Water Quality and Biological Assessment of Ghazi Shah and Kai Springs of District Dadu, Sindh, Pakistan

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Abstract: Water samples from perennial natural Ghazi Shah and Kai springs located in Dadu district were collected for physico-chemical and biological analysis. Ghazi Shah spring indicated water temperature 38°C, conductivity and total dissolved solids of 1000 μS/cm and 856 mg/L similarly Kai spring indicated temperature 35°C, conductivity and total dissolved solids 680 μS/cm and 555 mg/L respectively. However some smell of hydrogen sulphide (H₂S) was observed from where Kai water, when it was oozing out. Algal flora (Cyanophyta) was dominant from where the water was coming out. In the channel down the flow Chara zeylanica, Chara vulgaris and some fish species Puntius ticto and Aplocheilus panchax were identified. The water quality is suitable for agricultural and fisheries development and as a source for drinking after about ½ km of travel.

Key words: Natural springs, limnological study.

Introduction
The natural water resources are important within dry, arid mountainous ranges. A few studies are reported on physico-chemical and biological life indicated in springs of Pub and Lakki hills of Khirthar mountainous range of Dadu district (Leghari et al., 1995; Leghari et al., 1998; Khuhawar et al., 1997). Ghazi Shah spring is located at sheet No. 35N/7 Latitude 28°27'H' Longitude 67°34'32" south 32 km south west of Johi town, 4 km from village Ghazi Shah upon the hill of Khirthar mountain range at about 600 feet above sea level. Kai spring is located in sheet No. 35 N/12, Latitude 26°95' and Longitude 78°42' near village Kai, about 40 km west of Sehwan and 25 km from Janghara village. Lieutenant MacLagen described Ghazi Shah spring as a hot spring at a considerable elevation (1844). Panhwar (1988) has described the location of the Ghazi Shah and Kai spring and Abu Bakr (1965) has listed both the springs among thermal springs of Pakistan. The water of the springs is used for the irrigation of about 250 to 300 acres of land and as a source of drinking water in the region. A number of natural springs are reported from district Dadu and Karachi area (Beg et al., 1984; Khan and Husain, 1987; Zahid 1986; Leghari et al., 2001; Jahangir et al., 2001). The present work examines the water quality and the biological life inhabiting in the water body.

Materials and Methods
The Ghazi Shah spring oozes out on the hill from the creek at the foot of the another ridge of the hills with opening of about 7.5 feet wide and 9 feet height with water depth of 1.5 feet. The water flows in the form of channel for about 1 km and then falls down the hill in a slopes. The water collected is carried away in the form of channels for the agricultural lands. Kai springs oozes out from well type opening of area 20 x 25 feet with water depth of about 6 to 8 feet. The water oozes out with a large number of bubbles from its bottom. The water is carried from the spring in the artificial channel to the agricultural lands. A smell of hydrogen sulphide was observed from the point where the water was oozing out. However as the water traveled along the channel, no smell of hydrogen sulphide (H₂S) was observed after about 1/2 km. The water samples one each from where the water oozes out was collected from both the springs and one samples down the hill, before Ghazi Shah spring was collected from Ghazi Shah spring. The water samples were collected within depth 3-9 inches from the surface of water during 2000. Samples of 1.5 L was transferred to clear plastic bottle. The temperature of the water and air, conductivity salinity and total dissolved solids (TDS) by WTW 320 conductivity bridge were measured at the site, pH was evaluated with Orion 410 pH meter. The dissolved oxygen was determined by Winkler method, chloride, alkalinity and hardness were determined by titration with standard silver nitrate, hydrochloric acid and EDTA respectively (APHA, 1985). Nitrate nitrogen, phosphate-phosphorous and silicate-silica were determined by using spectrophotometer. Nitrate was determined by brucine sulphate method. Orthophosphate was determined by reducing phosphomolybdic acid formed with ascorbic acid to molybdenum blue. Sodium potassium, calcium and magnesium were determined by air-acetylene flame using Varian Spectr AA-20 spectrophotometer. The analysis was carried out in triplicate with integration time 3 sec and delay time 3 sec. The water discharge was calculated using the following relation.

\[ Q = a \times V \]

where \( Q \) = quantity of water a = area of the water body \( B \times D \) & \( V \) = velocity of flowing water \( S/T \)

\[ Q = (B \times D) \times (S/T) \]

Where \( Q \) = quantity of water, \( B = \) breadth, \( D = \) depth, \( S = \) specified distance in drains and \( T = \) time taken for the water for specified distance (khoura, 1978). All the biological samples were collected by plankton net 25 μm, hand nets and by hand picking methods and preserved in 70% ethanol and identified with help of taxonomic keys of Prescott (1962). Desikachary (1961) for the algae and higher aquatic plant (Angiospermic) (Cock, 1996) and for fishes (Mirza, 1990).

Results and Discussion
The results of chemical analysis indicate a good water quality for the irrigation with electrical conductivity and TDS of 606 μS/cm and 554 mg/L for Kai spring and 728-1024 μS/cm and 468-880 mg/L for Ghazi Shah spring respectively (Table 1) [WHO, 1984]. The water temperature from where the water oozes out from the springs Kai and Ghazi Shah were 35-38.2°C as compared to air temperature of 30-32°C respectively. The water of both springs was transparent and did not have any visible turbidity. The pH of the springs was observed slightly alkaline within acceptable limit with 8.2 for Kai and 7.1-7.2 for Ghazi Shah. The hardness alkalinity and chloride were observed 270 mg/L as CaCO₃, 1.28mg/L as CaCO₃ and 106 mg/L for Kai spring and 222-360 mg/L, 85-318 mg/L and 80 -160 mg/L for Ghazi Shah spring respectively. Orthophosphate was observed below the detection limit but total acid hydrolyzable phosphate phosphorous was observed 0.21 mg/L in Kai spring. The metal ions sodium potassium calcium and magnesium from where the water oozes out indicated Na > Ca > Mg > K for Kai spring and Ca > Na > Mg > K for Ghazi Shah spring.
Table 1: Water analysis physico-chemical analysis of natural springs of Kai and Ghazi Shah district Dadu, Sindh.

<table>
<thead>
<tr>
<th>Parameters</th>
<th>Kai spring</th>
<th>Ghazi Shah Spring</th>
<th>Ghazi Shah village</th>
</tr>
</thead>
<tbody>
<tr>
<td>Temp. Of air in °C</td>
<td>38</td>
<td>42</td>
<td>42</td>
</tr>
<tr>
<td>Temp. Of water in °C</td>
<td>35</td>
<td>38.2</td>
<td>27.2</td>
</tr>
<tr>
<td>Transparency in inches</td>
<td>Transparent</td>
<td>Transparent</td>
<td>Transparent</td>
</tr>
<tr>
<td>pH</td>
<td>8.20</td>
<td>7.14</td>
<td>7.28</td>
</tr>
<tr>
<td>Conductivity in us/cm</td>
<td>865</td>
<td>1064</td>
<td>465</td>
</tr>
<tr>
<td>Salinity in ppm</td>
<td>0.10</td>
<td>0.20</td>
<td>0.10</td>
</tr>
<tr>
<td>TDS in mg/L</td>
<td>564</td>
<td>680</td>
<td>370</td>
</tr>
<tr>
<td>Hardness in mg/L</td>
<td>270</td>
<td>390</td>
<td>222</td>
</tr>
<tr>
<td>Malleability in mg/L</td>
<td>126</td>
<td>318</td>
<td>85</td>
</tr>
<tr>
<td>Chloride in mg/L</td>
<td>106</td>
<td>160</td>
<td>80</td>
</tr>
<tr>
<td>CO2 in mg/L</td>
<td>-</td>
<td>64</td>
<td>Absent</td>
</tr>
<tr>
<td>Orthophosphate in mg/L</td>
<td>Absent</td>
<td>Absent</td>
<td>Absent</td>
</tr>
<tr>
<td>Total acid hydroxylatable</td>
<td>0.21</td>
<td>Absent</td>
<td>Absent</td>
</tr>
<tr>
<td>Phosphate in mg/L</td>
<td>1.40</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Nitrate in mg/L</td>
<td>1.40</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Silica in mg/L</td>
<td>1.40</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Na in mg/L</td>
<td>92</td>
<td>54</td>
<td>60</td>
</tr>
<tr>
<td>K in mg/L</td>
<td>8</td>
<td>13.8</td>
<td>10.70</td>
</tr>
<tr>
<td>Ca in mg/L</td>
<td>8</td>
<td>81</td>
<td>46</td>
</tr>
<tr>
<td>Mg in mg/L</td>
<td>31</td>
<td>52</td>
<td>45</td>
</tr>
</tbody>
</table>

Sampling stations
I. Kai spring district Dadu
II. Ghazi Shah natural spring on the hill (Bhil) of mountain behind Ghazi Shah Taluka Johi
III. Ghazi Shah spring drain. Samples collected from out side of village Ghazi Shah 2-3 km away from the source.

Plate 1: Figs. 1-22: Flora and fauna of Ghazi Shah and Kai springs of district Dadu, Sindh, Pakistan
1. Monostroma antarense Schaffner
2-3. Chroococcus minutulus (Kutz) Nag
4. Chroococcus turugus var. maximus Nylg.
5. Chroococcus giganteus West and W.
6. Chroococcus sp.
7. Chroococcus indicus
10. Unknown fungal spores.
11. Gomphonema tabulaeforme Kutz
12 & 17. Oscillatoria papillosa Vauch.
13. Oscillatoria radiosa (Dill.) Thom.
15. Phormidium eutumatum (Eng.) Commerce
18. Lyngbya nodulosa Lemm.
20. Phormidium sp.
21. Anabaena sp.
22. Microcoleus lacustre Pabi Farkov.
23. Lyngbya nodulosa Lemm.
24. Oscillatoria nigra Vauch.

Plate 2, Figs. 25-31: Flora and Fauna of Ghazi and Kai springs of district Dadu, Sindh, Pakistan
25. Coenium dipunctatum Borg
26. Scenecidum bungei (Trü. & Day)
27. Chlorococcum limneticum (Nag.) Nag.
28. Pleurosigma eculinarium Orbin
29. Pleurosigma algaemum W. Sm.
30. Chroococcus limneticus Lemm.
31. Spirogyra sp.

Ghazi Shah and Kai springs on the basis of water temperature 35-38°C may be classified as eutermal springs (Voek, 1825) at source. In the Kai spring at the source a presence of H2S was observed. There are Cyanophyta species dominant at the source in which Lyngbya majuscula, Lyngbya aeruginosa-carinata (Kutz) Gom., Lyngbya matansiana, Oscillatoria pyrida, Oscillatoria tenuis, Oscillatoria tumescens, Chroococcus stigmasus var. Maximus, Chroococcus minor, Aphanothece sp. and Microcoleus vicioides (Plate 1, Figs. 1-22, Pl. 3, Figs. 12-15) and Microcoleus amasoni, Phormidium nigrum is found at the source and Spirogyra sp., Magnesia sp., Stigeoclonium stagnale, Cladophora gomera and Microcoleus lacustar, Phormidium sp.
were found present on the side of the water channel (Plate 2, Figs. 26-31). As water flow, the oxygen dissolves with the loss of H2S. At the middle of the channel Chara zeylanica, Chara vulgaris, Cycotoma costata (Plate 4, Figs. 38, 39 & 42) and Finger Lings of Pentiaracto and Aplachlorus pedunculatus were observed.

Ghazi Shah spring flow in the form of channel for 4.5 km before it is used for agricultural purposes. On the way Spiragya rhodoendros, Spiragya sp., Myriophyllum sp., Chara vulgaris, Chara zeylanica, Scenedesmus acutus, Pediasium simplex is found growing together with Chara vulgaris, Chara zeylanica. Spiragya rhodoendros, Myriophyllum sp., Chara vulgaris, Chara zeylanica, Scenedesmus acutus, Pediasium simplex provide shelter to Finger Lings. A similar observation of flora and fauna were recorded from Laki hot spring (Leghari et al., 1985, Khothawar et al., 1985).

The water quality analysis indicated as acceptable source for irrigation and fisheries. The water contents indicate natural growth of algal flora as could be expected for fresh water reservoir.

Acknowledgment

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References


Leghari et al.: Ghazi Shah and Kai springs of district Dadu, Sindh


