Effect of sand, zeolite, and ash husk filters, and the filtration period, in reducing the salinity of well water

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ABSTRACT

A laboratory experiment was conducted on five Groundwater Wells from Al-Zubair district with primary electrical conductivity of (5.2, 8.3, 13.3, 16.9, and 22.7 $dS.m^{-1}$), and modified to (4, 8, 12, 16, and 20 $dS.m^{-1}$). It was then passed on three types of filters which are rice husk ash and sand with mixing ratio of (25%, 50% and 75%), zeolite and sand filter with mixing ratio of (25%, 50% and 75%) and zeolite filter and rice husk ash with a mixing ratio (1: 0.25 and 1: 0.5 and 1: 1). The water was then passed during four time periods (direct, 15, 30, and 60 min). The electrical conductivity of the water ECiw was measured after being passed through filters and at time periods. The results showed the role of different filters in reducing the values of electrical conductivity for well water according to different filtration time periods, where the type of filter had a significant effect in reducing the electrical conductivity of well water. The zeolite filter mixed with the ash of rice husk at a mixing ratio (1: 1) has excelled by giving it the lowest electrical conductivity, while the zeolite filter mixed with sand at a mixing ratio of 3: 1 recorded the highest electrical conductivity compared to the original sample of well water. The direct passage of water gave the lowest values compared to other time periods (15, 30, and 60 min).

Keywords: sand filter, zeolite, rice husk ash, well water salinity.

1. INTRODUCTION

Groundwater is considered one of the most important water resources in Iraq, especially in southern Iraq, and the concentration of salts in groundwater has increased in recent times, which required using many treatments to solve the problem of salinity and reuse it for irrigation purposes (Al-Ansari, 2013). The use of plant residues, mineral and organic materials have a role in treating salty water and reusing it for irrigation. Liu et al., (2000) demonstrated the role of the sand filter in the formation of the biofilm on its surfaces, which has a high capacity for biodegradation of organic matter in water, which reached the removal of BOD, COD and TOC to the limits of 95%. Widrig et al., (1996) also mentioned the ability of the sand filter to remove total suspended solids (TSS) of at least 90%. The first attempt to treat water with natural substances containing the mineral zeolite (Mx / n [(AlO_2) x (SiO_2) y]. MH_2O was applied in the nineteenth century. This was the first practical application of using zeolite in water treatment due to the ion exchange property of zeolite (Breck, 1974). Erdem et al., (2004) observed that the mineral zeolite has a positive effect on the environment through wastewater purification. Jakkula, (2005) showed that zeolite has a role in treating wastewater and drinking water, removing radioactive isotopes from agricultural water, and removing ammonium from wastewater. Zeolite mineral was also used as a soil reformer, a treatment agent for wastewater, controlling heavy elements, and as a filter for water due to its low weight and low density due to a large number of cavities within its crystalline structure, which increases its efficiency in treating water and soils treated with it (Cabanilla et al., 2016). Rice husks are considered agricultural wastes that are available in large quantities in rice milling factories, and when they are burned, ash forms, which are an adsorbent of many ions and an effective agent in water treatment (Feng et al., 2004). Daffalla et al., (2010) indicated that the active groups present on the surface of the ashes of the rice husks produced from the crafts under the temperatures of 600°C (Si-OH, C-OH, -OH, C-H) are associated with the phenolic compounds in aqueous solutions and work to remove them. Shamasdeen and Al-Kaderry, (2004) observed that the ash of rice husks contains active groups on the surface of the ash, and treating soil and water with it reduces water pollution and reduces its salinity. Koupai and Esfahani, (2012) observed that using rice husk ash with a ratio of (10 and 20%), a sand filter, and irrigation water at electrical conductivity of (12 $dS.m^{-1}$) led to a significant reduction in the chemical components of the irrigation water. Radi, (2014) also found that the highest reduction efficiency in the electrical conductivity value of the rice husk ash filter at a burning temperature of 1000°C was 99.45%.Al-Hakim (2016) showed the efficiency of the rice husk ash filter in reducing water hardness in the wells of Al-Zubayr, Al-Barjisia and Safwan with percentage amounted to (90.98%, 91.72%, and 89.36%), respectively. The results of Salman (2017) also showed the efficiency of the rice husk ash filter in reducing the turbidity and total hardness values of drainage water at electrical conductivity of (60 $dS.m^{-1}$), with a percentage of reduction amounted to (92.11% and 90.83%), respectively. Due to the high salinity of well water in Basra province and its effect on the growth and productivity of many crops, Therefore, the study was conducted to demonstrate the effect of the efficiency of rice husk ash and zeolite mineral with sand filter in reducing well water salinity and improving its quality.

2. MATERIALS AND METHODS

The study included conducting a laboratory experiment to study the possibility of reclaiming saline wells water in Basra, where water samples were brought from five wells in Al-Zubair district, Al-Raha area, and Al-Mashrue has electrical conductivity of (5.2, 8.3, 13.3, 16.9, and 22.7 $dS.m^{-1}$) which modified to (4, 8, 12, 16, and 20 $dS.m^{-1}$). The water samples were collected and kept in plastic containers in the refrigerator at a temperature of 4 °C to avoid the occurrence of biological changes in them until the required analyzes are conducted. The experiment included the use of the following factors: -

1- Five different saline levels of well water (4, 8, 12, 16 and 20 $dS.m^{-1}$)
2- Mixing ratios between ash of rice husks and sand (25%, 50%, and 75%) for making filters
3- Mixing ratios between zeolite and sand (25%, 50%, and 75%) for making filters.
4- Mixing ratios between zeolite and ash of rice husks (0.25: 1, 0.5: 1, and 1: 1) to make the filters.
5- The time period for passing the salt water through the filters (direct, 15, 30, 60 min).

The water was passed according to the salinity levels on the above filters according to the used time periods, the electrical conductivity (E.Ciw) and its chemical composition were then measured with the determination of its quality according to international and Iraqi standards for irrigation purposes.

Preparation of filters used in well water treatment

Three types of filters were used to reclaim water wells according to the following:

The filter of rice husk ash mixed with sand

Raw Rice Husk (Amber cultivar) (Oriza Sativa L) was collected from agricultural fields in Al-Shamiya District, Qadisiyah province. The impurities, as well as the soil, were removed after cleaning and washing with distilled water. The samples were air dried, and they were then burned in the Muffle Furnace at a temperature of 1000 °C for 3 hours to obtain Rice Husk ASH (RHA). Plastic tubes with a diameter of 7.5 cm and a height of 20 cm were chosen, ending with a conical end connected to a valve to control the time of water descent from these tubes, and putting glass wool at the bottom of the tubes to prevent ash from escaping from them. The volume of ash and sand in this filter was 450 cm3 according to the mixing ratios of ash husk and sand (25%, 50% and 75%) from the weight of sand, 25 g of rice husks ash and 75 g of sand and the amount of water filtered each time 300 cm^3. Four different time periods were used to keep the sample on the filter, which are direct filtration and filtration after 15, 30 and 60 min, and after the specified time period had passed from placing the water sample in the filter, the valve was opened to receive the treated water. The water was collected in sealed plastic container until the necessary analyzes were conducted. The ash filter configuration was adopted according the method used by (Radi, 2014).

Sand-mixed zeolite filter

It was adopted the same method as for the filter of the rice husk ash and sand.

Mixing filter (rice husk ash mixed with zeolite)

The same method used in the filter ash of rice husk mixed with sand was also adopt. The electrical conductivity of the water samples was measured using a Lovibond Con200 EC meter

Some general properties of rice husk ash and zeolite

1- **The percentage of ash in the rice husks**

The percentage of ash in the rice husks was estimated after taking a known weight from the husks and burning them in the incineration apparatus at a temperature of 1000 °C, it was then left to cool down and recorded the weight after burning, the percentage ash was calculated as shown in Table (1).

Table 1: Physical and chemical properties for burnt rice husk ash at 1000 °C.

Diameter range (mm)	**Percentage for gradation of particles diameters of rice husks**	**Surface area ($g.cm^{-2}$)**	**The percentage of ash (%)**
0.1-0.01	0	0.194	27.61
0.1-1.0	0.52	Bulk density ($g.cm^{-3}$)	Apparent density ($g.cm^{-3}$)
1.0-10.0	10.63	2.31	0.79
10.100	40.54	Ec ($dS.m^{-1}$)	pH
100-1000	51.69	6.14	7.92

2- **Surface area and particle size for rice husk ash and zeolite.**

The surface area of rice husk ash and zeolite and the size distribution of ash and zeolites particles were estimated using a Mastersizer Particle Size Analyzer (PSA) type MS2000 in the laboratories of the Geological Survey Department / Ministry of Industry Table (1 and 2).

Table 2: The physical and chemical properties of the zeolites used in the study.

Diameter range (mm)	**Percentage for gradation of particles diameters of rice husks**	**Surface area ($g.cm^{-2}$)**	**Cation exchange capacity ($cmol.kg^{-1}$)**
0.1-0.01	0	0.136	122.31
0.1-1.0	0.96	Bulk density ($g.cm^{-3}$)	Apparent density ($g.cm^{-3}$)
1.0-10.0	8.5	2.69	1.04
10.100	39.4	Ec ($dS.m^{-1}$)	pH
100-1000	51.14	0.51	7.02

3- The apparent density and bulk density of rice husk ash and zeolite

The apparent and bulk density of rice husk ash and zeolite were estimated as described in (Black et al., 1965) oxides, carbon, and other organic materials in rice husk ash and zeolite. The concentration of silica oxides and the oxides of the mineral and base elements of rice husk ash and zeolite were estimated using the X-Ray Fluorescence device (Spectro-Xepos.Germany) in the Iraqi-German laboratory at the University of Baghdad as shown in Table (3).

Table 3: Concentration of oxides, carbon, and other organic materials in rice husk ash and zeolite.

Content (%)	SiO_2%	Fe_2O_3%	Al_2O_3%	CaO%	MgO %	Na_2O %	K_2O %	Carbon and other materials
Rice husk ash	90.13	0.41	1.03	2.61	1.14	0.26	3.07	1.35
Zeolite	38.61	13.76	11.98	11.47	3.26	2.47	1.25	17.2

3. RESULTS AND DISCUSSION

Table (4) shows the role of the different filters in reducing the values of electrical conductivity for well water according to the different filtration time periods, where the type of filter had a significant effect in reducing the electrical conductivity of wells water. The filter of zeolite mixed with the ash of rice husks at mixing ratio (1: 1) has excelled recording it the lowest electrical conductivity amounted to (0.5 $dS.m^{-1}$) and with a percentage of reduction amounted to (87.50%). While the filter of zeolite mixed with the sand at a mixing ratio of 3: 1, recorded the highest electrical conductivity amounted to (2.68 $dS.m^{-1}$) and a percentage of reduction amounted to (33.00%) compared to the original sample of well water. When ranking the filters according to their lowering of the values of electrical conductivity will be as the following order:

Rice husk ash mixed with zeolite (1: 1) <rice husk ash mixed with zeolite (1: 3) <rice husk ash mixed with zeolite (3: 1) <rice husk ash mixed with sand (1: 3) <zeolite mixed With sand (1: 3) <zeolite mixed with sand (1: 1) <zeolite mixed with sand (1: 1) <sand mixed rice husk ash (3: 1) <zeolite mixed with sand (3: 1).

As for the time, it is noticed that there is a control for the filtering time factor in the values of electrical conductivity, where the electrical conductivity increased with the advancement of the filtration time from 0.94 $dS.m^{-1}$, with a percentage of reduction amounted to (76.50%) at direct filtration to 1.64 $dS.m^{-}$

^{1} at a time of 60 min, with a percentage of reduction amounted to (59.00%). This may be normal, where the mineral and organic filter (zeolite and ash of rice husks) have certain limits in absorbing dissolved ions, after which the electrical conductivity begins to increase. It is noticed from the results that the interaction between the filters and the filtration time had a significant effect on the values of electrical conductivity for the water after filtration, where the interaction between direct filtration (zero time) and the filter of zeolite mixed with rice husk ash at a mixing ratio of (1: 1) recorded a value amounted to (0.34 dS.m^{-1}) while the interaction between 60 min filtration and the filter of zeolite mixed with sand at a mixing ratio of (3: 1) recorded the highest value amounted to (3.23 dS.m^{-1}), with a percentage of reduction amounted to (91.5% and 19.25%), respectively. The apparent difference between the different filters is due to the difference in the mineral and organic composition of the filters, which was reflected in the nature of the interaction between the filter materials used in the experiment and the water passing through it, where the filters operate with different mechanisms that enable them to achieve lower percentages for the concentrations of positive and negative ions from the water. The results of the current study showed an effective role for the filter of zeolite mixed with the ash of the rice husk at a mixing ratio (1: 1). The reason is due to the combined effect for the materials used in the filter and to the different mechanisms by which these materials work in reducing the dissolved ions that cause salinity, in addition to the increase in the size of ash and its mixing with zeolite compared to the filters that contain sand within their components leads to an increase in the thickness of the ash layer that is in contact With treated drainage water, which means an increase in the number of pores, thus gives a great opportunity to trap the dissolved ions that make up the salinity, where the ash burned at high temperatures 1000 °C leads to the possession of the ash particles very small diameters, which means that it has a high surface porosity and a large number of pores, thus providing an opportunity for the treated water to penetrate into the ash body, the crystal structure and direct contact with the inner surface. Xiong et al., (2009) and Imyim and Eakachai, (2010) showed that improving the surface area and high porosity of rice husk ash, especially when burning at a temperature higher than 700 C, increases the chance of filtered water penetration within the ash structure, the crystal structure, and direct contact with the internal surfaces of the filters, these results agree with (Radhi, 2014; Al-Hakim, 2016).

Table 4: the values of electrical conductivity for wells water with initial conductivity of (4 dS.m^{-1}) after treating with filters

Type of filters	**Filtration time (min)**				**Average of filtered water**
	Direct	**15**	**30**	**60**	
Zeolite + sand (3: 1)	2.08	2.58	2.82	3.23	2.68
Zeolite + sand (1: 1)	1.01	1.44	1.57	1.82	1.46

Zeolite + sand (1: 3)	0.98	1.46	1.58	1.73	1.44
Rice husk ash + sand (3: 1)	1.57	1.59	1.92	3.18	2.07
Rice husk ash + sand (1: 1)	0.78	0.89	1.05	1.23	0.99
Rice husk ash + sand (1: 3)	0.52	0.59	0.78	0.98	0.72
Zeolite + ash of rice husk (3: 1)	0.68	0.73	0.83	0.93	0.79
Zeolite + ash of rice husk (1: 1)	0.34	0.44	0.55	0.69	0.50
Zeolite + ash of rice husk (1: 3)	0.51	0.56	0.78	0.98	0.71
Time	0.94	1.14	1.32	1.64	
$LSD_{0.05}$					
Type of the filtered	**Time**				**Time × type of the filtered**
0.0064	0.0043				0.0129

Table (5) indicates that the filter of zeolite mixed with the ash of the rice husk at a mixing ratio (1: 1) had a significant effect in reducing the electrical conductivity of the filtered well water from (8 $dS.m^{-1}$) to (0.57 $dS.m^{-1}$), with a percentage of reduction amounted to (92.84). As for the filter of zeolite mixed with sand at a mixing ratio (3: 1) recorded the lowest percentage of reduction amounted to (39.75%), where the electrical conductivity value amounted to (4.27 $dS.m^{-1}$), this is considered a good percentage compared to the original value of well water. As for the time factor, it had a significant effect on the values of electrical conductivity when salinity increase to (8 $dS.m^{-1}$). The zero filtration time recorded the highest reduction of conductivity, amounted to (1.59 $dS.m^{-1}$), with a percentage of reduction amounted to 78.73%, compared to the highest value of electrical conductivity recorded by the filtration treatment after 60 min, which amounted to (3.18 $dS.m^{-1}$), with a percentage of reduction amounted to 58.11%. As for the Interaction between the type of filter and the filtration time, it had a significant effect in reducing the electrical conductivity of wells water, with electrical conductivity amounted to (8 dS.m-1), where this conductivity decreased to (0.35 dS.m-1) at the interaction between direct filtration and a filter zeolite mixed with the ashes of rice husks at a mixing ratio (1: 1) which amounted to (95.63%), and the highest values of electrical conductivity were when the water passed through the filter of zeolite and sand at a mixing ratio (3: 1) which amounted to (6.84 dS.m-1) after 60 min of filtration, with a percentage of reduction amounted to (14. 50%). These results agree with (Radhi, 2014; Al-Hakim, 2016; Salman, 2017; Al-Aqili, 2017).

Table 5: the values of electrical conductivity for wells water with initial conductivity of (8 $dS.m^{-1}$) after treating with filters

Type of filters	Filtration time (min)				Average of filtered water
	Direct	15	30	60	
Zeolite + sand (3: 1)	3.61	3.91	4.92	6.84	4.27
Zeolite + sand (1: 1)	2.90	3.14	3.42	5.08	3.39
Zeolite + sand (1: 3)	1.27	1.45	2.40	3.18	2.55

Rice husk ash + sand (3: 1)	2.91	3.11	3.92	5.84	4.27
Rice husk ash + sand (1: 1)	1.84	2.08	2.97	3.72	3.18
Rice husk ash + sand (1: 3)	0.87	0.90	1.20	2.03	1.25
Zeolite + ash of rice husk (3: 1)	0.74	0.76	0.91	1.07	0.92
Zeolite + ash of rice husk (1: 1)	0.35	0.40	0.62	0.92	0.57
Zeolite + ash of rice husk (1: 3)	0.82	0.86	1.01	1.48	1.00
Time	1.92	2.07	2.33	3.18	
$LSD_{0.05}$					
Type of the filtered	**Time**				**Time × type of the filtered**
0.0231	0.0154				0.0462

Table (6) shows that the type of filter had an effect on the values of electrical conductivity, where the filter of zeolite mixed with the ash of rice husk at a mixing ratio (1: 1) has excelled by giving it a value amounted to (0.92 $dS.m^{-1}$), which approximately similar to the value was recorded by the filter of zeolite with the ash of the rice husk at mixing ratio (3: 1) which amounted to (0.96 $dS.m^{-1}$), with a percentage of reduction amounted to (92.33 and 92.00%), respectively. The direct time factor has excelled in reducing the values of electrical conductivity on the rest of the experiment factors when using water wells with primary electrical conductivity amounted to (12 $dS.m^{-1}$), Where there was an increase in the value of electrical conductivity with the increase of the filtering time from the direct filtering (zero time) to 60 min, where an electrical conductivity gave values amounted to (2.09, 2.23, 2.84 and 3.50 $dS.m^{-1}$) for all factors (direct, 15, 30 and 60 min), respectively with high significant differences at (0.05) level between all treatments. The effect of the interaction between the type of filter and the filtration time has significantly affected in reducing the values of electrical conductivity for the well water, where the electrical conductivity decreased from (12 $dS.m^{-1}$) to (0.53 $dS.m^{-1}$) when filtration directly with a filter of zeolite mixed with the ash of the rice husks at a mixing ratio (1: 1) and with a percentage of reduction amounted to (95.58%), the highest values of electrical conductivity were at the interaction between the filter zeolite mixed with sand at a mixing ratio (3: 1) and filtration time of 60 min, which amounted to (7.63 $dS.m^{-1}$), with a percentage of reduction amounted to (36.42%). The reason is due to the efficiency of the filter of rice husk ash when burning it at high temperatures 1000 °C which contributes to increasing the number of pores and the specific surface area in the ash in addition to the presence of zeolite, which has many characteristics that have an important role in reducing electrical conductivity, including the characteristic of high adsorption and selectivity, ability to absorb and lose water, and high exchange capacity, which is very suitable in the field of natural water treatment and polluted water. All these traits are due to its high porosity and fine sieves that were provided in zeolites due to the presence of mutual positive ions and the precise dimensions of internal channels and caves. These results agree with (2014).

Table 6: the values of electrical conductivity for wells water with initial conductivity of (12 $dS.m^{-1}$) after treating with filters

Type of filters	**Filtration time (min)**				**Average of filtered water**
	Direct	**15**	**30**	**60**	
Zeolite + sand (3: 1)	4.44	4.92	5.81	7.63	5.70
Zeolite + sand (1: 1)	4.23	4.84	4.89	5.17	4.78
Zeolite + sand (1: 3)	2.75	2.50	3.50	3.92	3.17
Rice husk ash + sand (3: 1)	4.20	4.36	4.82	5.48	4.71
Rice husk ash + sand (1: 1)	0.68	0.72	1.52	2.75	1.41
Rice husk ash + sand (1: 3)	0.65	0.72	1. 23	1.97	1.14
Zeolite + ash of rice husk (3: 1)	0.55	0.60	1.14	1.53	0.96
Zeolite + ash of rice husk (1: 1)	0.53	0.57	1.12	1.47	0.92
Zeolite + ash of rice husk (1: 3)	0.78	0.82	1.23	1.87	1.18
Time	2.09	2.23	2.84	3.50	
$LSD_{0.05}$					
Type of the filtered	**Time**				**Time × type of the filtered**
0.0733	0.0488				0.1466

Table (7) shows that the type of filter had an effect on the values of electrical conductivity, where the filter of zeolite mixed with the ash of rice husk at a mixing ratio (1: 1) has excelled on the rest of the types of filters in reducing the electrical conductivity value, which amounted to (1.89 $dS.m^{-1}$), with a percentage of reduction amounted to (88.17%), while the filter of zeolite mixed with sand (3: 1) gave the highest value of electrical conductivity which amounted to (9.15 $dS.m^{-1}$), with a percentage of reduction amounted to (42.80%), When ranking the filters according to their lowering the values of electrical conductivity will be as the following order:

Zeolite mixed with rice husk ash (1: 1) <zeolite mixed with rice husk ash (3: 1) <rice husk ash mixed with sand (1: 3) <zeolite mixed with rice husk ash (1: 3) <husk ash Sand mixed rice (1: 1) <zeolite mixed with sand (1: 3) <zeolite mixed with sand (1: 1) <sand mixed rice husk ash (3: 1) <zeolite mixed with sand (3: 1).

It is noticed that there are significant differences at the level of 0.05 between the filtration times for wells water with initial electrical conductivity of (16 $dS.m^{-1}$), where the electrical conductivity increased with the advancement of the filtration time from (3.20 $dS.m^{-1}$), with a percentage of reduction amounted to (79.98%) at direct filtration to (6.56 $dS.m^{-1}$) at 60 min, with a percentage of reduction amounted to (58.97%). It is also noticed that there are significant differences at the 0.05 level for the interaction treatments between the filtration time and the type of filters as shown in Table (4) in which the interaction treatment between zero time (direct) and the filter of zeolite mixed with rice husk ash (1: 1) achieved a significant superiority compared to all the other factors, where the maximum decrease in the values of electrical conductivity were recorded, which amounted to (0.61 $dS.m^{-1}$), While the interaction between the filtration time (60 min) and the filter of zeolite mixed with sand (3: 1) recorded the highest value of electrical conductivity amounted to (10.95 $dS.m^{-1}$), with a percentage of reduction amounted to (96.19% and 31.56%), respectively.

Table 7: the values of electrical conductivity for wells water with initial conductivity of (16 $dS.m^{-1}$) after treating with filters

Type of filters	**Filtration time (min)**				**Average of filtered water**
	Direct	**15**	**30**	**60**	
Zeolite + sand (3: 1)	7.62	8.41	9.63	10.95	9.15
Zeolite + sand (1: 1)	5.11	5.86	7.19	8.47	6.66
Zeolite + sand (1: 3)	1.39	2.16	3.76	4.93	3.06
Rice husk ash + sand (3: 1)	7.34	8.03	9.51	10.84	8.93
Rice husk ash + sand (1: 1)	3.39	4.11	5.42	6.41	4.83
Rice husk ash + sand (1: 3)	1.27	1.97	3.28	4.89	2.85
Zeolite + ash of rice husk (3: 1)	0.98	1.21	3.13	4.39	2.43
Zeolite + ash of rice husk (1: 1)	0.61	1.26	2.28	3.42	1.89
Zeolite + ash of rice husk (1: 3)	1.11	1.94	3.24	4.78	2.77
Time	3.20	3.88	5.27	6.56	
$LSD_{0.05}$					
Type of the filtered	**Time**				**Time × type of the filtered**
0.0132	0.0088				0.0265

Table (8) shows that the type of filter had a significant effect on the values of electrical conductivity, where the filter of zeolite mixed with the ash of the rice husks at a mixing ratio (1: 1) gave the lowest value of the electrical conductivity, which amounted to (1.96 $dS.m^{-1}$), while the filter of zeolite mixed with sand (3: 1) gave the highest value of electrical conductivity, which amounted to (11.09 $dS.m^{-1}$), with a percentage of reduction amounted to (90.21% and 44.55%) respectively. The reason for the efficiency of the rice husks ashes and zeolites is that the increase in the size of ash and zeolites leads to an increase in the thickness of the ash layer that is in contact with the treated wastewater, thus increasing the number of pores in addition to the trait of the sponge composition that the ash possesses, which gives it the ability to retain the largest number of positive and negative ions inside The voids in the spongy composition of silica in addition to the physical structure of zeolites are porous and contain internally bound voids that hold the cations. Table (8) shows that the direct time factor in reducing the values of electrical conductivity is greater than the rest of the experiment factors when using well water with electrical conductivity (20 $dS.m^{-1}$), where there was a decrease in the value of electrical conductivity with a decrease in the filtration time from 60 min to the direct time from 7.81 to 3.98 $dS.m^{-1}$, with percentage of reduction efficiencies amounted to (60.95% and 80.10%), respectively. As for the bi-interaction treatments, the filtering time factor and the type of filters had significant differences, where the treatment of direct filtration time and the filter of zeolite mixed with rice husk ash, at a mixing ratio (1: 1), which their value amounted to (0.61 $dS.m^{-1}$), was followed by the rest of the study factors, with a percentage of reduction efficiency amounted to (96.95%). While the interaction treatment between the filtration time (60 min) and the filter of zeolite mixed with sand (3: 1) gave a value amounted to 13.28 dS.m-1), with a percentage of reduction efficiency amounted to (44.55%), When ranking the filters according to their lowering the values of electrical conductivity will be as the following order:

Zeolite mixed with rice husk ash (1: 1) <zeolite mixed with rice husk ash (1: 3) <zeolite mixed with rice husk ash (3: 1) <rice husk ash mixed with sand (1: 3) <husk ash Sand mixed rice (1: 1) <zeolite mixed with sand (1: 3) <zeolite mixed with sand (1: 1) <sand mixed rice husk ash (3: 1) <zeolite mixed with sand (3: 1).

Table 8: the values of electrical conductivity for wells water with initial conductivity of (20 $dS.m^{-1}$) after treating with filters

Type of filters	**Filtration time (min)**				**Average of filtered water**
	Direct	**15**	**30**	**60**	
Zeolite + sand (3: 1)	8.96	10.17	11.95	13.28	11.09
Zeolite + sand (1: 1)	6.88	7.83	9.64	11.18	8.88
Zeolite + sand (1: 3)	1.48	2.27	3.83	5.73	3.33
Rice husk ash + sand (3: 1)	8.52	9.63	11.42	13.19	10.69
Rice husk ash + sand (1: 1)	5.83	6.31	9.01	10.27	7.86
Rice husk ash + sand (1: 3)	1.27	1.83	3.03	4.51	2.66
Zeolite + ash of rice husk (3: 1)	1.06	1.21	2.72	4.01	2.25
Zeolite + ash of rice husk (1: 1)	0.61	0.87	2.34	4.01	1.96
Zeolite + ash of rice husk (1: 3)	1.21	1.67	2.87	4.11	2.47
Time	3.98	4.64	6.31	7.81	
$LSD_{0.05}$					
Type of the filtered	**Time**				**Time × type of the filtered**
0.712	0.475				1.424

CONCLUSIONS

The filter of rice husk ash mixed with zeolite has recorded the highest efficiency in reducing the salinity of well water, especially when passing through it directly, and the efficiency of reducing salinity decreases with the increase of the time period.

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