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Water quality analysis of falaj daris at Nizwa area- A case study

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Abstract
The Aflaj is a ground water recourse that originates from mountains of Oman and caters the needs of drinking water and of agriculture by gravity flow. Five Aflaj systems in Oman were identified as world heritage centre by UNESCO. Aflaj system was existed in this area date back to 2500BC.Development is an ongoing process. Unplanned urbanization and industrialization are affecting ecosystems and species. Due to rapid growth in urbanization, huge quantity of municipal solid waste is accumulating. The municipal solid waste is the main source of ground water pollution. Since the Aflaj originates from ground water, there is a need to check the quality of all Aflaj systems at frequent intervals. The water quality of Falaj Daris of Nizwa area was checked by using standard methods of water quality analysis. Thirteen important water quality parameters were analyzed and found that the values were much below the limits.

Keywords: Aflaj, Falaj daris, Nizwa, water quality

Introduction
Falaj Daris is one of the biggest Aflaj in Oman. It is located at Al Dakliya/ Nizwa area, 6 km north from the center of Nizwa town. It's along wadi called Al Abyadh, which drains the south and south western slope of Jabal Al Akdhar Mountains.
Falaj Daris has two branches, the biggest one has length around 2750 meter and the other one has a length of 1950 meter. The main branch of Falaj Daris was constructed before the advent of Islam and was irrigation a small area in north Nizwa. The source of this branch consist four wells only and one of them considered as mother well (Said, 1994). This Falaj consists of about 82 shafts. Falaj Daris supplies the northern part of the date palm garden area of Nizwa, bounded by wadi Al Abyadh to the east and wadi Kalbu to the west. This consists of a gross area approximately 200 hectares.

Literature review:
Water is the back bone of life for every living being. Sultanate of Oman is located in dry areas and people faced problem to meet both drinking water and agricultural need. They made a great system to save and to manage the Ground water. Deep wells were dug and connected the wells by underground channels. This system is called the Daudi falaj.
W.R. NORMAN, et al. (1998) described the traditional irrigation in north Oman and the aim of this study is to find modern irrigation methods to save water. Six date gardens from north Oman were studied for 11 months. It was observed that huge quantity of water is being unutilized. Oman receives 100 to 200 mm of annual rainfall for 62000 hectares of irrigation land. So this study was focused to educate the farmers to adopt latest technology for irrigation to save water. In many Arabian countries the loss of water is around 50% and there are less of studies which can solve those problems in Aflaj Oman. The study concluded with some recommendations that the farmers should start working with the government.
Al-Ghafri, (2005) in this paper the author studies the Aflaj system. It is a humane solution makes life possible in the arid and semi- arid regions such as Sultanate of Oman. These systems were based on the Omani life. Falaj is a center which is formed around lifestyles in the Omani environment. Falaj can be defined as the system provides water to farming community of the villages. Falaj Arabic origin of the word carries the meaning of the term divide and sharing. Aflaj located in the Sultanate of Oman in the northern terrain centering on the slopes and valleys of the eastern and western mountains of stone. There are 3017 Falaj systems existing out of 4112 Falaj. This Aflaj irrigate 17,600 hectares, nearly half of the agricultural area in the Sultanate of Oman. This paper describes agricultural systems, administrative, engineering historical and cultural significance.

This paper also discusses the most important problems that threaten the continuation Aflaj water flow and ensure their durability. In the end, the author recommends that all documents regarding Aflaj are to be maintained to keep its identity.

Ghrefat, et al. (2011) in this paper the authors studied the chemical analysis of water samples for 42 Falaj to check the quality. GIS indicate that chemical component of water change from places to others and related to the topographical of surface. In introduction, authors mentioned that the average annual rainfall is from 100 to 200 mm. The area of irrigated land by the Aflaj is around 26484 hectare. The age of Aflaj is more than 2000 years and there are three types of Afalaj. Daoudi which represent 21% and its average depth around ten meters and its length reach to ten km. Ghaili which represent 46% and it depth around four meters and it length more than two km. Aini which represent 33% and it's parallel to the earth's surface. The ions and other chemicals are studies very well in this study and it give strength to the study and the authors recommended the following, the value of pH was high in all the Falajs, it reach 12.9 in Al Daherah. Value of CE and TDS was high in Al Sharqia and the value of TDS different from places to other related to the geology of earth. NO3 found in Muscat Aflaj was high.

Study Area:

Nizwa is located on the south-Facing slope of the northern Oman Mountains approximately 150 km south west from capital Muscat. The area has been populated for thousands of years since the flock of the nomad first gazed on the vegetation supported by the occasional floods in major wadis of Al Abyadh and Kalbu. Falaj Daris has been producing water from the alluvium of wadi Al Abyadh for centuries, as evidenced by the Falaj and its irrigated fields. The northern part of the area is composed of rugged west-north west trending mountain ranges with peaks as high as 2500 meter. The southern part of the area is composed of low gravel covered hills separated by flat – bottomed wadis that from a braided drainage system (Said, 1994). The falaj Daris of Nizwa area is similar to the module shown in fig 1.

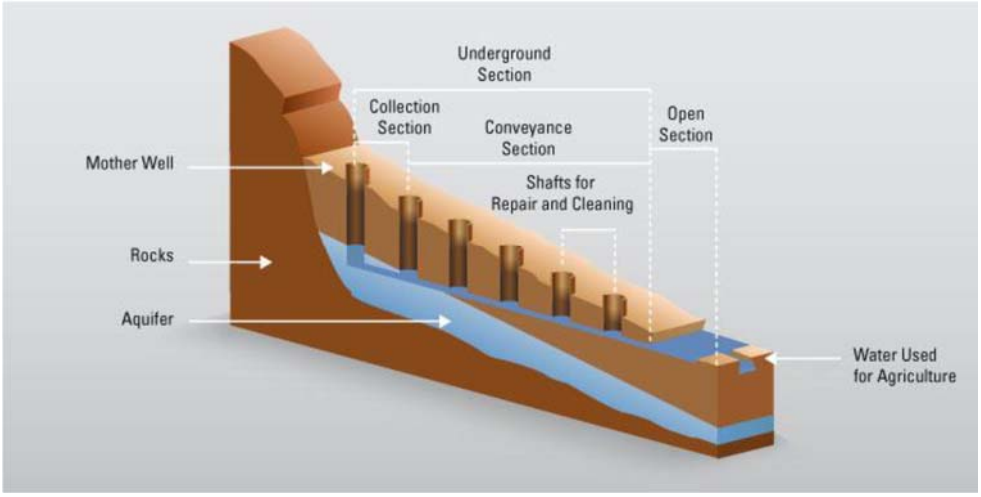


Fig 1: Module of Falaj Daris of Nizwa area.

Methods and Methodology:

Sampling method and sample collection

The samples were collected from water Falaj Daris during the four periods in the summer and winter in the year 2014. The first sample was taken in May 2014 and the last sample was taken in December 2014. The samples were collected in the morning and kept in cool box to prevent sunlight and heat. There are five sampling stations; three were at the underground tunnel and two from demand area. The first station is near from the Mother well, the second one is 500m from the first station, and the third one is 700m from the second station. The fourth point is in demand area in Shariat Al Falaj and the last station is 300m from fourth one.

Samples Analysis:

The samples were analyzed by using Text book on "standard methods for examination of water and waste water" published by American Public Health Association (APHA).

The Falaj daris water samples were analyzed for the following parameters.

1. pH, 2. Conductivity, 3. Total Alkalinity, 4. Total Hardness, 5.Chloride, 6.Calcium, 7. Magnesium, 8. Sodium, 9.Nitrate, 10. Silica, 11.Sulphate, 12. BOD, 13. Total Dissolved Solids (TDS) and 14.Fluoride.

pH

pH is measured using pH meter. It is standardized using pH 7.0 and 9.2 buffers.The samples were taken in to a 100 ml beaker and measured the pH values by dipping the electrode in to the samples.

Conductivity:

The conductivity of all samples is measured using conductivity meter.

Total Alkalinity:

Total alkalinity was estimated by titrating with 0.02 N H_2SO_4 using methyl orange indicators till color changes from yellow to changes to bright golden yellow.

Total Hardness, **Calcium and Magnesium:**

Total hardness, calcium and magnesium were estimated by titrating with 0.02 N EDTA using EBT and muroxide indicators respectively.

Total hardness – Calcium = Magnesium.

Chloride:

Chloride was estimated by titrating with 0.02N silver nitrate solution using potassium chromate indicator till color changes from yellow to brick red color.

Nitrate and Silica:
Nitrate and Silica were estimated calorimetrically by using spectrophotometer.

BOD:
BOD was estimated by using Dissolved Oxygen meter. Dissolved oxygen was estimated on day 1 and day 5. The difference in DO was BOD.

Total Dissolved Solids:
Filtered water samples were evaporated and weighed to estimate total dissolved solids.

Fluoride:
Fluoride was estimated by using Ion meter.

Results and discussions:
The average analysis of samples 1, 2, 3, and 4 are as given in Table 1:

Table 1: Average analysis of water samples.

S.No	Parameter	Sample 1	Sample-2	Sample-3	Sample-4
1	pH	7.62	7.33	7.44	7.61
2	Conductivity, Micromhos/cm	572	476	479	533
3	Hardness in mg/l	247	257	259	268
4	Alkalinity in mg/l	572	476	479	533
5	Chloride in mg/l	32	29	28	41
6	Calcium in mg/l	43	58	59	57
7	Magnesium in mg/l	33	27	27	30
8	Nitrate in mg/l	14	18	17	21
9	Sulphate in mg/l	36	38	36	40
10	Fluoride in mg/l	0	0.3	0.3	0.85
11	Silica in mg/l	12	19	19	9
12	TDS in mg/l	325	326	324	342
13	BOD in mg/l	4	4	4	3

It was observed that all values except BOD are below drinking water standards. However BOD values varied from 3 mg/l to 4 mg/l.

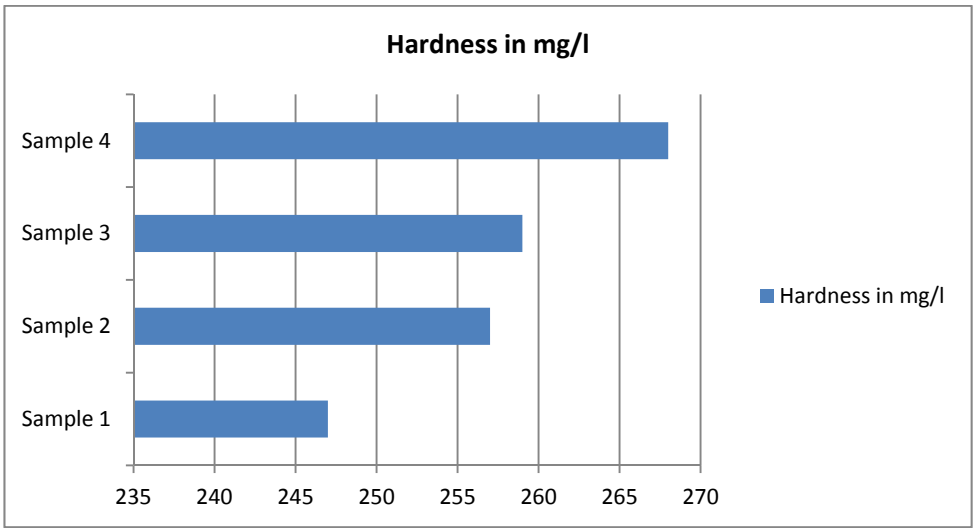
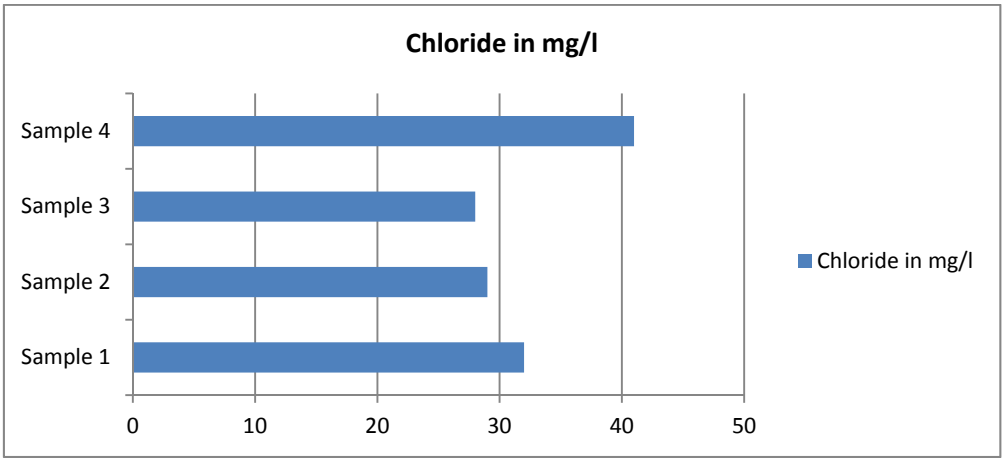


Fig 1: Total Hardness values.



Conclusions:

The Falaj Daris, Nizwa area water quality is suitable for drinking. It requires some disinfection methods like chlorination, ozonation or UV sterilization to nullify the impact of BOD values.

References:

1. Norman, W.R., Shayya, W.H., Al- Ghafri, A.S., McCANN, I.R., 1997. Aflaj irrigation and onfarm water management in northern Oman. *Kluwer Academic Publishers*. [e-journal] 12 (1). p. 35-48. [Accessed: 3rd March 2014]
2. Ghrefat, H. A., Jamarh, A., Al-Futaisi, A., Al-Abri B., 2011. Water quality mapping and assessment, and weathering processes of selected aflaj in Oman. *Springer Science+Business Media B.V.* [e-journal] 181 (1-4). p. 509-524. [Accessed: 3rd March 2014]
3. Parks, Y. P., Smith, P. J., 1983. Factors affecting the flow of aflaj in Oman: a modeling study. *Elsevier Science Publishers B.V.* [e-journal] 65 (4). p. 293-312. [Accessed: 3rd March 2014]
4. Shahalam A. M. 2001. Review of Omani Aflaj Systems: an Element of National Water Resources,Technology and Economic Developments. *Sultan Qaboos University.* [e-journal] 6. p. 1-14. [Accessed: 13th March 2014]
5. Al-Marshudi, A. S., 2007. The falaj irrigation system and water allocation markets in Northern Oman. *Elsevier B.V.* [e-journal] 91 (1-3). *p.* 71-77. [Accessed: 3rd March 2014]
6. Al-Sulaimani Z.K., Al Hatmi H. K., Al Amri,S.S., Helmi T. 2008. Maintainace works of water structures, Aflaj challenges in The Sultanate Of Oman. WSTA the 8th Gulf Water Conference, Water In The GCC, Towards an Optimal Planning and Economic Perspectives. Manama, 3-6 March 2008. ResearchGate.pp 1-18.
7. McCann I.R., Al Ghafri A. S., Al-Lawat I. A., Shayya W. H. 2000. Aflaj: the challenge of preserving the past and adapting to the future. *Oman International Conference on the Development and Management of Water Conveyance Systems (Aflaj*). Oman 18-20 May 2002. ReasearchGate. pp 35-41.
8. Al Ghafri A., Aflaj's irrigation water demands/supply ratio: two case studies, 2006. *Agriculture and Marine Science.* 11. pp 85-92.
9. Al Habsi S.N., *Falaj Daris: The Maximum Utilization of the Available Groundwater in the wadi Al-Abyadh Catchment in the Nizwa region, Sultanate of Oman*. A dissertation submitted in partial fulfillment of the requirement for the degree of Master of Science in water resources, Center for Arid Zone Studies. University Of Wales.
10. Al Ghafri A., Aflaj of Oman: a Threatened Life System. 2006. *The Regional Conference on Protecting Underground Water*. Tripoli, Libya 20-22 November 2006. pp 1-9.
11. Tchobanoglous, G. & Schroedar, E. D., 1987. Water Quality.USA: Addison-Wesley Publishing Company.