Sultanate of Oman

Ministry of Education

General Directorate of Education in Al Dakhiliyah Governorate

Umm Hani School for Basic Education (7-12)

Study entitled:

Inventing biochar from olives, and its impact on treating the sulfuric water of hot springs in the Wilayat of Samail

Prepared by the two students:

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Abstract;

The goal of the research is to create a type of biochar from the waste of olive fruits, and to study its effect in treating the sulfurous water of the hot springs in the state of Samail in Oman.

The following questions were asked:

1. How can we make biochar from olive waste?

2. What is the impact of using biochar from olive waste in treating sulfurous water?

To answer these questions, cooperation was made with some laboratories and research centers at Sultan Qaboos University, and the water protocol was applied to the study samples to measure transparency, acidity, conductivity, and salinity, and to analyze some special components. In water samples before and after mixing with biofuel in the Applied Analysis Unit at the College of Science at Sultan Qaboos University.

The results indicated the possibility of making biochar from olive waste through a special oven in which the olives were subjected to a temperature of 400◦C in the process of slow pyrolysis. Adding charcoal to sulfurous water contributed to reducing acidity and absorbing aluminum (Al) to zero. The results also showed that the percentage of potassium (K) increased at a significant rate after adding biochar.

Key Terms:

Biochar: It is an element added to the soil to make it richer and more fertile. Biochar is produced from branches and wood residues through pyrolysis (exposure to high heat without air). (https://ar.wikipedia.org/wiki/%D9%81%D8%AD%D9%85_%D8%AD%D9%8A%D9%88%D9%8A, retrieved on 2/3/2024)

Research questions:

1. How can we make biochar from olive waste?

2. What is the impact of using biochar from olive waste in treating sulfurous water?

Introduction and literature review:

Biochar is used to raise soil fertility, improve its physical properties, increase agricultural production, and protect plants from some diseases caused by the soil. (Al-Bahnasawy, 2023)

Biochar can be made from some agricultural wastes, such as roots, stems, and fruits such as olives. (Sarah et al., 2022) used agricultural waste to remove organic materials and heavy metals from aquatic media, and was also able to remove nitrogen and phosphorus derivatives as well.

Regarding the effect of some elements on the environment, aluminum, which is soluble in water, is dangerous to the central nervous system. When the concentration of aluminum in the environment increases, it has serious effects on human health. Aluminum also accumulates in plants and animals that feed on it, and the effect of aluminum on animals causes respiratory problems, weight loss, and decreased activity. (Retrieved on 2/3/2024 from https://ar.anbar.asia/)

As for potassium, it is considered one of the main elements that the plant needs in large quantities that exceed other nutrients. The importance of potassium is evident through its many physiological functions and its effective participation in the building process. Photosynthesis, the formation of proteins and carbohydrates, and the absorption of water and nutrients. It is considered an activator for more than 85 species in plants and may exceed the number of enzymes activated by potassium.

Research methods: First: Research plan:

- Setting a timetable for the research plan.

- Distributing work roles among the research team, represented in preparing tools and field application,

applying the water protocol, collecting and analyzing data, and writing the research under the supervision of the teacher.

- Identifying and reviewing some sources Information related to the research topic and documenting it.

- Interviewing researchers at the Center for Environmental Research Studies.

- Adopting experimental research to study the impact of biochar on water.

- Choosing and defining the study site in preparation for starting data collection.

- Determine the appropriate protocols for collecting research data, which were mainly represented by the water protocol and element analysis.

- Determine the appropriate devices and tools to implement the research plan (GPS, paper, pen, smartphone, transparency tube, conductivity and acidity measuring device, some laboratory devices

- Applying the research by implementing the protocol at the study site.

- Sending samples to the Applied Analysis Unit at the College of Science/Sultan Qaboos University.

- Collecting data and organizing it into tables.

- Entering data into the program's website. (www.GLOBE.gov)

- Analyze the data collected through the protocol.

- Arrange a conclusion

second: Study location:

The plan of this research was implemented in the state of Samail. (Sultanate of Oman, Al Dakhiliyah Governorate, Samail Wilayat, Siya'a, January 2024, moderate weather, water protocol applied).

Table (2) Coordinates of the study site

Siya' town	Site coordinates via GPS
(Samail Wilayat)	23.16.49 N 58.02.17 E

The images below show location maps.

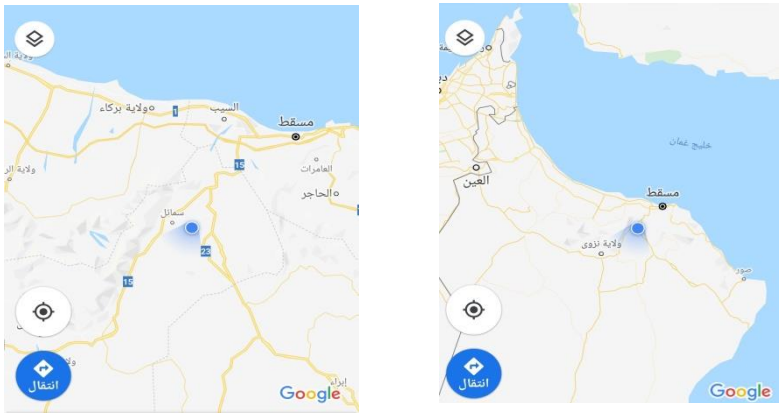


Image (1) location maps

Third: Data collection and analysis:

The first question: How can we make biochar from olive waste?

Dr. Saleh Jalali and Professor Ahmed Al-Sudairi / Center for Environmental Studies and Research at Sultan Qaboos University were interviewed, and cooperation took place with the center to convert pressed olive waste into charcoal. Biochar.

Second question: What is the impact of using biochar from olive waste in treating sulfurous water? The water protocol was applied, measuring transparency using a transparency tube, measuring acidity, conductivity, and a special request to analyze some elements in the Applied Analysis Unit at the College of Science at Sultan Qaboos University.

Methods of collecting data:

The olive waste was subjected to a slow pyrolysis process to transform it into biochar by placing it in an oven (400◦C) for two hours and then leaving it in the oven until the next day to cool slowly.

Pyrolysis is a burning process in the absence of oxygen.

The pictures show the olive waste before and after it is converted into biochar and the oven used.



Images (2) olive waste before and after

Determine the area to which the search tools will be applied.

- Taking a sample of sulfurous water from the site of the spring, and applying the water protocol to measure transparency using a transparency tube and measuring acidity, salinity and conductivity

Repeat the measurements three times to ensure the accuracy of the results.

- Mixing a water sample Sulfur with biochar (Biochar) according to the recommendations of Dr. Saleh Jalali (1 g/L) (250 ml of water with 0.25 g of Biochar)

The mixing process was done for two hours using the magnetic mixing capsule available in the school laboratory.

Biochar was also mixed with distilled water in the same way to use it as a control experiment and compared with the experiment of mixing biochar with sulfurous water.

- Re-measurements of acidity, conductivity, and salinity after the mixing process with biochar

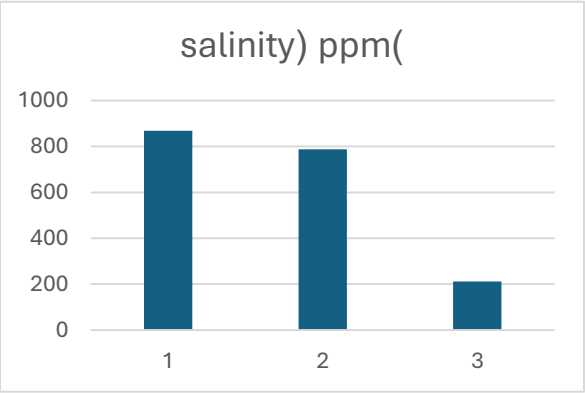
- Sending three samples (1. Sulfurous water, 2. 3. Sulfur water after mixing it with biochar, 3. Distilled water with biochar) to the Applied Analysis Unit at the College of Science to examine some elements.

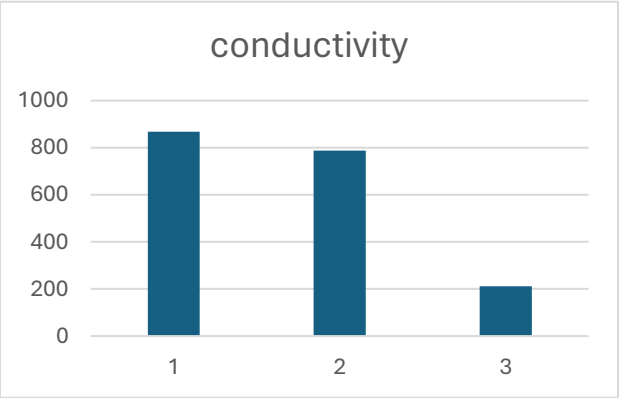
Results:

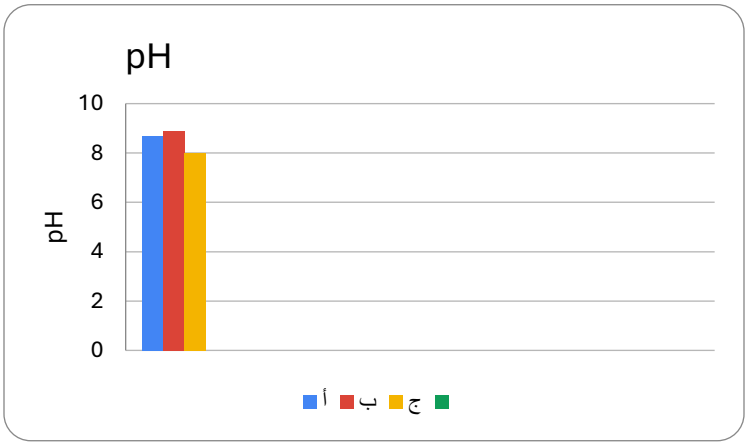
Hydrological characteristics for samples collected for the study using GLOBE tools.

Table (2) Hydrological characteristics for samples

pH	Salinity Ppm	Conductivity µs	Transparency	Sampel
8.7	868	1230	120	Sulfurous water
8.9	788	1161	…	Sulfur water after mixing it with biochar
8.0	212	302	…	Distilled water with biochar



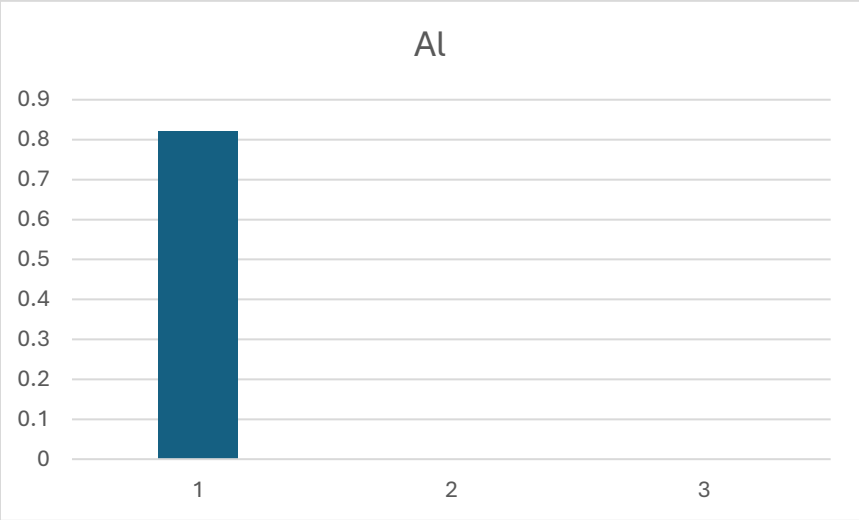


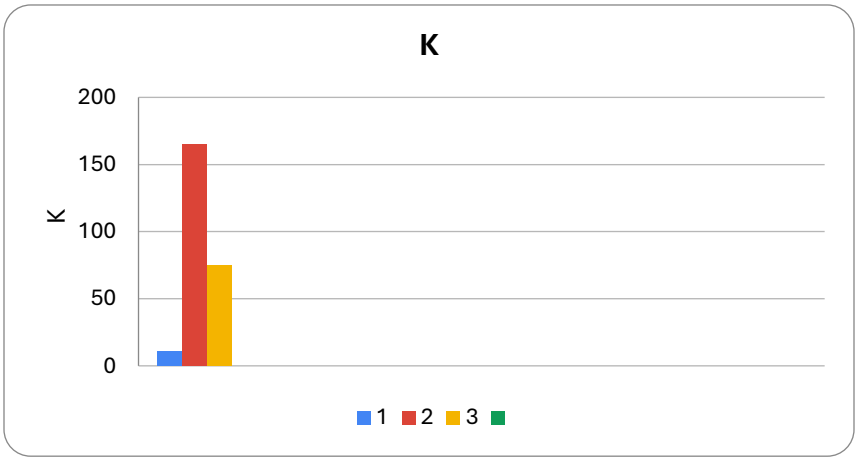


The following table indicates the data of the elements that were examined in the three samples, which were sent to the Applied Analysis Unit for analysis of some elements.

ICP-OES Results

SAMPLE ID	Zn	Pb	Cd	Ni	Ba	Fe	B	Mn	Cr	Cu	Al	Sr	Na	K	Ca	Mg	As	Hg	Ag	Co	Bi	S	Al
1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	247.23	10.40	83.06	ND	ND	ND	ND	ND	ND	2093.9	0.82
2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	194.82	164.64	3.67	ND	ND	ND	ND	ND	ND	2356.5	ND
3	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	7.67	74.89	23.05	7.08	ND	ND	ND	ND	ND	1741.1	ND





Images (3) results of Al & K in search samples

Through the results, we noticed the following:

The acidity, salinity, and conductivity of the sulfurous water decreased after adding biochar, Table (2)

The biochar (Biochar) eliminated the aluminum metal present in the sulfurous water, Table (4)

An increase in the percentage of the element Potassium after adding biochar to sulfurous water, Table (3) mm indicates that olives are rich in potassium

- The data was entered and sent to the program website (www.GLOBE.gov) via the application (DATA ENTRY) where the site was added New work and entering data collected through research.

Discussion of the results:

Through the data collected, we noticed that biochar (Biochar) can be made from olive waste using the slow pyrolysis process in the absence of oxygen.

The manufactured Biochar (Biochar) was added to sulfurous water from one of the hot springs and its effect was observed. We noticed a decrease in the acidity and salinity of the sulfurous water after adding biochar. Biochar contributed to the treatment of aluminum sulfurous water, as it recorded a zero value after mixing it with biochar. Biochar also contributed to increasing the proportion of potassium, which can be very useful in increasing soil fertility.

Conclusion:

Thanks to God, this research was completed, during which we used a water protocol to study various samples before and after adding biochar (Biochar) made from olive waste. The research concluded the effect of Biochar (Biochar) in treating aluminum sulfur water and reducing Acidity

and salinity level. The results also showed the effect of biochar in increasing the percentage of potassium, which enables us to exploit it to increase soil fertility.

Acknowledgments:

Praise be to God, and prayers and peace be upon the Messenger of God, and after...

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We extend our thanks to the central team of the GLOBE program for their constant encouragement to participate. Asking God Almighty for success and payment.

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ICP-OES Results

SAMPLE ID	Zn	Pb	Cd	Ni	Ba	Fe	B	Mn	Cr	Cu	Al	Sr	Na	K	Ca	Mg	As	Hg	Ag	Co	Bi	S	Al
1	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	247.23	10.40	85.06	ND	ND	ND	ND	ND	ND	2095.9	0.82
2	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	394.82	184.64	3.67	ND	ND	ND	ND	ND	ND	2358.5	ND
3	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	7.67	74.89	23.05	7.28	ND	ND	ND	ND	ND	1741.1	ND

ND-NOT DETECTED
Results are in PPM.

pH Results

Sample ID	pH
1	8.7 @ 20.7 ^{0}C
2	8.9 @ 20.3 ^{0}C
3	8.0 @ 20.1 ^{0}C

END OF REPORT

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