Ministry of Education

General Directorate of Education in Al Dhahirah Governorate

Sawdat Al-Muminin School (5-12)

Prepared by:

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School: Sawda Umm al-Mu'minin

Studying the effect of using lemon peel and moringa plants as a gray water purifier

Contents

Summary

Our research aims to study how to use dried lemon peels and ground moringa in purifying gray water, as well as what is the difference between the properties of the two samples of washing machine water before and after purification in terms of transparency, salinity, acidity and oxygen.

We asked the following questions:

1. How can dried lemon peels and ground moringa be used to purify water?

2. What is the difference between the properties of the two samples in terms of transparency, salinity, acidity, and oxygen?

With increasing interest in environmental sustainability and reuse of water resources, purifying used washing machine water is a major environmental and economic challenge. The research includes studying the use of low-cost, environmentally friendly natural materials such as dried lemon peel and dried and ground moringa leaves in purifying washing machine water. To answer the research questions, we dried the lemon peel and moringa leaves, ground the moringa into a powder in the form of a powder, and placed specific amounts of materials in the purification tool so that the washing machine water could pass through it to evaluate its effectiveness in removing pollutants (oils, detergents). This became clear to us by measuring the acidity, salinity, transparency, and oxygen before and after purification. We concluded that lemon peel has the ability to absorb oils and odors because it contains acidic compounds and aromatic substances. Moringa leaves are also efficient in precipitating fine impurities and suspended materials because they contain proteins that act as natural coagulants.

Search questions

1. How can dried lemon peels and ground moringa be used to purify gray water?

2. What is the difference between the properties of the two samples in terms of transparency, salinity, acidity, and oxygen?

search terms

Moringa: The moringa tree is known by several different names, such as the oilseed tree, the shua tree, or the drum tree. It is also known in Africa as the miracle tree, because they used it during the food crisis because of the many medicinal benefits of moringa, its rapid growth, and its low cost. Moringa is distinguished by containing a variety of proteins, vitamins, minerals, and antioxidants that play a major role in helping to treat many diseases and maintain health.

Salinity: The dissolved salt content in water.

Acidity: The basic number in a molecule or the number of hydroxide group in a chemical equation.

the introduction

In light of the increasing need to find sustainable solutions to the problem of water scarcity, research into natural materials has become an excellent alternative to traditional techniques. Based on this logic, attention is drawn to lemon peels and moringa leaves in our research as natural materials capable of effectively purifying gray water. Lemon peels are characterized by their antibacterial properties and contain natural compounds capable of absorbing pollutants and reducing unwanted odors, while moringa is known for its superior ability to kill bacteria because it contains special proteins that are effective in treating water.

Search method

First: Timetable (1) for implementing the research plan

Student's name	Mission	Implementation date
Lama Abdullah Al-Hanaia Malk Yasser Al-Ghafri	Collecting information about the research topic from various sources	October
Lama Abdullah Al-Hanaia Malk Yasser Al-Ghafri	Determine the farms to which the research tools will be applied.	October
Lama Abdullah Al-Hanaia Malk Yasser Al-Ghafri	Collecting contaminated washing machine water samples.	October
Lama Abdullah Al-Hanaia Malk Yasser Al-Ghafri	Sending samples to Al Dhahirah Municipality.	November
Lama Abdullah Al-Hanaia Malk Yasser Al-Ghafri	Note the final results and write the research.	November

Second: Study site:

Study location: Sultanate of Oman, Al-Dhahirah Governorate, Ibri State, Al-Duraiz village.

***Longitude 23.330675 North.**

***Latitude 56.610489 East.**

As shown in the two pictures in Figure (1) and Figure (2).

***The weather temperature ranges between**

***It was applied from the months of October-November. A hydrosphere protocol was used.**

الشكل (٢)

الشكل (١)

Third: Collect and analyze data

To answer the first question, we did the following:

We first brought lemon peel and moringa leaves, dried them, then ground them into small pieces to aid in the purification process. After that, we brought the used washing machine water and then put it in the purification device, where we put the dried lemon in one funnel and the moringa in the other funnel, then we carried out the purification process by pouring the used water into the purification device, as picture (3) show:

picture (3)

To answer the second question, we did the following:

We took a sample of water before and after the purification process, where we measured:

Salinity, acidity, oxygen, and transparency. The results were as follows

Acidity:

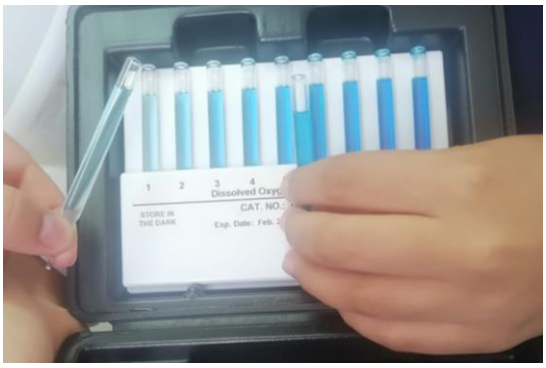
As for acidity, we used the acidity device to measure the acidity in the two samples. In the sample before purification, it became clear to us that the acidity was equal to (8.5), but after the purification process, it became clear to us that the acidity was equal to (7.1), as explained, and indeed we noticed that the acidity was much better.

Salinity:

In salinity, we did the same process, where we used the salinity device to identify the salinity, and indeed it became clear to us that the salinity of the sample before purification was equal to (2.70), and after purification it was equal to (2.5), and this shows us that the salinity ratio is better.

Oxygen:

We used a substance that detects oxygen in water. It became clear to us that the sample before purification was equal to (1) and after the purification process it became (6), as the picture (4) shows.



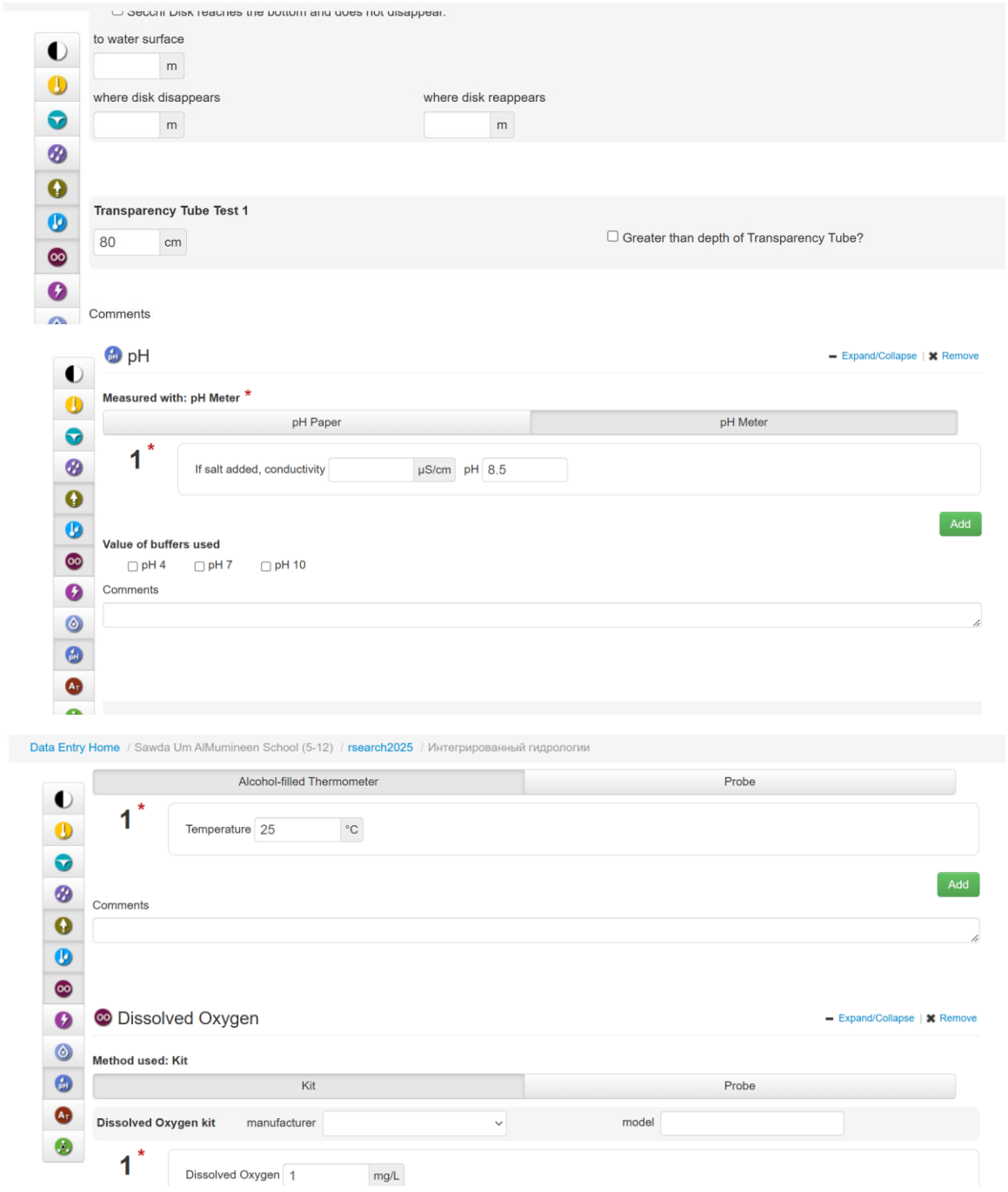
Picture (4)

Transparency:

We brought a transparency tube and poured the samples into it before and after purification. Before purification, the transparency was (80), but after purification it became (120), as the picture (5) shows.

Picture (5)

Fourth: Data entry:



Results

	Before the purification process	After the purification process
Salinity	**2.70**	**2.50**
Acidity	**8.5**	**7.1**
Transparency	**80**	**120**
Oxygen	**1**	**6**

We noticed from the results that:

Water after purification is better than water before purification in terms of acidity, salinity, transparency and oxygen.

After sending the samples to the Department of Health Affairs in the municipality of Ibri

Water properties	Washing machine water	Water after treatment (purification)
coliform bacteria	80.5mpn	0
Salinity	612	304
Acidity	7.8	7.9

The results confirmed to us that the water after purification became better, as the bacteria before purification were (80.5).

After purification, it was (0), and the salinity in the water also decreased after purification, as the table shows

Discuss the results

Regarding the first question, through the results that appeared to us, we discovered that we can use lemon peels and ground moringa to purify gray water, as lemon peels help absorb odors and help kill organic compounds, and as for ground moringa, it helps kill bacteria and sediment suspended particles, as lemon peels and ground moringa are natural materials that are easily available and are environmentally friendly.

For the second question, we compared the two water samples before and after the purification process in terms of acidity, salinity, dissolved oxygen in the water, and finally transparency:

In terms of acidity, it became clear to us that the water sample before purification had more acidity (8.5) than the water sample after purification (7.1).

As for salinity, the salinity was greater in the water sample before purification (2.7), while the salinity in the water sample after purification was less (2.5).

As for dissolved oxygen in the water, the percentage of oxygen in the water sample before purification was very low (1), so it was not usable for irrigating plants, but the percentage of oxygen in the water sample after the purification process contained a greater percentage of oxygen (6), which means that it is usable for irrigating plants.

Finally, transparency, as the water sample before purification had a low transparency (80), but after the purification process the transparency was more (120).

Conclusion

1- **Ground moringa lemon peels can be used to purify gray water, as lemon peels help absorb odors and help kill organic compounds. As for ground moringa, it helps kill bacteria and sediment suspended particles. They are natural materials that are easily available and are environmentally friendly.**

2- **A clear difference appeared between the two samples before and after purification in terms of acidity, salinity, dissolved oxygen in the water, and transparency. The results after purification show us that lemon peels and ground moringa have made a positive difference in the water, making it suitable for use in irrigating plants.**

Thanks, and appreciation

We can only express our deep gratitude to everyone who supported this project from its beginning, and I especially thank teacher Fakhriya Al-Balushi for her cooperation in this distinguished and useful project, and the administration of our school who cooperated with us and supported us. We would also like to thank the Ibri municipality for their cooperation with us and their examination of the samples, as well as Mr. Badr Al-Mahamari, the program coordinator in the governorate.

Reference

1. Ali Muhammad Salman, & Karima. (2024). Study of the antibacterial effect of Moringa (Oleifera) leaf extract on some bacterial species (Doctoral dissertation, University of Zawia).

2. Chalabi, M. (2020). The suitability of available water sources for growing the Moringa oleifera tree at home in Al-Heera district. Kufa Journal of Arts, 1(43), 541-614
3. Zeina Muhammad Ali Abbas, & Eng. M. Wafa Abdel Sattar Shatti. (2022). Preparation of nano-magnetic hemanite iron oxide from cumin seed extract and dried lemon peels and using it to kill types of bacteria.

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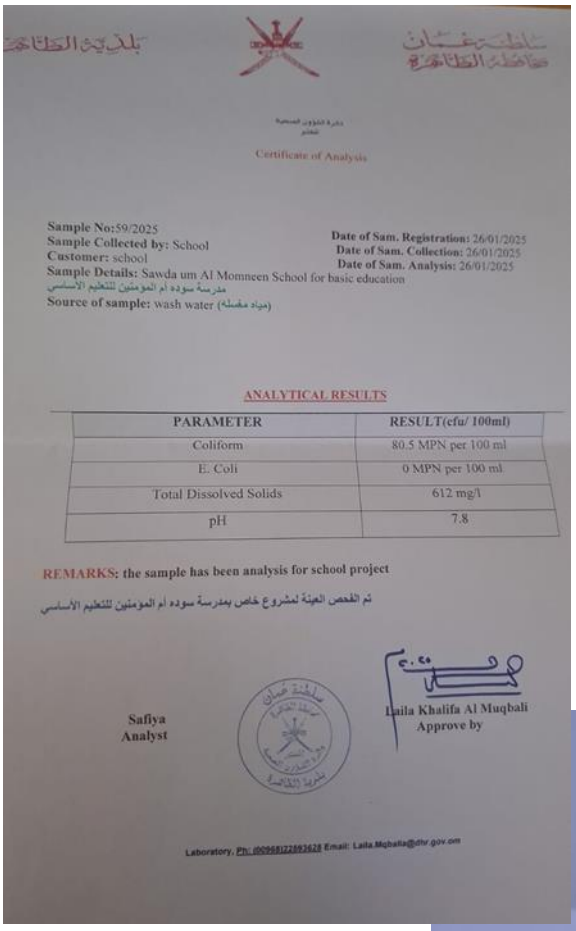
5. A team GLOBE Environmental, scientific committee of the central team 2018\2019 Outstanding research Brochure

6. Technical Office of the program GLOBE, (2012) WATER protocol Note for the GLOBE Teacher Training programme

Appendix



بلدية الظاهرة

سلطنة عمان
محافظة الظاهرة

Certificate of Analysis

Sample No:59/2025
Sample Collected by: School
Customer: school
Sample Details: Sawda um Al Momneen School for basic education
مدرسة سودة أم المومنين للتعليم الأساسي
Source of sample: wash water (مياه مغسله)

Date of Sam. Registration: 26/01/2025
Date of Sam. Collection: 26/01/2025
Date of Sam. Analysis: 26/01/2025

ANALYTICAL RESULTS

PARAMETER	RESULT(cfu/ 100ml)
Coliform	80.5 MPN per 100 ml
E. Coli	0 MPN per 100 ml
Total Dissolved Solids	612 mg/l
pH	7.8

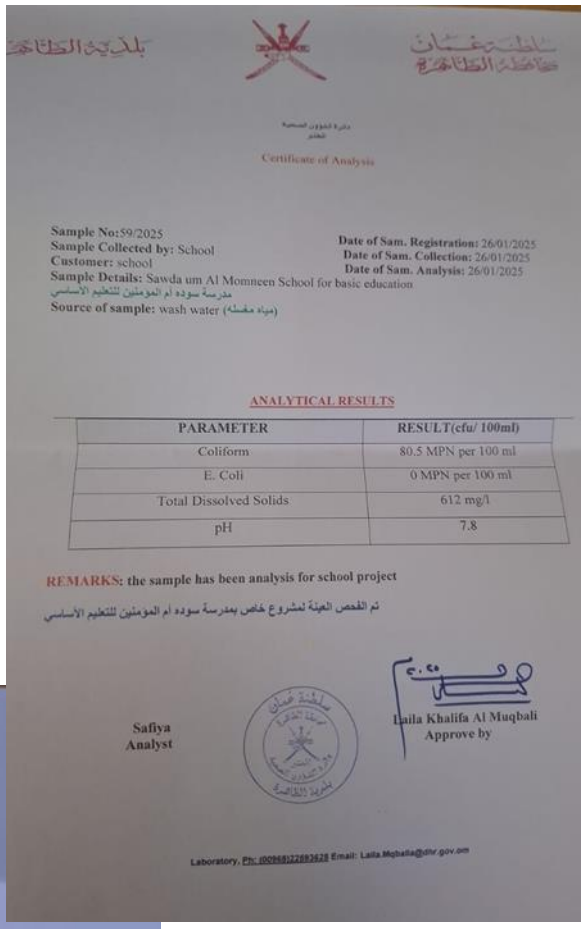
REMARKS: the sample has been analysis for school project

تم الفحص العينة لمشروع خاص بمدرسة سوده أم المومنين للتعليم الأساسي

Safiya
Analyst

Laila Khalifa Al Muqbali
Approve by

Laboratory, Ph: (00968)22693628 Email: Laila.Mqbalia@dlv.gov.om



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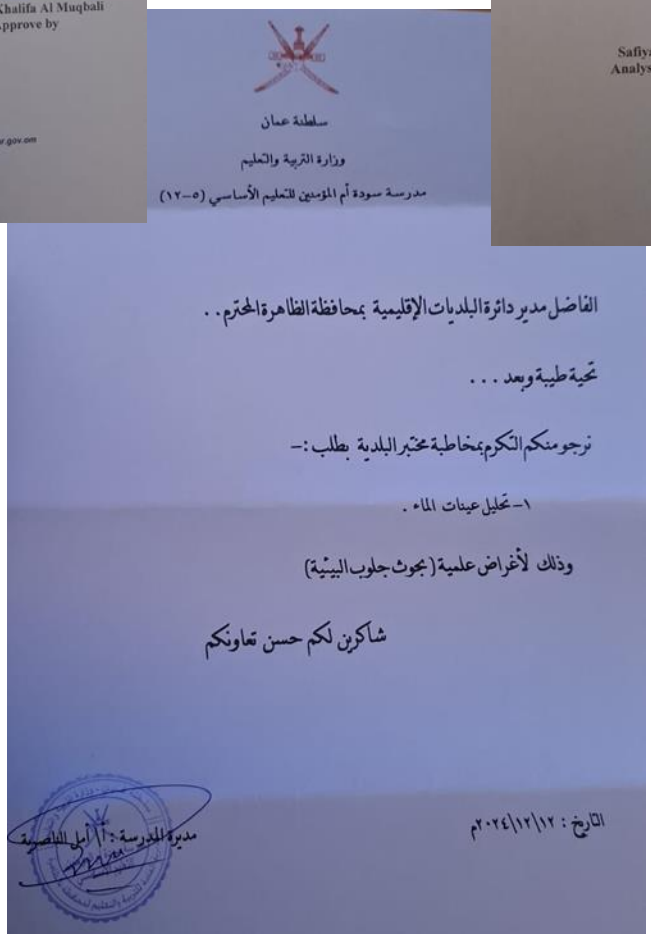

سلطنة عمان

وزارة التربية والتعليم

مدرسة سودة أم المومنين للتعليم الأساسي (٥-١٢)

الفاضل مدير دائرة البلديات الإقليمية بمحافظة الظاهرة المحترم . .

تحية طيبة وبعد . . .

نرجو منكم التكرم بمخاطبة مختبر البلدية بطلب :-

١- تحليل عينات الماء .

وذلك لأغراض علمية (بحوث جلوب البيئية)

شاكرين لكم حسن تعاونكم

التاريخ : ١٢/١٢/٢٠٢٤م

مديرة المدرسة : أ/ أمل الناصرية