14	40	10	23	58

**Table-1 (b)**  
**Seasonal variation (year wise) in physico-chemical and bacteriological characteristics of sitapat Pond- 2007**

S. No.	Parameters	Station-4			Station-5			Station-6		
		Rainy	Winter	Summer	Rainy	Winter	Summer	Rainy	Winter	Summer
1	Taste	TL	TL	SS	TL	TL	TL	TL	TL	TL
2	Colour	Dusky	Dark Green	Light Green	Dusky Green	Dark Green	Light Green	Dusky	Dark Green	Light Green
3	Turbidity	42.8	22.4	24.6	36.2	18.3	20.8	36.1	18.8	20.2
4	pH	7.1	7.3	7.4	8.1	8.4	8.8	7.8	8.1	8.2
5	Specific conductivity	462	418	508	321	310	336	329	315	339
6	TDS *	271	285	304	230	221	238	240	225	248
7	Total Hardness*	155	170	207	131	139	155	134	140	149
8	Total Alkalinity*	172	185	240	170	182	197	172	182	195
9	Chloride *	229	244	254	125	136	150	127	135	148
10	Fluoride *	0.86	0.88	0.97	0.8	0.82	0.86	0.81	0.83	0.85
11	Nitrates *	2.2	2.4	2.1	0.91	0.99	0.88	1.2	1.5	1.0
12	Sulphates *	38.2	40	36.1	38.5	42.6	32	36.1	42.4	32.1
13	Phosphate*	3.1	2.85	3.3	2.04	2.02	2.9	2.08	2.05	2.12
14	DO*	5.6	5.9	5.4	9.2	9.7	9.5	9.1	9.5	9.2
15	BOD *	5.36	5.31	5.41	5.61	5.48	5.71	5.62	5.56	5.7
16	COD*	22	29	18.3	20	22	17	22	25	18
17	Bacteriological Total coli.	9	21	143	0	18	35	0	14	20
18	Bacteriological Faecal coli.	4	5	47	0	7	18	0	6	8

**Table-2 (a)**  
**Seasonal variation (Year Wise) in Physico-Chemical and bacteriological characteristics of Sitapat Pond-2008**

S. No.	Parameters	Station-1			Station-2			Station-3		
		Rainy	Winter	Summer	Rainy	Winter	Summer	Rainy	Winter	Summer
1	Taste	TL	TL	TL	TL	TL	TL	TL	TL	TL
2	Colour	Dusky	Dark Green	Light Green	Dusky	Dark Green	Light Green	Dusky Colour	Dark Green	Light Green
3	Turbidity	39.2	19.3	22.4	39	22.2	25	43.2	22.9	25.5
4	pH	7.3	7.4	7.9	7.2	7.4	7.9	6.7	6.9	7
5	Specific con.	360	347	382	448	443	466	490	481	545
6	TDS *	234	252	257	461	440	492	489	480	507
7	Total Har.*	138	145	156	177	186	198	185	199	225
8	Total Alka.*	178	189	196	172	177	196	192	241	248
9	Chloride *	205	215	222	218	233	248	221	246	262
10	Fluoride *	0.89	0.93	0.96	0.88	0.93	0.95	0.90	0.97	0.98
11	Nitrates *	1.92	1.99	1.89	2.1	2.3	2	2.2	2.4	2
12	Sulphates *	47	52	33	38.1	49.5	34.6	41.3	59.6	39.2
13	Phosphate*	2.11	2.10	2.16	2.16	2.11	2.22	3.1	2.91	3.3
14	DO*	5.7	5.9	5.5	7.4	7.8	7.2	5.6	5.9	5.4
15	BOD *	4.11	4.7	4.15	3.81	3.71	3.90	3.8	3.7	3.10
16	COD.*	22	24	19	21	26	18.2	33	34.7	30
17	Bacteriological Total coli.	78	56	86	40	20	88	12	45	148
18	Bacteriological Faecal coli.	31	13	49	14	11	45	8	28	53

TL- Taste Less, Turbidity=NTU, Specific Conductivity= umhos/cm, Total /Faecal coliform (MPN/100ml), \* = mg/L

**Table-2 (b)**  
**Seasonal variation (Year Wise) in Physico-Chemical and bacteriological characteristics of Sitapat Pond-2008**

S. No.	Parameters	Station-4			Station-5			Station-6		
		Rainy	Winter	Summer	Rainy	Winter	Summer	Rainy	Winter	Summer
1	Taste	TL	TL	TL	TL	TL	TL	TL	TL	TL
2	Colour	Dusky Colour	Dark Green	Light Green	Dusky	Dark Green	Light Green	Dusky	Dark Green	Light Green
3	Turbidity	42.5	23.1	24.2	35.7	18.7	20.6	34.1	18.8	20.6
4	pH	7	7.2	7.4	8.1	8.3	8.6	7.8	8.2	8.3
5	Specific con.	464	419	509	321	309	327	347	320	327
6	TDS *	303	287	305	232	223	240	238	227	247
7	Total Har.*	158	176	220	132	140	156	133	141	150
8	Total Alka.*	175	196	241	171	187	198	173	184	198
9	Chloride *	228	243	251	126	137	149	128	136	149
10	Fluoride *	0.85	0.88	0.96	0.81	0.82	0.85	0.82	0.84	0.86
11	Nitrates *	1.98	2.2	2	1.1	1.3	0.99	1.3	1.6	1.1
12	Sulphates *	40	49	38.1	38.5	44.1	32.2	36.6	47.3	32.21
13	Phosphate*	2.98	2.84	3.2	2.05	2.03	2.2	2.07	2.04	2.11
14	DO*	5.6	5.9	5.5	9.2	9.8	9.5	9.1	9.4	9.2
15	BOD *	5.38	5.32	5.45	5.55	5.42	5.78	5.64	5.52	5.7
16	COD.*	23	28	19	20	23	18	22	24	18.5
17	Bacteriological Total coli.	12	46	147	8	25	40	10	33	49
18	Bacteriological Faecal coli.	7	12	55	0	8	25	2	5	10

TL- Taste Less, Turbidity=NTU, Specific Conductivity= umhos/cm, Total /Faecal coliform (MPN/100ml), \* = mg/L

**Table-3 (a)**  
**Tap Water Samples: Physico-Chemical and bacteriological examination (Mean value)**

S. No.	Physico-Chemical and Bacteriological Parameters	Name of the Tap Water Samples								
		1. Prakash Nagar			2. Salkanpur Road			3. Naugaon		
3	Seasons	Rain y	Winte r	Summe r	Rain y	Winte r	Summe r	Rain y	Winte r	Summe r
1	Colour (Visual)	True Colour			Dusky Colour			True Colour		
2	Turbidity (NTU)	2.69	1.6	1.4	3.6	2.5	2.2	2.5	1.9	1.8
3	pH	7.8	7.84	7.87	7.4	7.6	7.67	7.4	7.4	7.5
4	Specific conductivity (umhos/cm)	376	307	340	330	321	255	413	352	353
5	TDS (mg/L)	249	198	214	249	156	167	279	180	210
6	Total Hardness (mg/L)	117	126	135	146	142	153	126	134	138
7	Total Alkalinity (mg/L)	73	79	84	98	90	85	98	102	107
8	Chloride (mg/L)	205	213	220	210	220	232	208	213	218
9	Fluoride (mg/L)	0.34	0.36	0.39	0.35	0.37	0.39	0.35	0.36	0.38
10	Nitrates (mg/L)	1.13	1	1.06	0.94	0.93	0.89	1.3	1.4	1.5
11	Sulphate (mg/L)	22.6	20	17.3	29	25.6	22.6	25	22	20.3
12	Phosphate(mg/L)	0.02	2.01	0.01	0.04	0.03	0.02	0.05	0.03	0.02
13	DO(mg/L)	4.1	3.9	3.9	4.1	4.4	4.3	4.6	1.6	4.2
14	BOD(mg/L)	2.8	2.5	2.3	2.4	2.3	2.3	2.4	2.3	2.30
15	COD (mg/L)	7.9	7.9	8.1	8.6	8.6	8.7	8	9	8
16	Total coliform (MPN/100ml)	2.6	Nil	Nil	20	Nil	15	8.3	Nil	10
17	Faecal coliform (MPN/100ml)	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil	Nil

TL- Taste Less, Turbidity=NTU, Specific Conductivity= umhos/cm, Total /Faecal coliform (MPN/100ml), \* = mg/L

**Table-3 (b)**  
**Tap Water Samples: Physico-Chemical and bacteriological examination (Mean value)**

S. No.	Physico-Chemical and Bacteriological Parameters	Name of the Tap Water Samples					
		4. Po-choupati			5. M. G. Road		
3	Seasons	Rainy	Winter	Summer	Rainy	Winter	Summer
1	Colour (Visual)	True Colour			True Colour		
2	Turbidity (NTU)	2.6	1.8	1.6	2.16	1.7	1.4
3	pH	7.74	7.68	7.82	7.5	7.8	7.8
4	Specific conductivity (umhos/cm)	534	421	41	370	310	335
5	TDS (mg/L)	360	280	323	240	191	212
6	Total Hardness (mg/L)	171	167	164	118	127	136
7	Total Alkalinity (mg/L)	116	120	125	75	78	82
8	Chloride (mg/L)	213	221	233	2.06	215	218
9	Fluoride (mg/L)	0.37	0.42	0.44	0.35	0.37	0.39
10	Nitrates (mg/L)	1.06	1.05	1.04	1.15	1.1	1.1
11	Sulphate (mg/L)	26.3	24.3	22.6	22.3	21	17.8
12	Phosphate(mg/L)	0.04	0.02	0.02	0.05	0.01	0.02
13	DO(mg/L)	4.6	4.7	4.2	4.3	3.3	3.6
14	BOD(mg/L)	3.3	3.1	3.1	2.7	2.8	2.4
15	COD (mg/L)	7	6.7	7.3	7.8	7.9	8
16	Total coliform (MPN/100ml)	9	Nil	7	15	Nil	Nil
17	Faecal coliform (MPN/100ml)	Nil	Nil	Nil	Nil	Nil	Nil

TL- Taste Less, Turbidity=NTU, Specific Conductivity= umhos/cm, Total /Faecal coliform (MPN/100ml), \* = mg/L

**pH:** The pH indicates the intensity of acidity and alkalinity. It is a measure of the concentration of hydrogen ion in water. The pH values were found minimum 6.7 in the rainy season and maximum 8.8 in the summer season. High pH value was

recorded in the summer season because of due to utilization of bicarbonate and carbonate buffer system due to evaporation of water

The minimum pH value was found during rainy season due to influx, dilution of pond, low temperature or organic matter decomposition. The pH pond water was good for plankton growth leading to good fish production. The pH of tap water were found within the permissible limit of BIS<sup>4</sup>.

**TDS:** TDS refer to any minerals, salts, metals cations or anions dissolved in water. TDS values found maximum in summer season (507 mg/ l) and minimum in the winter season (221 mg/l). It is higher due to contamination of domestic waste water, garbage, fertilizers etc, in water body. High concentration of TDS enriches the nutrient status of water body which was resulted in to eutrophication of the aquatic ecosystem. High solid content having inferior potability may induce an unfavorable physiological reaction in the transient consumer. Tap water samples were under the permissible limit of BIS<sup>4</sup>.

**Total Alkalinity:** Total alkalinity is a measure the ability of water is neutralized or assimilates acids. High value (248 mg/ l) of total alkalinity was recorded in the summer season due to mixing of garbage inside the pond. The low alkalinity value (170 mg/l) was found during rainy season. Alkalinity values of tap water samples were found from 70 mg/l to 134mg/l. this fluctuation in alkalinity values due to the doses of alum and biocide.

**Chloride:** The chloride was higher in the summer season (260 mg/l) and minimum value (125 mg/l) was recorded in the rainy season due to evaporation of water and mixing of organic waste of animal. It is directly correlated with the pollution level (Munnawar, 1970). The chloride content of tap water samples was under the desirable limit of BIS<sup>4</sup>.

**Fluoride:** Concentration of fluoride is significantly low in most of the samples. Fluoride ions have significant in water supplies. Excess concentration of fluoride causes dental fluorosis while a concentration less than 1mg/l results in dental caries. The fluoride values were found to be within the standard permissible limit of WHO and BIS. Fluoride content of all the tap water samples was also under the permissible limit of BIS<sup>4</sup>.

**Nitrates:** Nitrates are the highest organized form of nitrogen and in water its important source is biological oxidation in nitrogenous organic matter or both materials. Nitrate content in all the samples were found to be less than the standard permissible limit of 45mg/l and hence no health problem to the consumers. Nitrate content of tap water sample was also under the permissible limit.

**Phosphate:** Phosphate is one of the most important nutrients in aquatic ecosystem. The amount of phosphate was found minimum in the winter season was 2.02 mg/l and maximum in the summer season was 3.4mg/l phosphate of tap water samples was also under the permissible limit.

**Sulphates:** The sulphate value was recorded minimum in the

summer season was 32mg/l and maximum in the winter season was 59.6mg/l Sulphate in all the water samples was present below BIS limit of 200mg/l. The Sulphate value of tap water samples was also within the permissible limit.

**DO.:** DO is an important factor that determines the quality of water assessment, which reflects the physicals and biological processes prevailing in water. The DO content were found minimum (5.1mg/l) in the summer season and maximum (9.8 mg/l) in the winter season respectively DO values of all the tap water samples under the permissible limit of BIS<sup>4</sup>.

**BOD:** The BOD of water is the indicator of organic pollution. The BOD values were found minimum (3.6mg/l) in the winter season and maximum (5.78mg/l) in the summer season. The reason of high BOD in summer season may be that in summer several microbes present in the water bodies accelerated their metabolic activities with concentrated amount of organic matter in the form of domestic wastes discharge in to water bodies and hence required much amount of oxygen so the demand oxygen increased<sup>6</sup>. BOD values of all the tap water samples under the permissible limit of BIS<sup>4</sup>.

**COD:** The COD is a measure of the oxygen equivalent of the organic matter in water. The COD values water found minimum in the summer season and maximum in the winter seasons. COD values of all the tap water samples under the permissible limit. It means it does not receive any pollution bearing substances<sup>7</sup>.

**Bacteriological:** The bacteriological examination of water has a special significance in drinking water and pollution. The total coli form count of water samples was recorded from a 0 MPN/100ml to 150MPN/100ml and the faecal coli form counts were 0 MPN/100ml to 58 MPN/100ml. The high total coli form count was summer season and lowest in the rainy seasons. The faecal coli form was found high than permissible limit of WHO<sup>5</sup>. As these bacteria are not pathogenic, there was no jeopardy of developing some bacteria a disease among the human and animals but due to these water cannot be used for the drinking purpose.

## Conclusion

The present study provides the following information for the batter management, conservation of aquaculture and monitoring of water body.

Regular monitoring of the pond water should be carried out by the regular agencies. Bathing and washing activities of human beings and animals must be prohibited. Protection of water bodies from the pollution and other human activities is very necessary. To improve the quality of water there should be continuous monitoring of the pollution level of this pond. Awareness should be created among the people regarding filtration and treatment processes.

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