

Survey on Water Quality management A case study of Iran

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Abstract: Zabol Chahnimeh reservoirs are three natural and big cavities in the south of Sistan Plain Located in South-Eastern Iran and It Includes 50 Millions square meter extent. Stored Water In These Cavities Are Used To Sistan Earth And For Providing Drink Water Of Zabol And Zahedan Cities. In Spite Of Clearance Of Importance For Chahnimeh Lakes, Recently Only Study Of Sediments For Chahnimeh reservoirs And Study about Limnology have been done, But There Is not any investigation of Water Quality Of Chahnimeh reservoirs. For This Reason and health consideration, Physical And Chemical characteristics (14 parameters) Of Chahnimeh reservoirs, for identifying water quality have been investigated, From Fall of 2004 Until Half Of Summer of 2005. In 9 Selected Stations. Then, Samples Collected Season By Season. The Results Showed That Average Of COD, BOD₅, Nitrate And Nitrite For All Stations In Different Seasons Of Year Were Very Small And Have No Special Problem. Amounts Of Phosphate Was In Standard Level except In Third Station. Dissolved oxygen amount Is Suitable for All Seasons of Year. But Average Of dissolved And Suspended solids, Hardness, Turbidity And Also Electrical Conductivity In All Three Reservoirs Of Chahnimeh Are High, which related to the Atmospheric Conditions, High Temperature Of Area, Sand Storms And Kind Of Bed Soil For Lakes.

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Introduction:

The improvement of hygiene, environment and also economic and social development all over the world are always possible only by providing water. The most amount of water with higher quality would bring about more improvement and better development. The quality of water along with some physical, chemical and environmental characteristics could be defined. [1] Since the country of Iran doesn't receive much and regular rain over the year so it doesn't have high potential of water resources. The biggest plain of sistan which is located in the north part of Sistan & Baloochestan province is awfully dependant on the water sources which are mainly coming from Hamoon and Hirmand Rivers. The long period of drought and dearth has caused these rivers to become dry and yet the mismanagement of using these sources has put the area of sistan in a hazardous situation. Because of this, especial attention must be paid to the other water resources such as Chahnimeh reservoirs in the sistan plain. Chahnimeh reservoirs are three natural and big cavities in the south of Sistan Plain around the Hirmand mouth; they have been used since 1983 to save flood-water of Hirmand River. [2] The proper use of these resources, their maintenance and improvement is not possible without a wide spread scientific study, and complete recognition of these reservoirs. Thus for a correct planning and programming to develop

Chahnimeh reservoirs we need an exact and true recognition of the Chahnimeh Lakes that provide the water for these reservoirs. Also physical and chemical characteristics of these reservoirs have got to be considered. The goal of this project is to get primary information from conditions and general status of the Chahnimeh reservoirs and consequently to obtain physical and chemical characteristics of water of Chahnimeh Lakes. These results can be used as an environmental certificate and make the way for a better usage and management of these resources. The main project which so far have been done include the limnological study of these lakes and to appoint a trend of sediment at the Chahnimeh cavities. In Iran and since before 1979 revolution a lot of study has been done to determine the environmental characteristics of water resources in the country. How ever, nothing has been done to find characteristics of water of Zabol Chahnimeh Lakes.

Materials & Methods:

The area of this study includes lakes number 1, 2 and 3 Chahnimeh in Zabol which Includes 50 Millions square meter extent. The first Chahnimeh from Afghanistan border parallel to Sistan River up to 6 kilometers from city of zahak is located. The second Chahnimeh starts from Afghanistan border and ends to the middle of first Chahnimeh and the third Chahnimeh

is located west of second Chahnimeh. [3] To do the study with considering the river conditions such as the situation of entrances and exits, the area and shape of the lakes also meteoric conditions of the area in each of the reservoirs, three sampling stations (altogether 9 sampling stations) were placed. Stations 1, 2 and 3 at the first Chahnimeh, stations 7, 8 and 9 at the third station were placed. (Table 1) In order to study the physical and chemical quality of water sampling was done monthly from mid of fall 2004 to mid o summer 2005. The temperature of water with an alcoholic thermometer, and the salinity of water with equipment

called Huake were measured. Other parameters also measured and then were taken to the lab. Ph with ph meter P.M.T model 2001, turbidity with DRT-15CE, Electrical Conductivity (EC) with Hanna, total dissolved solids(TDS) by filtering, total hardness(TH) in the form of calcium carbonate by titration with versant solution(normalite:2%),dissolved oxygen(DO) by Vinkler method, biological oxygen demand(BOD) with assist from BOD, chemical oxygen demand(COD) from titration with sulfate feru aluminum 1% were measured, measurement of phosphate, nitrate and nitrite were done by spectrophotometer.[4,5]

Table 1: geographical coordinates of sampling stations

Latitude	Longitude	station
30°51'00" N	61°40'27"E	1
30°49'12" N	61°42'00"E	2
30°50'16" N	61°42'15"E	3
30°47'11" N	61°41'58"E	4
30°40'54" N	61°41'55"E	5
30°46'33" N	61°41'25"E	6
30°47'59" N	61°40'50"E	7
30°47'24" N	61°39'28"E	8
30°45'59" N	61°39'25"E	9

Results:

According to statistical calculations, the average amount of nitrate, nitrite and phosphate in the fall season are 1.5 mg/liter, 0.0002 mg/liter and 0.09 mg/liter respectively. BOD and COD as top indicators of water are 24 mg/liter and 1.6 mg/liter respectively. The dissolved oxygen in the fall with the average of 10 mg/liter is in a good situation. The Averages Of dissolved And Suspended solids are 735 mg/liter and 803.8 mg/liter respectively. (Table 2) The averages of nitrate, nitrite and phosphate as the most important nutritive materials in water in the winter are 1.5 mg/liter, 0.02 mg/liter and 0.03 mg/liter respectively. The averages of COD and BOD in winter are 25.3 mg/liter and 2.5 mg/liter. Dissolved oxygen with the average of 11.3 mg/liter has the highest value in the winter. The Averages of Suspended and dissolved solids in the winter are 567.8 mg/liter and 626.7 mg/liter. (Table 3) The averages of Nitrate, nitrite and phosphate in the spring season are respectively 1.5 mg/liter, 0.02 mg/liter and 0.01 mg/liter. Also the averages of COD and BOD in the spring are 21.5 mg/liter and 0.9 mg/liter. (Table 4) The Averages of Suspended and dissolved solids in the spring are 820 mg/liter and 836.5 mg/liter respectively. The averages of nitrate, nitrite and phosphate in the summer season are 1.5 mg/liter, 0.01 mg/liter and 0.02 mg/liter respectively. The averages of COD and BOD in this

season are 23.9 mg/liter and 1.02 mg/liter. Dissolved oxygen in the summer season with the average of 7.4 mg/liter shows its lowest value in the year. But the Suspended and dissolved solids with the average of 990.5 mg/liter and 980.7 mg/liter in the summer season show a high value. (Table 5)

Discussion & Conclusion:

In this study it was found out that the amount of nitrate, nitrite In all 9 stations have been lower than the standard limit, and this is because of the lack of polluted human resources around the Chahnimeh Lakes and yet the very low value of nitrate is because of the soil of lake bed. The averages of nitrate, nitrite in different seasons don't show a meaningful difference. The slope changes of pH were registered between 7.9 and 8.5 and this because of the alkaline characteristic of the soil in the area and not because of the water pollution. BOD and COD which are the main indicators o water in all stations were observed to be lower than the standard limit but in the seasons when there is little rain or no rain at all and the lack of fresh water in the cavities and eventually drought the volume of water is decreased and the activity and reproductions of marines are increased. The averages of COD and BOD in each Chahnimeh compare to the overall volume of water will be increased. The average of Dissolved oxygen at the second station is 9.75 mg/liter,

which is higher than the rest of stations. At the sixth station this value is 8.7 mg/liter that shows the worst condition. Winter season has the highest and summer has the lowest average of dissolved oxygen. The main reason is the higher temperature and increase of biology activities, and high wind that takes 120 days in the summer and the lack of these factors in the winter. The Averages of Suspended and dissolved solids are high in all stations, summer season with the average of 990.5 mg/liter for TSS and the average of 98.07 mg/liter for TDS have the highest value for the Suspended and dissolved solids present in water. The high blowing of wind with a lot of dust, the high temperature, water evaporation and water circulation in the summer justify the high amount of the solids in 3 reservoirs. Winter season has the lowest average for TDS and TSS. Between the electrical conductivity and solids of water a relation can be found which is not one to one. The high temperature in summer and water evaporation also the increase of solids will increase the electrical conductivity in summer. The lowest amount of electrical conductivity was registered in the winter. The amount of EC in summer is 1286 $\mu\text{S}/\text{CM}$ and in winter is 856.6 $\mu\text{S}/\text{Cm}$. Total hardness with regard to high amount of solids and the type of soil at all station is very high. Second, third and ninth stations with the

average total hardness of 512.75 mg/liter, 524.75 mg/liter and 507 mg/liter respectively, have more than allowed maximum of hardness. The turbidity also like electrical conductivity in the summer is highly increased due to the sand storms and the increase of solids. The average of phosphate at the third station is 0.2107 mg/liter which is rather high. The near distance between this station and educational green houses of Zabol University and also the entering of agricultural waters to the water of the third station is the major reason for the increase of phosphate at the third station. All and all the highest amount of some physical and chemical parameters in the water of Chahnimeh lakes are due to the some especial conditions of ecology and atmosphere of this area. Considering the numbers and figures the quality of water in the winter season is better than other seasons and summer season from this point of view has the worst conditions. With regard to the all above factors in order to avoid more damage to these sources and minimizing the crisis, and also improving the quality of water, one must apply an appropriate management in this field, as well as developing plant coverage, controlling the current sand movement in the area and near the Chahnimeh reservoirs and supporting the sustainable development projects.

Table 2. Statistics of 9 Stations in fall 2004

parameter	Unit	Station1	Station2	Station3	Station4	Station5	Station6	Station7	Station8	Station9	Mean	Max	Min	Std Deviation
temperature	$^{\circ}\text{c}$	14	14.2	13.8	14.5	14.8	14.2	14.6	13.9	14.2	14.24	14.8	13.8	0.332
turbidity	NTU	8.1	6.6	5.12	8.1	9.4	7.8	8.12	12.06	12.5	8.644	12.5	5.12	2.379
EC	$\mu\text{S}/\text{cm}$	940	920	935	980	1010	1110	1100	990	1021	1001	1110	920	68.34
TSS	mg/lit	640	712	790	742	741	718	792	760	720	735	792	640	46.17
TDS	mg/lit	710	762	810	812	820	820	840	850	810	803.8	850	710	42.81
hardness	mg/lit	351	447	497	323	458	458	508	442	520	444.9	520	323	67.42
salinity	PPm	0.04	0	0.019	0.017	0	0.57	0	0.007	0.03	0.076	0.57	0	0.186
PH		7.91	8.02	8.1	8.04	8.06	8.5	7.08	8.1	7.09	7.878	8.5	7.08	0.477
DO	mg/lit	9.1	8.9	8.7	11.2	9.9	8.4	10.6	11.3	11.8	9.989	11.8	8.4	1.275
BOD	mg/lit	1.2	1.1	1.8	2.1	1.3	1.4	2.3	2.2	1.3	1.633	2.3	1.1	0.469
COD	mg/lit	21	18	27	23	21	26	28	30	22	24	30	18	3.937
nitrate	mg/lit	1.07	2.01	1.8	1.22	1	1.4	2.02	1.78	1.08	1.487	2.02	1	0.418
nitrite	mg/lit	0.003	0	0.003	0	0.008	0.004	0	0.008	0	0.003	0.008	0	0.003
phosphate	mg/lit	0.003	0.018	0.64	0	0.002	0	0.003	0.08	0.04	0.087	0.64	0	0.209

Table 3. Statistics of 9 Stations in winter 2004

Parameter	Unit	Station1	Station2	Station3	Station4	Station5	Station6	Station7	Station8	Station9	Mean	Min	Std Deviation
temperature	$^{\circ}\text{c}$	12	11.7	11.9	10.8	11.9	10.8	12	11.6	11.7	11.6	10.8	0.474
turbidity	NTU	7.56	27.3	16.8	35.1	8.8	9.9	25.4	9.6	4.2	16.07	4.2	10.74
EC	$\mu\text{S}/\text{cm}$	1106	792	749	720	970	897	705	736	1034	856.6	705	150
TSS	mg/lit	580	950	980	550	450	210	190	350	850	567.8	190	301.7
TDS	mg/lit	600	600	600	400	800	600	540	700	800	626.7	400	126.1
hardness	mg/lit	376	579	529	410	447	570	512	458	508	487.7	376	69.7
salinity	PPm	2	1	1	0	1	0.5	0	0	0.02	0.613	0	0.695
PH		6.79	8.38	7.95	7.75	8.44	8.07	8.1	7.83	8.05	7.929	6.79	0.483
DO	mg/lit	11.4	12.6	12.2	10.8	11.2	10.8	10.2	11.2	11	11.27	10.2	0.735
BOD	mg/lit	2.8	3.1	2.7	2	2.3	2.1	1.9	2.8	2.8	2.5	1.9	0.43
COD	mg/lit	26	8	32	24	24	24	28	30	32	25.33	8	7.28
nitrate	mg/lit	1	2.001	4.002	1.07	0.5	1.001	2.009	2	0.5	1.565	0.5	1.099
nitrite	mg/lit	0.01	0.01	0.07	0.01	0.01	0.051	0.01	0.001	0.002	0.019	0.001	0.024
phosphate	mg/lit	0.001	0.07	0.12	0.002	0.001	0.004	0.09	0.017	0	0.034	0	0.047

Table 4. Statistics of 9 Stations in spring 2005

Parameter	Unit	Station1	Station2	Station3	Station4	Station5	Station6	Station7	Station8	Station9	Mean	Max	Min	Std Deviation
temperature	c	26	25	25	25.5	25.2	25.7	25.1	24.9	25	25.27	26	24.9	0.381
turbidity	NTU	5.26	5.26	4.2	4.53	4.8	4.78	3.28	3.6	4.05	4.418	5.26	3.28	0.694
EC	µs/cm	1230	1181	1225	1174	1241	1210	1317	1321	1342	1249	1342	1174	62.48
TSS	mg/lit	760	1160	1390	863	987	301	373	420	1126	820	1390	301	386.8
TDS	mg/lit	826	818	810	745	955	816	821	838	900	836.6	955	745	59.44
hardness	mg/lit	447	570	487	467	454	384	446	377	512	460.4	570	377	59.84
salinity	PPm	0.63	0.61	0.61	0.59	0.62	0.61	0.66	0.65	0.67	0.628	0.67	0.59	0.027
PH		8.55	8.75	8.68	8.67	8.72	8.65	8.67	8.75	8.71	8.683	8.75	8.55	0.061
DO	mg/lit	8.01	9.1	8.9	7.8	8.1	7.4	7.6	8.7	8.5	8.234	9.1	7.4	0.595
BOD	mg/lit	1.1	1.2	1	0	0.7	0.3	0	1.7	1.9	0.878	1.9	0	0.689
COD	mg/lit	32	22	12	28	24	12	16	28	20	21.56	32	12	7.196
nitrate	mg/lit	2	2.03	2.72	1.09	2.116	1	1.001	1	1	1.551	2.72	1	0.665
nitrite	mg/lit	0	0	0.009	0	0.032	0.032	0.047	0.032	0.031	0.02	0.047	0	0.018
phosphate	mg/lit	0	0	0.08	0	0.05	0	0	0	0	0.014	0.08	0	0.03

Table 5. Statistics of 9 Stations in summer 2005

Parameter	Unit	Station1	Station2	Station3	Station4	Station5	Station6	Station7	Station8	Station9	Mean	Max	Min	Std Deviation
temperature	c	30	29	28	28	27.5	26	25	28	30	27.94	30	25	1.667
turbidity	NTU	8.42	12.4	18.2	29.1	11.2	15.6	35.2	22.1	14.5	18.52	35.2	8.42	8.809
EC	µs/cm	1328	1346	1185	1216	1287	1318	1287	1335	1272	1286	1346	1185	54.87
TSS	mg/lit	856	817	915	1102	951	1310	876	984	1104	990.6	1310	817	156.5
TDS	mg/lit	870	916	714	1114	786	1417	791	1011	1207	980.7	1417	714	229.6
hardness	mg/lit	634	455	586	512	582	570	516	497	488	537.8	634	455	57.78
salinity	PPm	0.07	0.021	0.092	0.043	1	1.011	1.012	0.051	0.521	0.425	1.012	0.021	0.463
PH		8.61	8.74	8.32	8.41	8.41	8.61	8.61	8.63	8.61	8.55	8.74	8.32	0.136
DO	mg/lit	7.6	8.4	7.3	6.9	7.1	8.2	7.3	6.8	7.4	7.444	8.4	6.8	0.546
BOD	mg/lit	1.4	1.6	1.2	0.2	0.8	0.8	1.2	1.6	0.4	1.022	1.6	0.2	0.504
COD	mg/lit	28	29	21	24	20	24	24	22	23	23.89	29	20	2.977
nitrate	mg/lit	2.06	1.98	2.04	1.08	2.01	1.02	0.98	1	1.002	1.464	2.06	0.98	0.531
nitrite	mg/lit	0.009	0	0.008	0	0.004	0.03	0.04	0.028	0.042	0.018	0.042	0	0.017
phosphate	mg/lit	0.003	0.075	0.003	0.004	0.001	0.005	0.091	0.017	0.024	0.025	0.091	0.001	0.034

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