Sultanate of Oman

Ministry of Education

Umm Al Hakam bint Al Zubair School for Basic Education (1-10)

White Algae Causes & Effects on The Properties of Quraiyat Falajes

Done by:

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February 2020

Table of Contents

Abstract:

This research aims to study white algae causes & effects on the properties of Quraiyat falajes in order to answer the following questions:

Research Questions:

1. What are the reasons of the emergence of white algae in Al-Saih and Al-Jezeer falajes in Quraiyat?
2. What are the properties of water before and after treating white algae in the affected flajes?

This study was implemented in Quraiyat. Measurements of the coordinates from the site were taken and examinations of samples of the falajes. Examiners compared the properties of water before and after treating white algae by applying water protocol. Results showed that the salinity, acidity and conductivity ratio are high before treatment.

Coordination was done with the specialists of Center for Marine Research and Fisheries to visit the site of the affected falajes. Samples of algae were taken and tested. Results showed that the type of the affected algae is chlorophyte. In addition, it showed presence of blue-green algae from anabena type in very large quantities. It is worth mentioning that this type is considered to be toxic and harms living organisms, which explains the reason behind algae being stained white (Appendix 1).

An interview was done with Abdullah Al-Furi, to identify the reasons of such type of algae emergence. Due to the contamination of water with the remains of dead animals, and the dam has not been opened for almost a year, the water has become stagnat.

The recommendations that has been reached are the necessity of conducting a periodic examination of water falajes, addressing the competent authorities to treat this type of toxic algae, and educating the citizens not to drink and get shower in the affected falajes due to the high percentage of salts in them which affect their health.

Scientific Terms:

Algae: primitive plants that live in soil, water and swamps, and are considered to be among the oldest plants. (Haddad, Khaled. 2006)

Blue-green algae: prokaryotic bacterial organisms capable of fixing nitrogen. (Bonnie. 1998)

Anabena: A type of bacterium that converts nitrogen to ammonia and turns green

algae to white (Mahmoud, Mohamed, and Fahmy. 2009)

Research Questions:

1. What are the reasons of the emergence of white algae in Al-Saih and Al-Jezeer falajes in Quraiyat?
2. What are the properties of water before and after treating white algae in the affected flajes?

Introduction & Review of Literature:

Flajes in the Sultanate of Oman were considered as a main source for crops irrigation in the past. This unique water system has achieved the prosperity of agriculture; Therefore, Royal Decree No. 39/2007 has been issued specially for regulating and protecting falajes.

It was necessary to search and investigate to find out the reasons of the algae being stained white. Interviews with specialists were done regarding this field and it has been pointed out that the reason of such algae presence is the dead organisms fallen in the dam water. Gases in the water decay these animals' bodies. Therefore, Wadi Deiqa is a nutrition source for Al-Seih and Al-Jazeea falajes which, as a result, leads to the formation of blue-green algae of the anabena, a type of cyanobacteria that abound in fresh water. This causes algae being stained white.

We concluded that water can be classified based on the presence of algae in it. When the blue-green algae become prevalent, this indicates the saturation of water with organics. One of the factors that contribute to the prosperity of this type of algae in the water is the availability of nutrients such as phosphorous and nitrogen (Gudrun.2010).

Methodology:

First: The research plan:

1. Selecting a research problem.
2. Coordinating with Center for Marine Research and Fisheries of Muscat.
3. Interviewing Abdullah Al-Furi.
4. Applying water protocol and take measurements
5. Comparing the results, analyzing them graphically using Excel program and writing recommendations.

The timeline for conducting the research was as follows:

Period of Time	Task
September	Selecting a research problem, designing a period of time for the research, dividing the tasks and coordinating with the staff of Center for Marine Research and Fisheries
October	Coordinating with the General Directorate of Regional Municipalities and Water Resources in Muscat Governorate to test the samples from Al-Saih and Al-Jazeer falajes, and the dam's water
September & November	Applying water protocol in the study sites
January	Interviewing Abdullah Al Furi, analyzing data and writing recommendations
February	Writing, proofreading and presenting the reaserch

Table (1): The timeline for conducting the research

Dividing the roles among the research team according to preparing tools and field application:

Students	Task
Noof & Alathra	Writing the research problem clearly, specifying the required tools and preparing them
Noof & Ritaj	Data collection and analysis through applying the planned protocols inside and outside the school, and entering data in the website
All	Writing results through the collected data, summary and the research

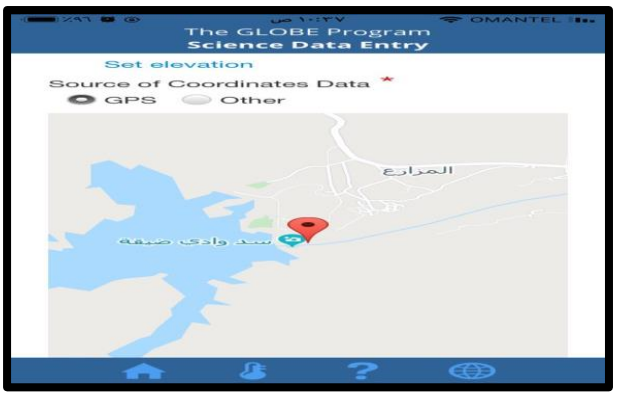
Table (2): Dividing the roles among the research team

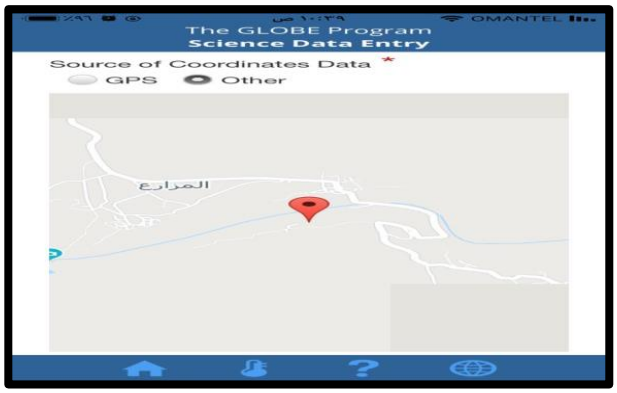
Study Site:

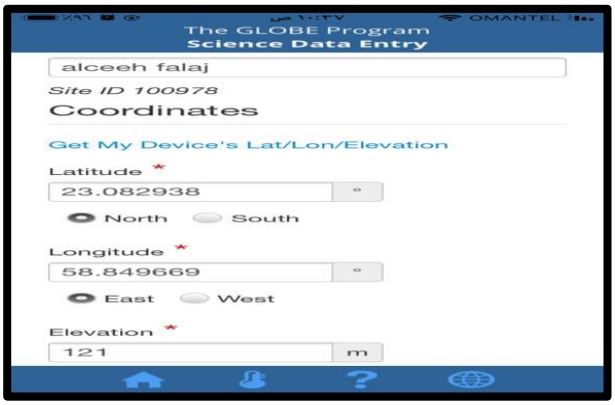
The research plan was implemented in (Sultanate of Oman – Muscat Governorate), Quraiyat, Al Mazari village, September, hot weather (42 C), by applying water protocol.

September, Hot weather (42 ° C), and by applying the water protocol.

The maps below show this geographical area:



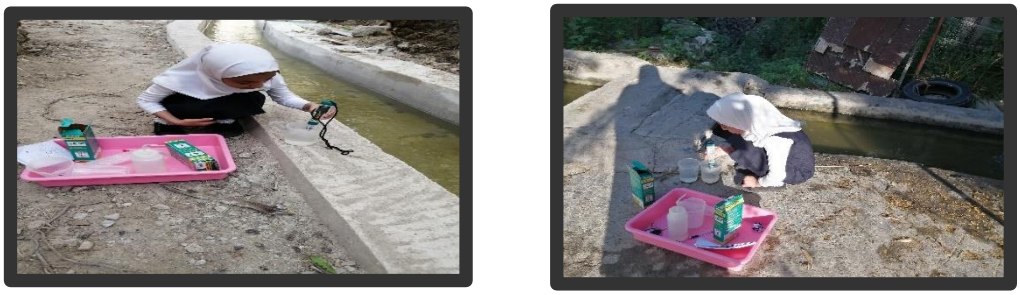




Data collection & Analysis:

An official address to Center for Marine Research and Fisheries to visit the site and take samples from the falajes and do an interview with Ms. Ahlam Al Kharousi. Acidity was measured. It was 7.8.

Pictures of the specialists of the Center taking samples from the falajes



An interview with Mr. Abdullah was conducted to coordinate with the General Directorate of Regional Municipalities and Water Resources to examine samples from the falajes and the water's dam and compare between their characteristics.

Results:

Results reached through this research are indicated in the following report:

بناءاً على البلاغ الوارد لمركز العلوم البحرية والسمكية من مدرسة أم الحكم للتعليم الاساسي بقرية المزارع الواقعة بولاية قريات، حول موضوع تضرر بعض القاطنين بالقرية من ازدهار الطحالب في بعض الأفلاج بشكل كبير وتصبغ بعضها باللون الأبيض؛ وتعرض بعض الأطفال بالحساسية الجلدية وظهور الحبوب على الجلد وذلك أثناء السباحة في الأفلاج المذكورة أعلاه،على ضوء ذلك تحرك فريق من المركز للمعاينة الميدانية، وتم مقابلة أحد المعلمات القاطنات بالمنطقة وكذلك مع أحد العاملين في تلك الأفلاج، اتضح أن هذه المشكلة قد ظهرت منذ شهر تقريباً، وصاحبها ظهور رائحة شديدة ولكنها بدأت بالإنخفاض تدريجياً.

وعند المعاينة، لم يكن للرائحة وجود ، أما بالنسبة لإنتشار الطحالب فقد كان كثيفاً في أفلاج قريتي السيح و الجزير، أما فلج قرية الغبيرة والتي تقع في وسط قريتي السيح والجزير، فلم نلاحظ ازدهار لهذه الطحالب فيها. وقد قام الفريق بأخذ عينات من الماء والطحالب، وتم قياس نسبة الحموضة ووجدت أنها متعادلة (7-8). و تم أخذ بعض الصور للأفلاج المتضررة وصور الطحالب. ثم قام الفريق بزيارة سد وادي ضيقة وهو المصدر المغذي لمياه الأفلاج في المنطقة وتم مقابلة أحد العاملين بالسد من أجل السماح لنا بمعاينة السد وأخذ عينة ماء منه ، ولم يلاحظ أي تواجد لهذه الطحالب كذلك وكان معدل الحموضة متعادل (7).

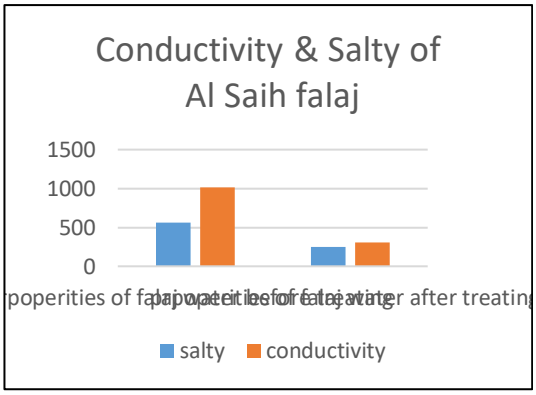
وقد قام المختصون بقسم البيئة البحرية و علوم المحيطات بتحليل عينات الطحالب و التعرف على الأنواع و أوضحت النتائج أن نوع الطحالب المتضررة هي مجموعة كلورفايت، كما أتضح تواجد الطحالب الخضراء المزرقة من نوع *Anabaena sp.* بكميات كبيرة جدا ، مع العلم أن هذا النوع يعتبر من الأنواع السامة جدا والتي لها أضرار كبيرة على صحة الأنسان و الحيوان، و يرجح هذا النوع كان السبب وراء تصبغ الطحالب باللون الأبيض. أما بالنسبة لتحاليل الماء للكشف عن مستويات العناصر الكيميائية وأنواع البكتيريا و الفطريات فلم يتمكن المختصون بإجراءها نظرا لعدم توفر الأجهزة اللازمة.

Appendix (1): A report of testing water samples from Center for Marine Research and Fisheries ensures the problem and that drinking and bathing are not allowed

First: properties of Al Saih falaj water before and after treating

properties of water after treating	properties of water before treating	Sample of Al Saih falaj
25	25	Temperature
6.48	9.49	(PH) Acidity
248ppm	565ppm	Salty
307us	1011us	Conductivity

Table (3): Data of Al Saih falaj water



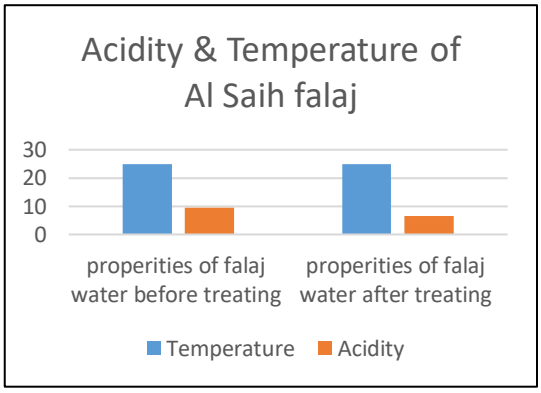
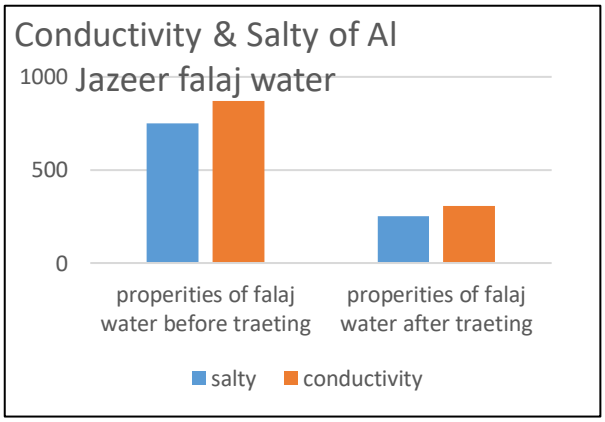


Diagram (1): proprieties of Al Saih falaj water

First: properities of Al Jazeer falaj water before and after treating

properties of water after treating	properties of water before treating	Sample of Al jazeer falaj
25	25	Temperature
8.61	11.2	(PH) Acidity
250ppm	751ppm	Salty
307us	870us	Conductivity

Table (3): Data of Al Jazeer falaj water



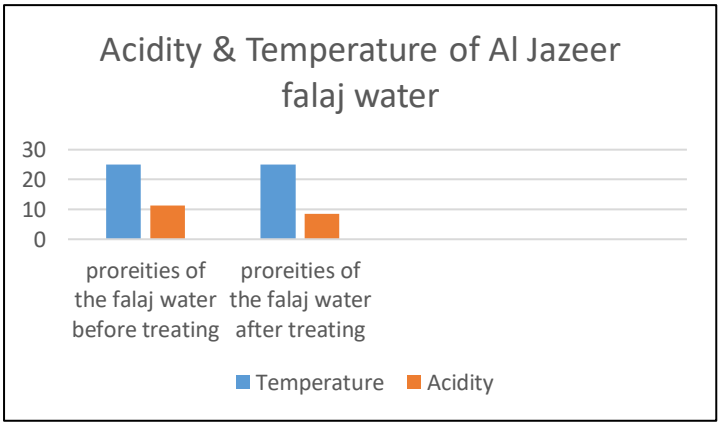


Diagram (2): proprieties of Al Jazeer falaj water

Third: A comparison of the results of Al Saih and Al Jazeer falajes, and the dam's water

properties of the dam's water falaj water after treating	properties of Al Saih falaj water after treating	properties of Al Jazeer falaj water after treating	The maximum percentage of water presence	elements and compounds
3.14mg/l	3.13 mg/l	3.07mg/l	-	Potassium carbonate
21.25mg/l	20.86mg/l	20.83mg/l	-	Calcium
385.23mg/l	332.69mg/l	407.82mg/l	1000	Dissolved solids
8.65	8.72	8.69	6.5-9.9	Acidity
9.13mg/l	9.02mg/l	8.92mg/l		Silicon
273.28mg/l	163.48mg/l	361.12mg/l		CO2
206.38mg/l	202.11mg/l	202.86mg/l	500	Stiffness
0.98mg/l	1.24mg/l	1.03mg/l	11.29	Nitric acid
0.0mg/l	000mg/l	0.00mg/l	1.5	Fluoride compound
0.51mg/l	0.49mg/l	0.49mg/l		Strunchium
41.84mg/l	42.07mg/l	23.89mg/l	400	Sodium
36.78mg/l	35.99mg/l	36.14mg/l	150	Magnesium
0.09mg/l	0.08mg/l	0.09mg/l	0.7	Barium
4.34mg/l	4.29mg/l	4.24mg/l		Silicon
224mg/l	134.00mg/l 00	296.00mg/l		Alkalinity
60mg/l	62.67mg/l	59.54mg/l	600	Chloride
73.08mg/l	70.82 mg/l	71.07mg/l	400	Sulfate
4.34mg/l	5.50mg/l	4.58mg/l	50	Nitrates
574 us/cm	569.00 us/cm	570.00us/cm		Conductivity

Table (5): properties of water samples in dams' laboratories

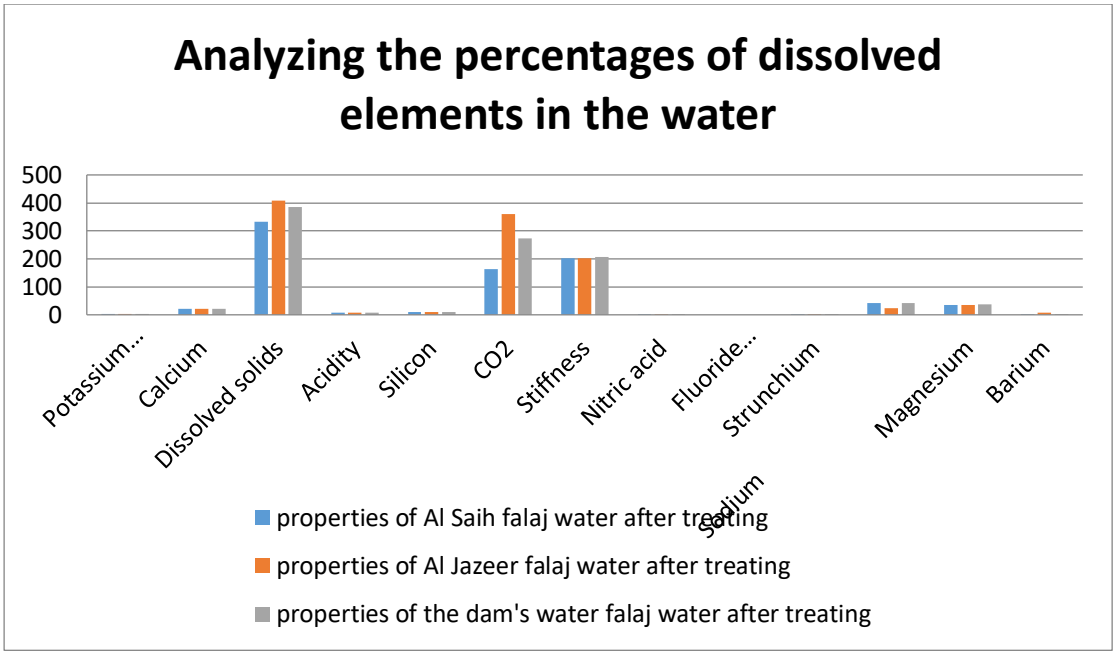
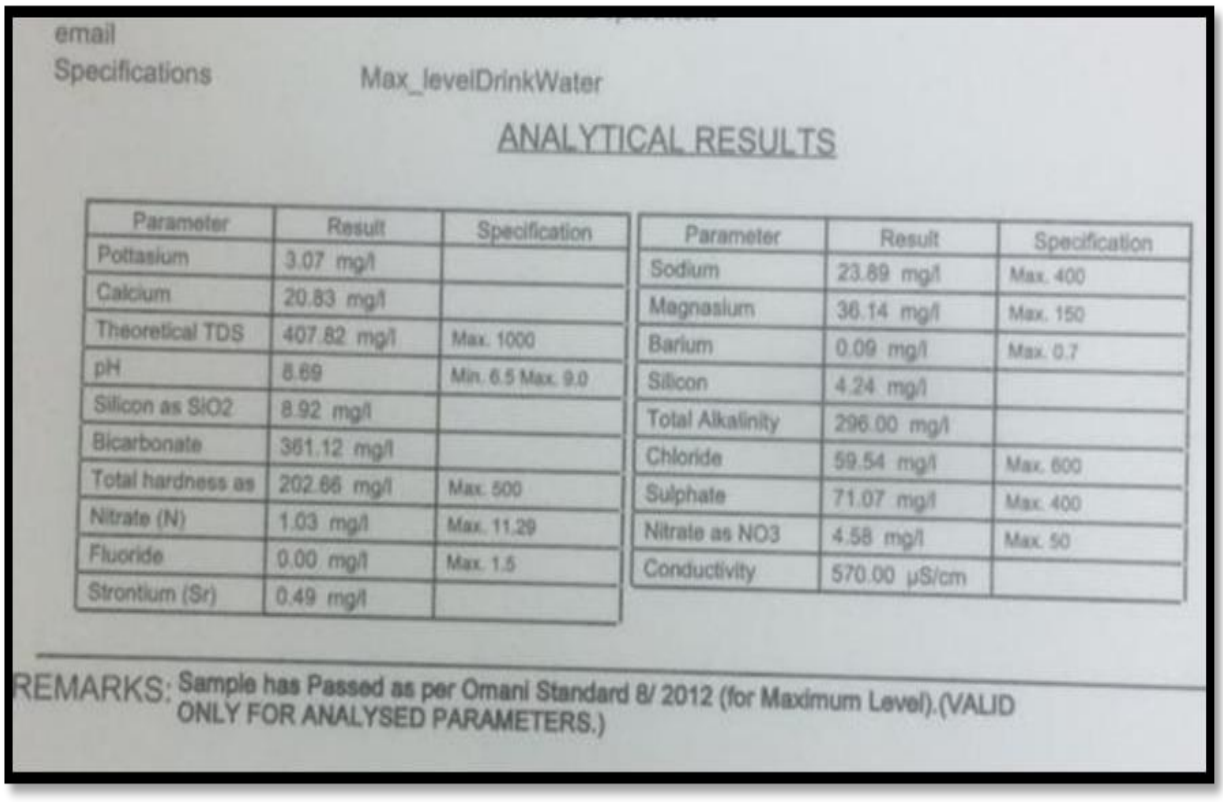


Diagram (3): properties of water samples in dams' laboratories



email

Specifications Max_levelDrinkWater

ANALYTICAL RESULTS

Parameter	Result	Specification
Pottasium	3.07 mg/l	
Calcium	20.83 mg/l	
Theoretical TDS	407.82 mg/l	Max. 1000
pH	8.69	Min. 6.5 Max. 9.0
Silicon as SiO2	8.92 mg/l	
Bicarbonate	361.12 mg/l	
Total hardness as	202.66 mg/l	Max. 500
Nitrate (N)	1.03 mg/l	Max. 11.29
Fluoride	0.00 mg/l	Max. 1.5
Strontium (Sr)	0.49 mg/l	

Parameter	Result	Specification
Sodium	23.89 mg/l	Max. 400
Magnesium	36.14 mg/l	Max. 150
Barium	0.09 mg/l	Max. 0.7
Silicon	4.24 mg/l	
Total Alkalinity	296.00 mg/l	
Chloride	59.54 mg/l	Max. 600
Sulphate	71.07 mg/l	Max. 400
Nitrate as NO3	4.58 mg/l	Max. 50
Conductivity	570.00 µS/cm	

REMARKS: Sample has Passed as per Omani Standard 8/ 2012 (for Maximum Level).(VALID ONLY FOR ANALYSED PARAMETERS.)

Appendix (2): A report of properties of Al Jazeer falaj water

Customer: Water Assessment Department

email

Specifications: Max_levelDrinkWater

ANALYTICAL RESULTS

Parameter	Result	Specification
Pottasium	3.14 mg/l	
Calcium	21.25 mg/l	
Theoretical TDS	386.23 mg/l	Max. 1000
pH	8.65	Min. 6.5 Max. 9.0
Silicon as SiO2	9.13 mg/l	
Bicarbonate	273.28 mg/l	
Total hardness as	206.38 mg/l	Max. 500
Nitrate (N)	0.98 mg/l	Max. 11.29
Fluoride	0.00 mg/l	Max. 1.5
Strontium (Sr)	0.51 mg/l	

Parameter	Result	Specification
Sodium	41.84 mg/l	Max. 400
Magnasium	36.78 mg/l	Max. 150
Barium	0.09 mg/l	Max. 0.7
Silicon	4.34 mg/l	
Total Alkalinity	224.00 mg/l	
Chloride	60.04 mg/l	Max. 600
Sulphate	73.08 mg/l	Max. 400
Nitrate as NO3	4.34 mg/l	Max. 50
Conductivity	574.00 µS/cm	

REMARKS: Sample has Passed as per Omani Standard 8/ 2012 (for Maximum Level).(VALID ONLY FOR ANALYSED PARAMETERS.)

Appendix (2): A report of properties of the dam's water

email

Specifications: Max_levelDrinkWater

ANALYTICAL RESULTS

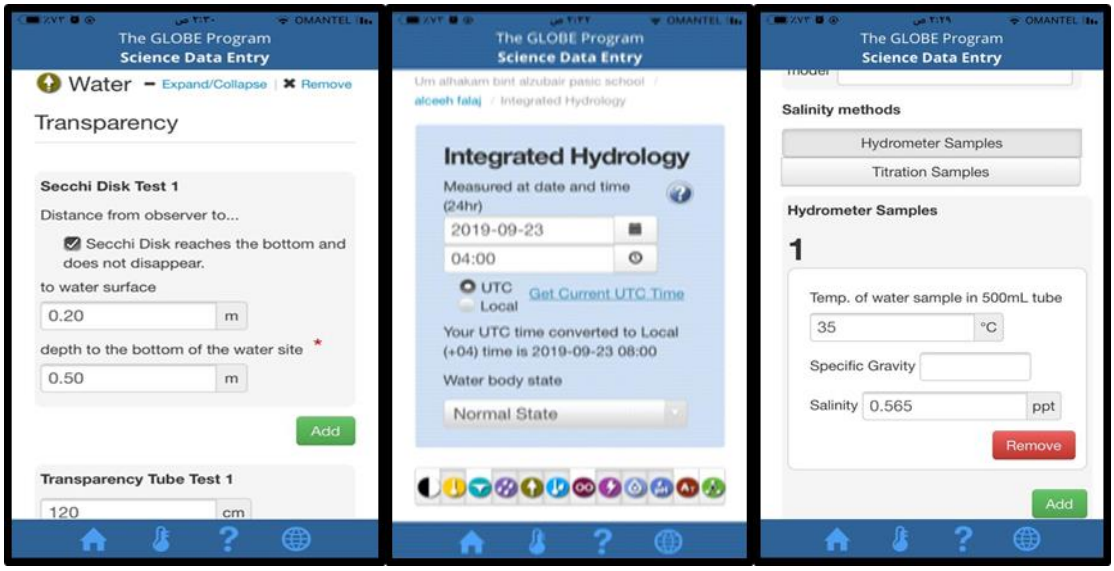
Parameter	Result	Specification
Pottasium	3.13 mg/l	
Calcium	20.86 mg/l	
Theoretical TDS	332.69 mg/l	Max. 1000
pH	8.72	Min. 6.5 Max. 9.0
Silicon as SiO2	9.02 mg/l	
Bicarbonate	163.48 mg/l	
Total hardness as	202.11 mg/l	Max. 500
Nitrate (N)	1.24 mg/l	Max. 11.29
Fluoride	0.00 mg/l	Max. 1.5
Strontium (Sr)	0.49 mg/l	

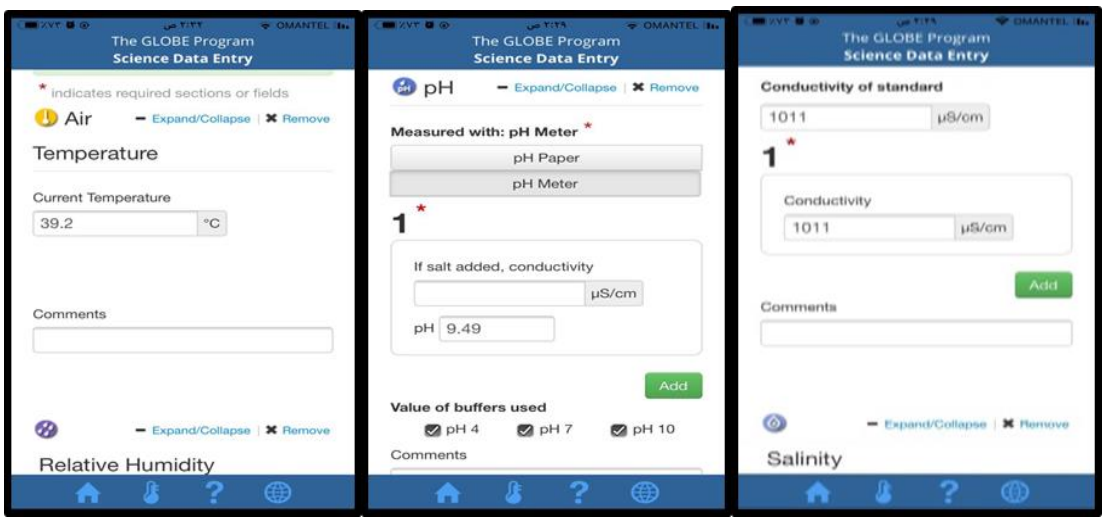
Parameter	Result	Specification
Sodium	42.07 mg/l	Max. 400
Magnasium	35.99 mg/l	Max. 150
Barium	0.08 mg/l	Max. 0.7
Silicon	4.29 mg/l	
Total Alkalinity	134.00 mg/l	
Chloride	62.67 mg/l	Max. 600
Sulphate	70.82 mg/l	Max. 400
Nitrate as NO3	5.50 mg/l	Max. 50
Conductivity	569.00 µS/cm	

REMARKS: Sample has Passed as per Omani Standard 8/ 2012 (for Maximum Level).(VALID ONLY FOR ANALYSED PARAMETERS.)

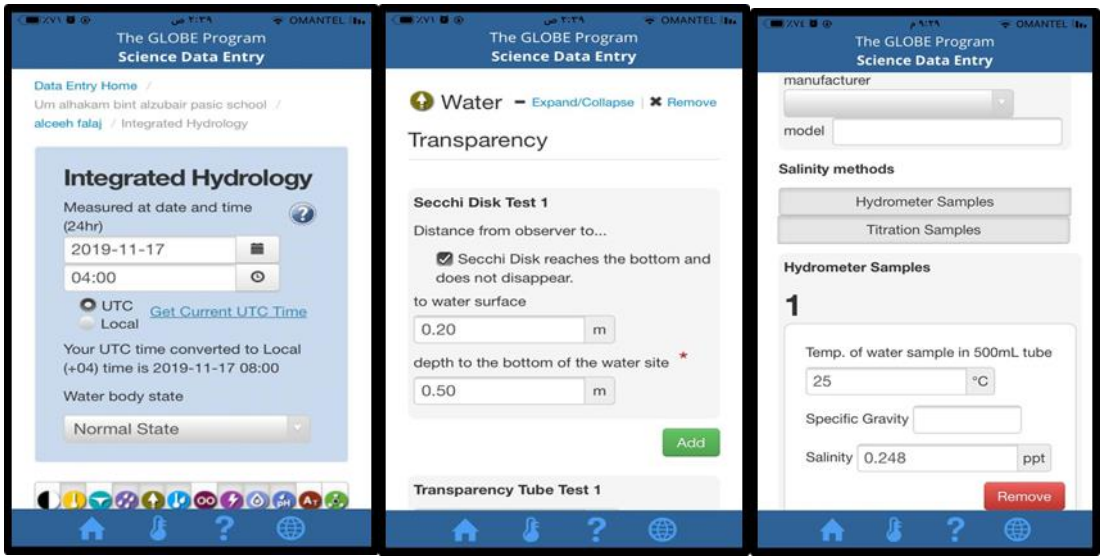
Appendix (4): Properties of Al Saih falaj water

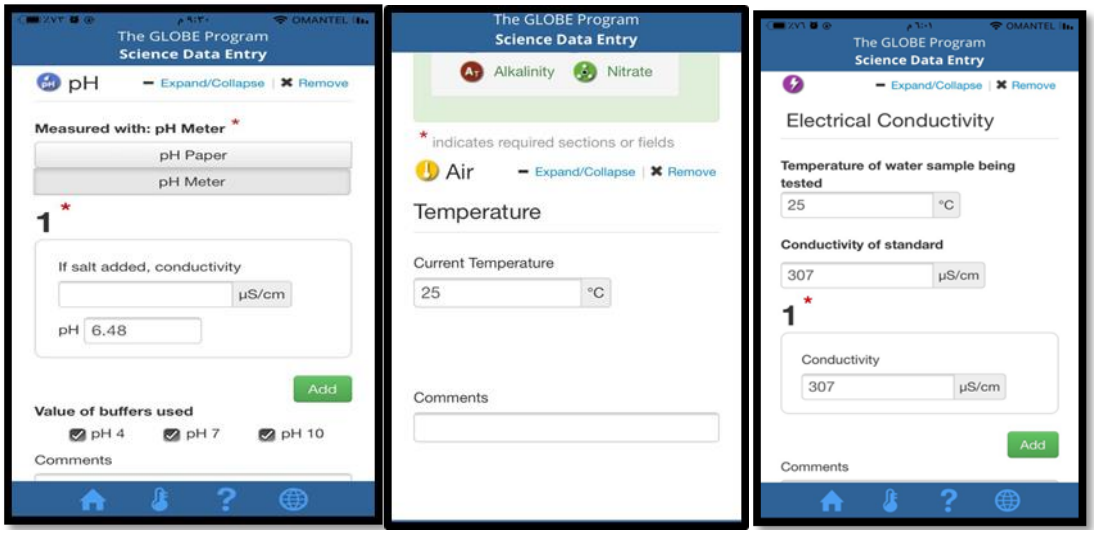
First: Data of Al Saih falaj water before treating



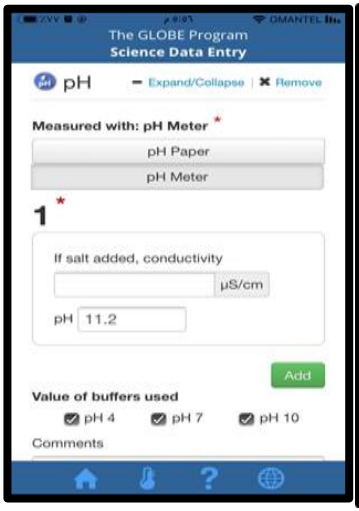


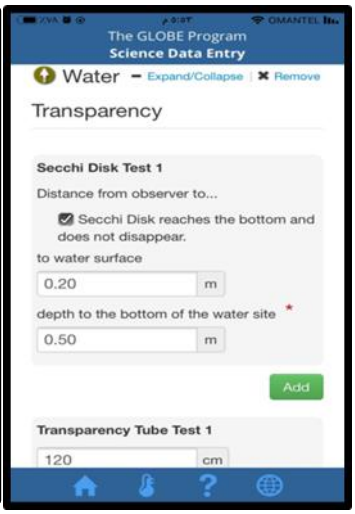
Second: Data of Al Saih falaj water after treating

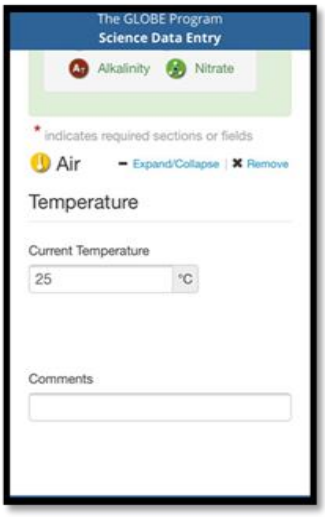


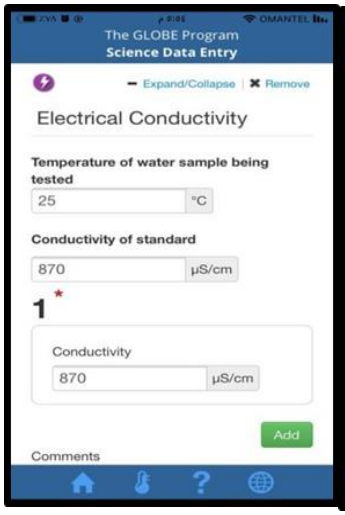


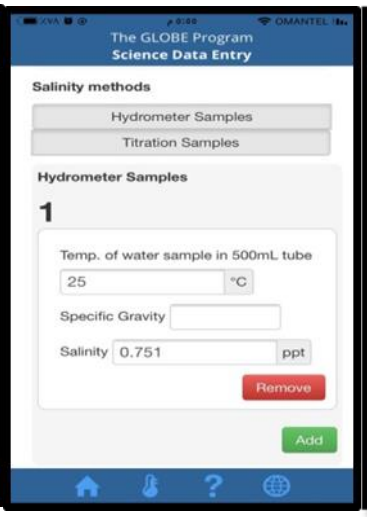
Third: Data of Al Jazeer falaj water before treating

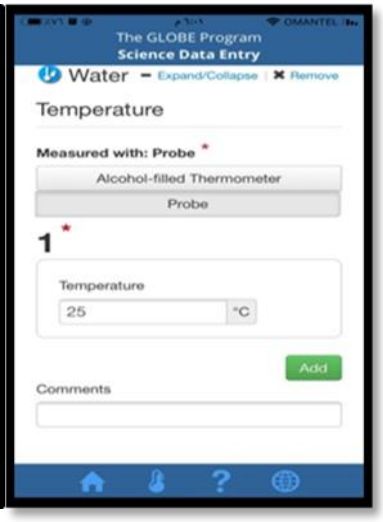




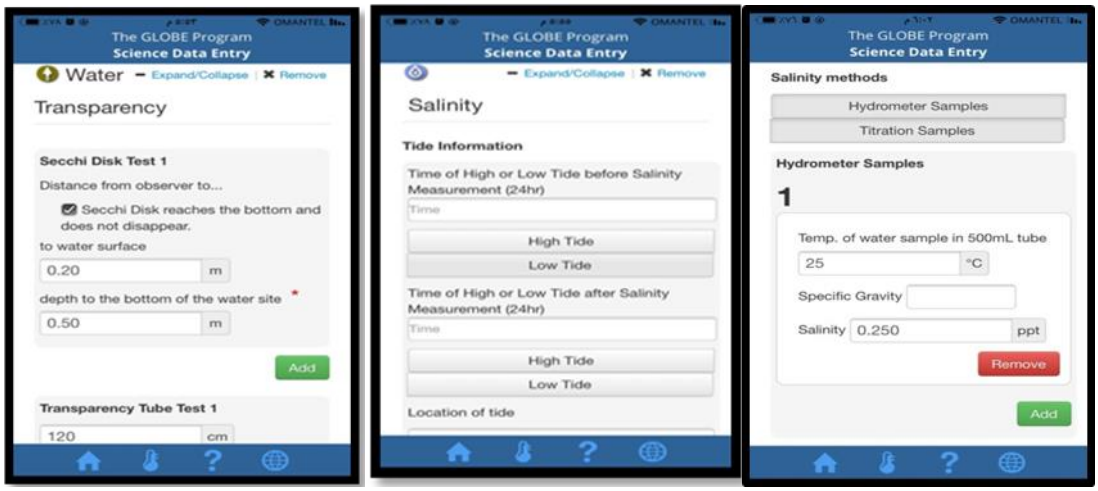


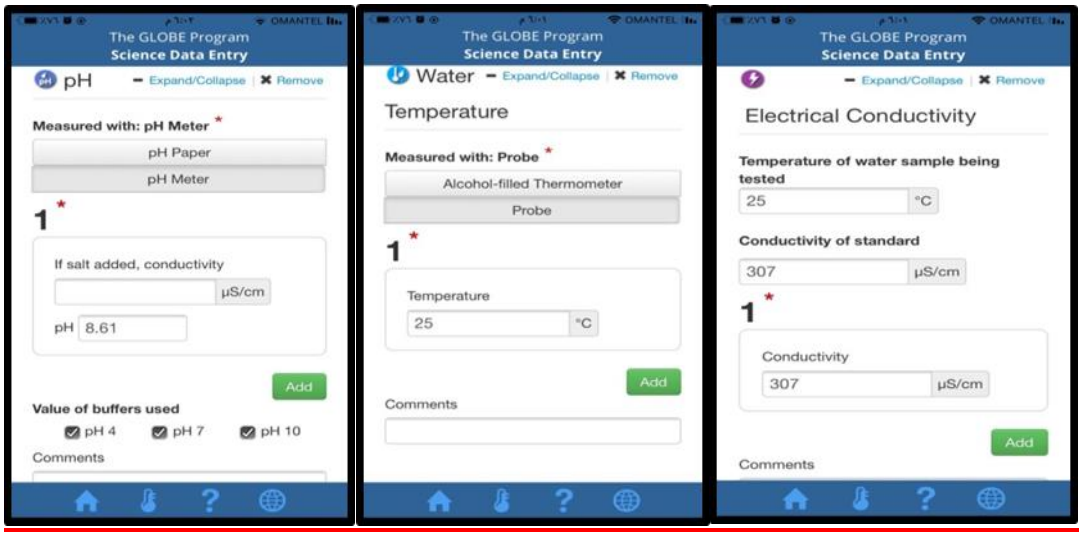






Forth: Data of Al Jazeer falaj water after treating





The interview:

An interview was done with Head of the operation and maintenance section of Wadi Deiqa Dam. We concluded the following:

- The reasons of the white algae emergence is the interaction of melting the residues of dead animals into the water of the dam.
- The effect is simple. It causes itchy and sensitive skin. Warning has been done not to drink the water or bath in it.
- To solve the problem, a radical solution will be reached to eliminate the white algea. The dam was opened and we got rid of the stagnant water.

Another interview was done with a resident of Al-Saih village, Ali Al-Niri. He indicated that this phenomenon has started first in July at the first time of constructing Al-Saih falaj. He was one of the affected people from the falaj.

He recommended exploiting the dam by making a fountain as an attractive marketplace for tourists to renew the water and not to allow bacteria and parasites accumulate and multiply in it.

Discussion:

The first question was answered:

It was revealed through appendix (1) that Anabena algea was found in very large quantities in the falajes water. It is worth mentioning that it is a toxic species that has great harm to human and animal health.

The second question was answered:

It was found that the value of acidity, conductivity and salinity in the falajes is greater before treatment. This indicates the accumulation of organic materials, which contributed to the spread of more green blue algae of the type of Anabena and water properties were changed as shown in table (3) and (4) and the graph (1) and (2).

Laboratory results from the General Directorate of Regional Municipalities and Water Resources, as stated in table (5), the chart (3) and the appendices (2, 3 and 4) when testing the samples and comparing them: the characteristics of the falajes, and the dam's water were affected by the presence of the Anabena bacteria despite their treatment. This effect is represented in:

First: A decrease in the percentage of some elements and compounds, such as: Dissolved solids, nitric acid, fluoride, sulfate, chloride, sodium, magnesium and

nitrate, which indicates that these elements are food for this type of algae.

Second: An increase in the percentage of some elements and compounds, such as: Alkalinity, acidity, conductivity, salinity and bicarbonate, which increase provided favorable conditions for the growth of this type of algae.

When comparing the three samples, it is concluded that the ratio of salinity, alkalinity, conductivity, elements, and compounds in the sample of Al Jazeera falaj water is greater. This indicates the presence and spread of blue-green algae of the anabena type in Al Jazeera falaj more. This is an evidence that the water in the falaj was saturated with organic materials which is confirmed by our results during applying the water protocol at the study site.

It has been observed that there has been a noticeable decline in the growth pattern with respect to the main isolation, intrinsic parasitism and induced mutations. Also, a decrease in the percentage of nitrogen-fixing vesicles was observed in conditions of saline stress. As for protein, an increase in the amount of protein was observed in conditions of salt stress as it helps the organism to resist salinity, while an increase in the production of beta-creatinoid dye that helps to withstand salinity has been observed along with its role in the absorption of the necessary radiation in the photosynthesis process. As for the pigments of Vicopleoprotein, a slight increase in its production has been observed to help with the tolerance of the salinity organism. Continuing awareness of farmers to monitor falajes cleaning should be done.

Conclusion:

We thank God for completing this research through which we recognized that the reasons of the white algea emergence in the falajes of the anabena type caused algae being stained white. In addition, the water protocol, testing samples in coordination with the General Directorate of Regional Municipalities and Water Resources as well as the laboratory of Center for Marine Research and Fisheries have contributed in conducting the research succefully. Intensive efforts should be made to educate people not to use water because of its drawbacks.

Sources of errors in the results of acidity, conductivity and salinity due to the different devices used in the school and the laboratory center. Strengths were obtaining vital results after examining the water in the laboratories center. Weaknesses were not giving the results of falajes water analysis before treatment and not stating the substances that were added to eliminate white algae. This research can be applied to the possibility of using blue-green algae to make biofuels.

Acknowledgements:

We are pleased to extend our sincere thanks to everyone who contributed to this research:

1. Nadhira Al-Harthiya
2. All faculty and principal of the school
3. Majed Al Busafi
4. Abdullah Al-Furi
5. Center for Marine Research and Fisheries of Muscat
6. The General Directorate of Regional Municipalities and Water Resources in Muscat Governorate
7. Ali Al Niri

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