Study of some Physical Properties (Before and after Purification) of Water from Dam Um Hashim - Khor Taqat - ElObeid - North Kordofan- Sudan

دراسة بعض الخصائص الفيزيائية(قبل وبعد التنقية) لمياه حفير أم هشيم – خور طقت- الأبيض – شمال كردفان- السودان

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Abstract

This research studied some physical properties (surface tension index, refractive index and viscosity index) before and after purification of the water of Dam Um Hashim - Khor Taqat - El Obeid - North Kordofan State. The study aimed to purify water using a natural method without resorting to chemicals, by studying some of its physical properties. A purification system was used, which is a water collection tank made of iron, coated

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inside and out with an anti-rust material and conforming to the technical specifications. The tank was divided into four internal stages. It contains multiple layers of sand and gravel of small sizes and measured heights. The average values of the parameters (surface tension, refraction, and viscosity) were calculated before and after purification. The study reached the following results: The average value of the surface tension coefficient before purification is equal to 57.14 N/m and after purification is equal to 73.54 N/m, while the average refractive index before purification is equal to 1.63 and after purification is equal to 1.39, and the average viscosity coefficient before purification is equal to 0.819 N.s/m and after. Purification is equal to 0.743 N.s/m, and from these results we notice that the result before purification is greater than the result after purification, and this indicates the presence of an amount of impurities, plankton, and silt dissolved in the water. Thus, we have achieved pure water by creating a purification system and using some physical properties. Without resorting to chemicals, the study recommends further study of the physical properties.

Key words: physical properties, surface tension index, refractive index, viscosity index, Dam Um Hashim, khor taqat.

الملخص:

تناول هذا البحث دراسة بعض الخواص الفيزيائية(معامل التوتر السطحي، معامل الإنكسار والمعامل اللزوجة) قبل وبعد التنقية لمياه حفير أم هشيم – خور طقت – الأبيض – ولاية شمال كردفان. هدفت الدراسة الى تنقية المياه بإستخدام طريقة طبيعية دون اللجوء للمواد الكيميائية وذلك عن طريق دراسة بعض الخواص الفيزيائية لها، أُستخدم نظام للتنقية وهو عبارة عن خزان لجمع المياه مصنوع من الحديد مطلي من الداخل والخارج بمادة مانعة للصدأ ومطابقة للمواصفات الفنية، قُسم الخزان الى أربع مراحل داخلية تحتوي على طبقات متعددة من الرمل والحصى ذات أحجام صغيرة وبإرتفاعات محسوبة. حُسب متوسط القيم لمعاملات (التوتر السطحي، الإنكسار واللزوجة) قبل وبعد التنقية. توصلت الدراسة للنتائج التالية: أن قيمة متوسط معامل التوتر السطحي قبل التنقية تساوي 57.14 N/m وبعد التنقية تساوي 73.54 N/m ، أما متوسط معامل الإنكسار قبل التنقية يساوي 1.63 وبعد التنقية يساوي 1.39 ، ومتوسط معامل اللزوجة قبل التنقية يساوي 0.819 N.s/m وبعد التنقية يساوي 0.743 N.s/m ، ومن خلال هذه النتائج نلاحظ أن النتيجة قبل التنقية أكبر من النتيجة بعد التنقية وهذا يدل على وجود كمية من الشوائب والعوالق والطمي الذائب في الماء، وبهذا نكون قد توصلنا الى مياه نقية عن طريق عمل نظام تنقية وإستخدام بعض الخواص الفيزيائية دون اللجوء للمواد الكيميائية ، تُوصي الدراسة بإجراء مزيد من دراسة الخواص الفيزيائية.

1. Introduction:

Water is a transparent, colorless, odorless substance. It is the basic component of streams, lakes, seas, and oceans, as well as the fluids in all living organisms. It is the most widespread chemical compound on the surface of the Earth. The water molecule consists of a central oxygen atom to which two hydrogen atoms are linked on either end by a covalent bond, so that its chemical formula is H_2O. At standard conditions of pressure and temperature, water is a liquid; The solid state is formed at the freezing point, and is called ice. The gaseous state is formed at the boiling point, and is called water vapor.

Water is the basis for the existence of life on planet Earth, and it covers 71% of its surface, and sea and ocean water represents the largest percentage of water on Earth, amounting to about 96.5%. The remaining percentages are distributed between groundwater and the ice of the polar regions (1.7% for both), with a small percentage in the form of water vapor suspended in the air in the form of clouds, and sometimes in the form of fog or dew, in addition to rain or snow showers[1,2]. The percentage of fresh water is only about 2.5% of the water present on Earth, and most of this amount (about 99%) is present in the ice masses in the polar regions, while 0.3% of fresh water is present in rivers, lakes, and in the atmosphere [1].

As for nature, the state of water changes between the three states of matter on the surface of the Earth constantly through what is known as the hydrological

cycle (or water cycle), which includes the occurrence of evaporation and transpiration (evaporative transpiration), then condensation, precipitation, and then flow to reach the mouth in bodies of water.

Obtaining a pure source of drinking water has been important to the emergence of civilizations throughout history. In recent decades, cases of fresh water scarcity have been recorded in many regions of the world. United Nations statistics have estimated that about a billion people on the surface of the Earth still lack the means available to access a safe source of drinking water, and that about 2.5 billion lack an appropriate means for Water disinfection [3].

2. Theoretical background:

Fresh water Fresh water is that water that contains in its components 1% of sodium chloride salt (table salt), or contains many other salts such as: calcium, magnesium, and fresh water may be visible on the surface. The surface of the Earth, or present in its interior [4]. Sea water is that water that constitutes 70% of the Earth's surface area, and it is composed of sea and ocean water, and the salts in this water constitute 2.5% of the full percentage of its contents, and it is It contains 1% of other substances, such as dissolved organic and inorganic substances, and a small number of gases. Seawater is characterized by containing many important elements that are used in trade. Such as magnesium, sodium chloride, which is known as table salt, and bromine. It should be noted that sea water can be used for drinking.

This is done by desalinating it using specialized desalination plants [5]. Distilled water is water that does not contain minerals, as distilled water is purified and various minerals are removed from it through the distillation process; The water is boiled until it begins to evaporate, then the steam is collected and condensed to produce distilled water. It should be noted that the distillation process allows the removal of salts and impurities present in the water, but it cannot remove some substances that mix with the water such as volatile organic substances and mercury [6]. Hard water Hard water is the water that exists when fresh water meets sea or ocean water, so that this water becomes less salty than sea water, and more salty than fresh water [7]. Drinking water is that water that is treated to make it suitable for drinking, and many types of water are used. Biological materials are used to treat this water and sterilize it from bacteria, such as using chlorine and ozone, and some other mineral components are also eliminated so that drinking water becomes compatible with recognized international standards [4].

States of water exists in nature in three states: [8,9] The solid state: the water is in the form of bright white snow, or in the form of ice, and water begins to freeze when the temperature is zero degrees Celsius. Gaseous state: Water is in the form of water vapor, and it becomes in this state when it reaches the boiling point, i.e. 100 degrees Celsius. Liquid state: It is the dominant state of water, in which it is odorless or colorless. Liquid water

constitutes 70% of the Earth's surface area, and water is in the liquid state at temperatures between the two degrees: freezing and evaporation

2.1. Surface tension:

Surface tension What is meant is the interconnectedness of the surface of the water so that it appears as an elastic layer that prevents small objects from diving into it. This phenomenon is formed due to the forces of cohesion between the water molecules themselves. Examples of surface tension include: [10] insects walking on the surface water. The needle floats on the surface of the water. Rotate bubbles. Circular raindrop shape.

2.2. The concept of refraction of light in water:

What is meant by refraction of light is the bending of light as it passes from one transparent material to another, whether it is glass, water, or other transparent media,[11] as its transfer from one material to another material changes its speed, thus resulting in either the bounce of light or its bending.[12] Video You may like: When light travels from air to water, this causes a change in its direction, and this change in direction is called refraction of light. Because water has a higher density than air, meaning a higher index of refraction, which makes it slow down when it enters,[12] it results from a change in the speed of light when it enters due to the difference in density in different media, which results in the interactions of individual photons with molecules in the substance[13]. Factors on which the refraction of light in water depends The amount of bending of light

when it enters a different medium depends on two factors: [12] Change in speed. This means that if a substance changes the speed of light, whether it speeds it up or slows it down, the light will be refracted differently. Angle of the incident beam: The light enters at a greater angle, so the amount of refraction of the resulting light will be greater and clearer. However, if it enters vertically, that is, at a 90-degree angle, the light will slow down as it enters, but its direction will not change. When measuring the resulting angles when it travels, we imagine an imaginary line at a 90-degree angle from the surface. The two materials, since if light enters a medium with a higher refractive index. For example, when it enters from air into water, it slows down and thus bends and approaches the line. However, if light enters a medium with a lower refractive index; For example, from water to air, it accelerates and thus moves away from the line [14].

2.3. Viscosity:

Viscosity is the resistance of a fluid to flow, and the extent of its resistance to pressure that forces it to move and flow. The higher the viscosity of a fluid, the less its ability to flow. For liquids, viscosity is equivalent to the colloquial term "thickness." Honey is thick and has a high viscosity, while water is smooth and has a low viscosity.

The molecules of a high-viscosity liquid are tightly bound together and therefore less able to move. Its friction with the solid body in contact with it increases,

and viscosity can be described as internal friction between the liquid molecules.

We feel viscosity in our daily lives, such as a spoon falling into honey or a piece of iron falling into tar, as well as the flow of water inside water pipes. The resistance to movement that occurs during this is related to the viscosity of the liquid.

It is an important property of fluids, by which the fluid resists the change in shape resulting from the effect of shear forces acting on it. If we assume that there is a layer of fluid between two parallel flat plates, as in the figure, such that the lower plate is fixed and the upper plate moves quickly under the influence of force

The kinematic viscosity (dynamic viscosity) of a liquid shows the amount of resistance the liquid has to flow (flow) when it is in motion and the relationship of this resistance to the temperature of the liquid. As the temperature increases, the kinematic viscosity decreases and the fluid becomes more fluid. This is due to the cohesive forces between molecules that overwhelm the transfer of molecular momentum between these molecules, and this is also due to the molecules being very close together (this explains why liquids are smaller in volume compared to gases). When a liquid is heated, the cohesive forces between molecules decrease and thus the attractive forces between them decrease, ultimately leading to a decrease in the viscosity of the liquid [11,15].

3. Research problem:

We find that some rural communities suffer from many water problems because they rely on water from ponds and pits mainly for human use, as this water contains varying percentages of plankton that may cause humans some health problems. Therefore, this study resorted to finding a simple and easy natural method in Available to everyone to improve the physical properties of water, making it a high degree of purity.

4. Objective:

Purifying water using a natural method without resorting to chemicals, by studying some of the physical properties of water before and after purification. Purifying water using a natural method without resorting to chemicals, by studying some of the physical properties of water before and after purification.

5.Water tank specifications:

The tank is a closed container for collecting water, made of sheet metal, coated on the outside and inside with an anti-rust material that conforms to the technical specifications. It is a cubic box with a length of 50cm, a width of 50cm, and a height of 50cm.

5.1. Internal specifications:

The tank was divided into four internal stages, which are as follows:

5.1.1. The first stage: 50cm long, 25cm wide, and 25cm high from the middle of the bottom. It consists of multiple layers of gravel and sand with calculated heights, arranged from bottom to top, and is as follows:

1-The first layer: a layer of small pebbles, 8cm high.
2 -The second layer: a layer of medium-coarse sand, 5cm high, then two layers of cloth were placed on it.
3-The third layer: It consists of medium-rough grains of gravel and sand, 5 cm high. All previous layers were covered with a piece of soft sand.
5.1.2. The second stage: It is 50cm long, 25cm wide, and 25cm high from the bottom. It is separated from the previous stage by a piece of sheet metal, which is then perforated with holes with diameters within the range of 5.0 cm.
5.1.3. The third stage: It is 25cm long, 25cm wide, and 50cm high. It also contains a layer of medium-sized pebbles, 8cm high from the bottom.
5.1.4. The fourth and final stage: It is 25cm long, 25cm wide, and 50cm high. It contains a few medium-sized pebbles, 4cm high.

6. Method:

A sample of water from Dam area (Um Hasheem) was brought. Which is located northeast of the Khortaqat University Complex. Water was gradually poured into the first stage of the tank. At this stage, large materials such as tree leaves, stones, algae, and other relatively large impurities were removed by passing the water through a piece of fine sand. This process is called sifting. Immediately after that, the water penetrated the layers of gravel and sand, and this process is called filtration (as the sand grains are larger than the suspended materials, and when the suspended materials

pass through the sand layer, they hit the surface of the sand grains and are trapped in the narrow corners between them, causing filtration to occur). After that, the water flowed down to the second stage, where it was deposited. An amount of silt and the water rose to 15 cm, then it crossed to the third stage using small plastic tubes extending to the bottom, so the water permeated the layer of pebbles at the bottom, rising to a height of 10 cm, then it slowly flowed to the fourth and final stage, which contains a layer of small pebbles at a height of 4 cm, and these connect to The stage includes a tap through which pure water exits. The water remained in the tank for a period of 48 hours before it came out.

7. results:

Table (1) Determination of the surface tension coefficient of Dam water before purification:

no	y_1	y_2	r	X_1	X_2	h	ρ
1	2.50001	2.40002	0.04999	2.36009	2.6008	0.24021	58.83
2	2.45014	2.3501	0.05002	2.71105	2.50071	0.21034	51.55
3	2.55002	2.60003	0.7005	2.3908	2.21101	0.1779	61.06

Average:

$$\rho = 57.14$$

Table (2) Determination of the surface tension coefficient of Dam water after purification:

no	y_1	y_2	r	X_1	X_2	h	ρ
1	2.50001	2.40002	0.04999	2.70015	3.0002	0.30005	73.49
2	2.45014	2.3201	0.05002	2.10041	1.80001	0.3004	73.62
3	2.55002	2.60003	0.075005	2.51001	2.81003	0.30002	73.51

Average:

$$\rho = 73.54$$

Table (3) Determination of the refractive index of Dam water before purification:

No	A	B	C	$C-A$	$C-B$	$n = C-A/C-B$
1	4.3003	4.6005	5.2004	09001	0.5999	1.5004
2	4.9103	5.1101	5.6204	1.099	0.7101	1.547
3	4.2002	5.4602	4.995	0.7003	0.4403	1.590
4	4.1006	4.5002	5.0001	0.8995	0.4999	1.799
5	4.5004	4.7003	4.9802	0.4798	0.2799	1.714

Average:

$$n = 1.63$$

Table (4) Determination of the refractive index of Dam water after purification:

No	A	B	C	$C-A$	$C-B$	$n = C-A/C-B$
1	4.1001	4.3001	4.8005	0.7004	0.4994	1.402
2	4.6004	4.7404	5.1002	0.4998	0.3598	1.389
3	4.3005	4.330	4.4004	0.0999	0.0704	1.419
4	4.000	4.3421	5.3001	1.3001	0.9580	1.3526
5	4.5005	4.7011	5.2004	0.6999	0.4993	1.4017

Average:

$$n = 1.39$$

Table (5) Determination of the viscosity coefficient of Dam water before purification:

No	r / m	d / m	t / s	$V = d / t$	$\eta = \frac{2}{9} gr^2 \frac{\rho - \sigma}{v}$
1	0.00541	0.5	0.81	0.617	0.702
2	0.00637	0.5	0.80	0.625	0.961
3	0.00612	0.5	0.82	0.609	0.9107
4	0.00588	0.5	0.77	0.649	0.7889
5	0.00516	0.5	0.73	0.6684	0.733

Average:

$$\eta = 0.819$$

Table (6) Determination of the viscosity coefficient of Dam water after purification:

NO	r / m	d / m	t / s	V = d / t	$\eta = \frac{2}{9} gr^2 \frac{\rho - \sigma}{v}$
1	0.00541	0.5	0.77	0.649	0.667
2	0.00588	0.5	0.80	0.625	0.819
3	0.00612	0.5	0.81	0.617	0.8985
4	0.00550	0.5	0.81	0.617	0.7257
5	0.00516	0.5	0.77	0.699	0.6072

Average:

$\eta = 0.743$

8. Discussion:

I took a sample of Dam water from the Um Hashem area and studied some of its physical properties, including the index of refraction, the coefficient of surface tension, and the coefficient of viscosity.From Table (1), the refractive

index value of water was calculated before purification using a mobile microscope It was found that the average refractive index is 1.63, and this value is far from the known value of the refractive index of water, which is 1.33The reason is the amount of impurities and silt dissolved in the water. After the purification process, it became average. The index of refraction is 1.39, according to the readings in Table (2), and this value is close to the value. The known index of refraction of water is because the percentage of impurities and silt in the water decreased greatly after the process Purification. At a temperature of $27C^{\circ}$, the value of the viscosity coefficient was measured by falling balls, and the average viscosity coefficient was equal to 0.819 (N.s)⁄m, according to the readings. In Table (3), after the water passes through the purification stages. The viscosity coefficient became 0.743 (N.s)⁄m, according to the readings in Table (4). This means The viscosity of the water has decreased slightly due to the removal of silt and impurities. Finally, the value of the surface tension coefficient was calculated using capillary tubes and the average values were found
57.4N⁄m according to the readings in Table (5) before purification.
The average became 73.54 N⁄m. This is according to the readings in Table (6) after purification. From these results we notice that the refractive index for water is directly proportional to the coefficient Viscosity and inversely with the coefficient of surface tension.

9. Conclusion:

This research dealt with the purification of dam water and the study of its physical properties. This research compared the results before and after purification for some physical properties, namely refractive index, surface tension, and viscosity. A sample was obtained from Dam village of Um Hashim, Shikan locality, North Kordofan, and the results proved the obtained results. The index of refraction is directly proportional to the coefficient of viscosity and inversely proportional to the coefficient of surface tension, and this indicates that dam water has become of a high degree of purity.

10. Recommendations:

1- Building a concrete tank to get rid of the problem of rust resulting from the oxidation of iron, which changes the physical properties of water and other properties. Also, using concrete instead of iron greatly increases the life of the tank.

2- Conduct further studies of the physical properties of water.

Reverence:

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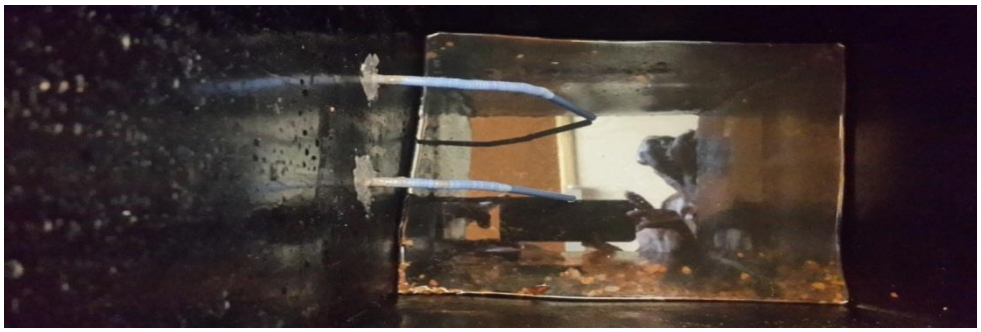
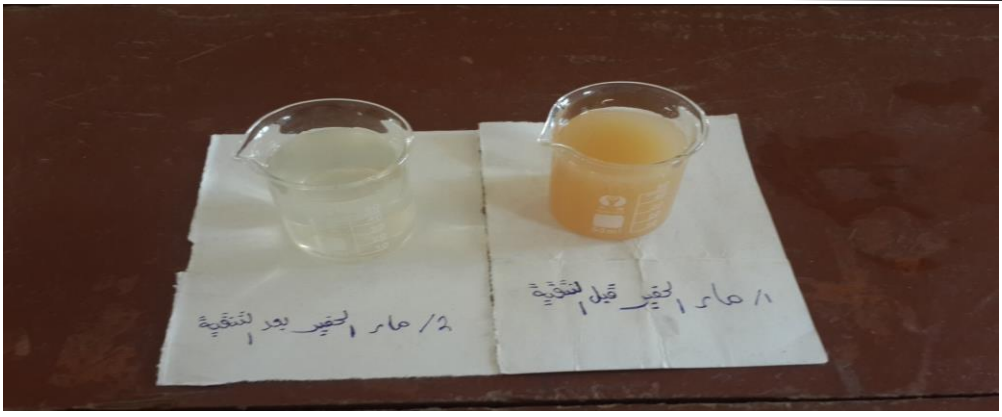
Appendix

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