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Effect of Pottery Jar on Water Quality

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Abstract: For this study, water from four water sources was collected. Physical and chemical properties estimated were total dissolved solid, electrical conductivity, K^{+1}, Na^{+1}, TH, Ca^{+2}, Mg^{+2}, Cl^{-1}, pH, dissolved oxygen in water and turbidity. A comparison was made between the raw water of the four samples and the hours of water preservation in pottery jars up to six hours on these parameters. The study showed that Iranian pottery jar had a preference over its Iraqi counterpart in improving the quality and purity of water. The concentrations of water parameters within the jar after three hours of retention does not change their quality even when adding water that equivalent 75% of the capacity of the pottery jar. The concentrations of parameters at the infiltrated water of pottery jars for all types of water were much greater than that registered in the water reserved inside the jars. The only desalination water sample was within the limits of drinking water specifications for all parameters.

Keywords: Pottery jar, Water reservation, Water quality

River water, groundwater, and waterfalls were the only drinking water source not so long ago, but due to pollution factors become unsuitable for direct use, so people resorted to desalination of salt water and purifications plants, and the use of multiple household filters to improve the water quality. With the continuing study of water quality, especially for drinking, this was observed that even water supposed to be suitable for drinking are basically not meeting all the requirements for the quality of clean and healthy drinking water. The water lacks the minimum levels of salts and magnesium, that cause an increase the incidence of heart disease (Contruvo 2006, WHO 2011). Another study confirms that the total hardness concentrations are always low in desalination water (Chen et al 2015). Several studies also indicate that total hardness has an inverse relationship with heart disease and blood circulatory diseases (Nebrand et al 2003, Kousa et al 2004). Therefore, the minimum limits for salts in drinking water should be specified, this is in terms of the lack of salts necessary for the human body and on the other hand, although desalination, filtering, bottled and filtered water achieve the permissible limits for drinking water at parameters of salts, turbidity, color, taste, smile, and minerals, however very important parameters are always overlooked, dissolved oxygen in water and pH. The use of pottery jars in drinking may be one of option for better water quality. Therefore study was conducted to evaluate the effect of using pottery jars in improving water quality, especially the properties of dissolved oxygen and pH.

MATERIAL AND METHODS

Water samples were collected from four different source viz. desalination water from the desalination plants (using Reverse Osmosis method (RO), water of Badaa taken from the tap and Tigris River through the purification plant at some areas of Basra, as well as the Euphrates water taken from the tap and its source from the Euphrates River through the purification plant at areas north of Basrah and finally the water of Shatt al-Arab taken from the tap and its source from the Shatt al-Arab river through the water purification plant. The samples were kept in clean, airtight plastic containers and three replicates per sample. The sampling method and estimation of some physical and chemical properties of the study samples was adopted as described in APHA et al (2005) which were electrical conductivity (Ec), pH, turbidity (Turb), total dissolved solid (TDS), dissolved oxygen in water (DO), total hardness (TH), calcium (Ca), magnesium (Mg), sodium (Na), chlorine (CL), and potassium (K).The parameters for different water samples was measured in raw water (before water was placed in the jar), as well as after water was placed in the pottery jar, which continued the period six hour. The parameters measurements were taken at each hour and compared with raw water measurements for studied water types. Infiltrated water measurements were also taken from the pottery jars of each water source after being assembled in metal vessels. Statistical analysis was done using SPSS V.19 (Amin 2007).

RESULTS AND DISCUSSION

Effect of Time Periods Changes in Water Quality During the Water Reservation In Pottery Jars

pH: There was no significant difference in pH between

Badaa, Euphrates and Shatt. The desalination water (RO) recorded a significant difference between other three types. There were no statistical differences between the hours of water retention in pottery and raw water at the three samples. The pottery jar recorded a significant difference and succeeded in converting the quality of desalination water (RO) from acidity to alkali (6.68-8.4). Badaa, Euphrates and Shatt were fundamentally alkaline where difference is less than desalination water (RO) (0.07, 0.08, and 0.14 respectively). The change in rising at desalination water (RO) and Al-Badaa water stopped at three hours, while in the Euphrates and Shatt water samples, the change in rising stopped after only two hours. The relationship curve between this parameter and the water retention hours in the pottery jar for the four types has been upward, starting with raw water, and there was no decreasing until the rise stopped. The four types of water samples after hours of water retention in the pottery jar have achieved the specifications of the drinking water of Iraq, the United States and the World Health Organization, and the sample of desalination water (RO) was the best, where it has shifted from the lowest to the highest pH.

Total dissolved solids (TDS): There were significant differences between the four types of water, while there were no significant differences between the hours of water retention in the pottery jar and the raw water of the three types (Badaa, Euphrates, Shatt al-Arab). Desalination water recorded statistical differences between the hours of water retention in the pottery jar and raw water, where the salinity of the water increased from 30 $mg.L^{-1}$ at raw water to 80 $mg.L^{-1}$ after three hours of retention in the pottery jar, except for the desalination water, which was low salinity, the water recorded only a slight increase between raw water in the first three hours of water retention at this parameter. The curve of the relationship between this parameter and the hours of retention in the pottery jar recorded an increased in concentrations of this parameter compared to raw water, and contrary to what was expected. All types recorded an increase in the first hour and then a slight decrease in the second hour and then another rise in third hour (GOWR 1999, COSQC 2001, WHO 2006 A , EPA 2012).

Electrical conductivity (EC): There were significant differences in EC between the four types of water, while no significant differences were recorded between the hours of water retention in the pottery jars and raw water at the three types of water (Badaa, Euphrates, Shatt al-Arab), except the desalination water recorded significant differences between the hours of water retention with raw water, where the concentration of raw desalination water reached 60 to 160 μs/cm after three hours of retention. All samples recorded an increase in the first hour at this parameter, followed by a slight decrease in the second hour, and at the third hour, again increased. The desalination water sample has met only the requirement of the specifications of Iraqi, American drinking water and the World Health Organization.

Turbidity (Turb): The statistical analysis showed that there were significant differences between the desalination water with the Shatt Al-Arab water and the water of Badaa with the Shatt Al-Arab water and between the Euphrates water with the Shatt Al-Arab water. The water quality of the desalination indicates that Badaa and the Euphrates did not record any significant differences between them. There were no significant differences between hours of water retention in pottery jars and raw water in study samples. The results showed that the curve of the relationship between the concentration of this parameter and the hours of water retention in the pottery jars was towards the decrease in the concentrations of all studied types between raw water and the hours of preservation, and the decrease continued from the first hour until the third hour and then stopped and thereafter achieved stability in the concentration at all the studied types. The results showed that the desalination of Badaa and the Euphrates water preserved in the pottery jars were within the limits of the specifications of Iraqi and American drinking water and the World Health Organization.

Sodium (Na): There were statistical differences between the studied water types, but no significant differences were recorded between the hours of water retention and raw water in the studied types, except in the desalination water in which the concentration of this parameter increased from 12.5 at raw water to 23.7 $mg.L^{-1}$ after three hours retention. The curve of the relationship between the parameter and the hours of water retention in pottery jars of the studied water types recorded an increase in the first hour and then decreased slightly in the second hour, and finally increased again at the third hour. The concentration of the parameter stopped changing at the Euphrates and Shatt Al-Arab water after only two hours. The stopping of the desalination and Badaa water was after three hours. Only the desalination water after the period of water retention in the pottery jars was within the limits of the specifications of Iraqi and American drinking water and the World Health Organization.

Potassium (K): There were significant differences between studied water types and no significant difference was recorded between water retention hours with raw water for water types, except in the desalination water sample, where the concentration of this parameter increased from 0.5 at raw water to 2.5 $mg.L^{-1}$ after three hours. The relationship curve for this parameter with hours of water retention in pottery jars recorded an increase in the concentrations of this parameter.

Table 1. Concentrations of water types before and at hours of water reservation in pottery jars

Different water types	Time reservation	PH	T (^{0}C)	TDS mg L^{-1}	EC µs/cm	Turb NTU	Na mg.L^{-1}	K mg.L^{-1}	TH mg.L^{-1}	Ca mg.L^{-1}	Mgmg.L^{-1}	Cl mg.L^{-1}
Desalination Water Reverse osmosis (RO)	Raw Water	6.68	19.5	30	60	2.7	12.5	0.5	18	4.5	3.29	19.17
	First hour	6.8	19.5	70	140	2.29	23.3	3	33	10.5	5.49	31.95
	Second hours	6.9	19.5	60	120	2.11	18.9	2	27	6.75	4.94	25.56
	Third hours	8.4	19.5	80	160	1.85	23.7	2.5	35	12	6.00	32.4
	Fourth hours	8.4	19.6	80	160	1.85	23.7	2.5	35	12	6.00	32.4
	Fifth hours	8.4	19.6	80	160	1.85	23.7	2.5	35	12	6.00	32.4
	Sixth hours	8.4	19.7	80	160	1.85	23.7	2.5	35	12	6.00	32.4
	Mean$^{\#}$	7.20^{ab}	19.50	60^{ab}	120^{ab}	2.24^{ab}	19.60^{ab}	2.00^{ab}	28.25^{ab}	8.44^{ab}	4.93^{ab}	27.3^{ab}
	Infiltrated water	7.9	19.7	764	1660	5.7	212.3	7	125	53	17.57	139
Badaa Water (from Tigris	Raw Water	7.89	20.2	1041	2082	12.16	291	11	392	144	47.00	543
	First hour	7.93	20.2	1099	2198	5.48	342	18	446	163	52.50	614.5
	Second hours	7.95	20.2	1065	2130	4.54	324	15	407	152	50.20	575.1
	Third hours	7.96	20.3	1094	2188	4.25	331	16	432	167	53.40	586.2
	Fourth hours	7.96	20.4	1094	2188	4.25	331	16	432	167	53.40	586.2
	Fifth hours	7.96	20.4	1094	2188	4.25	331	16	432	167	53.40	586.2
	Sixth hours	7.96	20.4	1094	2188	4.25	331	16	432	167	53.40	586.2
	Mean$^{\#}$	7.93^{c}	20.23	1075^{c}	2150^{c}	6.61^{b}	322^{c}	15^{c}	419.25^{c}	156.5^{c}	50.78^{c}	580^{c}
	Infiltrated water	7.94	20.4	1512	3024	14.11	369	22	515	246	66.00	1125
Euphrates River	Raw Water	7.92	19.7	1812	3624	8.85	527	22.5	562	312	63.20	766.8
	First hour	7.97	19.7	1850	3700	4.33	537	24	602	331	71.30	802.3
	Second hours	8	19.7	1823	3646	3.63	532	23	583	319	67.40	791
	Third hours	8	19.7	1823	3646	2.4	532	23	583	319	67.40	791
	Fourth hours	8	19.5	1823	3646	2.4	532	23	583	319	67.40	791
	Fifth hours	8	19.5	1823	3646	2.4	532	23	583	319	67.40	791
	Sixth hours	8	19.5	1823	3646	2.4	532	23	583	319	67.40	791
	Mean$^{\#}$	7.97^{b}	19.70	1827^{b}	3654^{b}	4.80^{c}	532^{b}	23.13^{b}	582.5^{b}	320.25^{b}	67.33^{b}	788^{b}
	Infiltrated water	8.04	19.6	2273	4546	13.35	617	47	656	372	82.00	1543
Shatt Al - Arab Water	Raw Water	7.96	20.3	2200	4400	34.9	620	32	632	384	68.50	866.2
	First hour	8	20.3	2280	4560	19.6	695	38	703	417	75.60	880.4
	Second hours	8.1	20.3	2270	4540	17.7	643	33	668	401	72.00	874

Cont...

Table 1. Concentrations of water types before and at hours of water reservation in pottery jars

Different water types	Time reservation	PH	T (^{0}C)	TDS mg L^{-1}	EC µs/cm	Turb NTU	Na mg.L^{-1}	K mg.L^{-1}	TH mg.L^{-1}	Ca mg.L^{-1}	Mgmg.L^{-1}	Cl mg.L^{-1}
	Third hours	8.1	20.3	2270	4540	16.3	643	33	668	401	72.00	874
	Fourth hours	8.1	20.3	2270	4540	16.3	643	33	668	401	72.00	874
	Fifth hours	8.1	20.5	2270	4540	16.3	643	33	668	401	72.00	874
	Sixth hours	8.1	20.5	2270	4540	16.3	643	33	668	401	72.00	874
	Mean[#]	8.04[a]	20.3	2255[a]	4510[a]	22.12[a]	650[a]	34[a]	667.75[a]	400.75[a]	72.02[a]	874[a]
	Infiltrated water	8.21	20.5	2740	5480	47.3	798	61	785	491	93.00	1873
The least Significant difference At 0.05 Time Reservation	Raw-First hour	0.87± 0.368	-	0.94± 680	0.94± 1361	0.34± 6.7	0.85± 196	0.67± 9.6	0.83± 201	0.88± 124	0.80± 21.7	0.9± 269
	Raw-Second hour	0.74± 0.368	-	0.96± 680	0.96± 1361	0.28± 6.7	0.93± 196	0.86± 9.6	0.92± 201	0.95± 124	0.89± 21.7	0.95± 269
	Raw-Third hour	0.2± 0.368	-	0.95± 680	0.95± 1361	0.23± 6.7	0.92± 196	0.83± 9.6	0.89± 201	0.91± 124	0.85± 21.7	0.94± 269
	First hour-Second hour	0.87± 0.368	-	0.98± 680	0.98± 1361	0.89± 6.7	0.92± 196	0.8± 9.6	0.9± 201	0.93± 124	0.91± 21.7	0.95± 269
	First hour -Third hour	0.26± 0.368	-	0.99± 680	0.99± 1361	0.8± 6.7	0.93± 196	0.83± 9.6	0.94± 201	0.96± 124	0.95± 21.7	0.97± 269
	Second hour-Third hour	0.33± 0.368	-	0.99± 680	0.99± 1361	0.91± 6.7	0.99± 196	0.97± 9.6	0.97± 201	0.97± 124	0.96± 21.7	0.99± 269
Different water types	RO- Badaa	0.03± 0.287	-	0.00± 18.8	0.00± 37.6	0.23± 3.5	0.00± 13.8	0.00± 1.5	0.00± 14.8	0.00± 6.8	0.00± 1.9	0.00± 12.1
	RO- Euphrates	0.02± 0.287	-	0.00± 18.8	0.00± 37.6	0.47± 3.5	0.00± 13.8	0.00± 1.5	0.00 14.8	0.00± 6.8	0.00± 1.9	0.00± 12.1
	RO- Shatt al - Arab	0.01± 0.287	-	0.00± 18.8	0.00± 37.6	0.00± 3.5	0.00± 13.8	0.00± 1.5	0.00± 14.8	0.00± 6.8	0.00± 1.9	0.00± 12.1
	Badaa- Euphrates	0.89± 0.287	-	0.00± 18.8	0.00± 37.6	0.61± 3.5	0.00± 13.8	0.00± 1.5	0.00± 14.8	0.00± 6.8	0.00± 1.9	0.00± 12.1
	Badaa- Shatt al - Arab	0.72± 0.287	-	0.00± 18.8	0.00± 37.6	0.00± 3.5	0.00± 13.8	0.00± 1.5	0.00± 14.8	0.00± 6.8	0.00± 1.9	0.00± 12.1
	Euphrates -Shatt al - Arab	0.82± 0.287	-	0.00± 18.8	0.00± 37.6	0.00± 3.5	0.00± 13.8	0.00± 1.5	0.00± 14.8	0.00± 6.8	0.03± 1.9	0.00± 12.1
The Limits of the Iraqi, EPA & WHO Specifications		6.5-8.5*	-	1000*	-	5*	200*	12**	500*	50*	50*	250*

These symbols mean: (*): (COSQC,2001, WHO,A,2006, EPA,2012) ; (**): (GOWR,1999) ; (#):The average was calculated starting from raw water until third hour, and that is the period in which the concentration of parameters stopped changing; (a, b, c, ab) : Coefficients of variance analysis

The concentration of potassium increased after an hour of retention in raw water, then returned to decreasing slightly in the second hour, and finally rose again at third hour. But at the samples of Euphrates and Shatt Al-Arab water, the change in the concentration of this parameter stopped only at second hour. The results showed at this parameter that the desalinated water sample preserved in pottery jars only was within the limits of the specifications of Iraqi and American drinking water and the World Health Organization.

Total hardness (TH): The TH in different water types recorded significant differences between while the hours of water retention in the pottery jars, with raw water were not significant except in desalination water, where the concentration of the parameter at raw water was 18 $mg.L^{-1}$, and after three hours of retention period recorded a significant increase with a concentration of 35 $mg.L^{-1}$. The curve of the relationship between the parameter and the hours of water retention in pottery jars in the samples of desalination and Badaa water was recorded an increase at the first hour and then decreased slightly in the second hour to rise again at third hour and settle there. In samples of the Euphrates and the Shatt Al-Arab, the change stopped at the second hour, recording slight decrease from the first hour. Only the desalination and Badaa samples of this parameter were within the limits of the specifications of Iraqi and American drinking water and the World Health Organization.

Calcium (Ca): There were significant differences in Ca between different water types, while no significant differences were recorded between the hours of water retention in the pottery jars, with the raw water, only with desalination water. The concentration was increased from 4.5 in raw water to 12 $mg.L^{-1}$ after three reservation hours and the rise was significant comparing to the concentration of raw water. The results showed an increase in the concentration of the parameter in the first hour, then a slight decrease in the second hour, and then increase at the desalination and Badaa samples, while the Euphrates and Shatt Al-Arab samples stopped after second hour, recording a slight decrease from the first hour. Only the sample of desalination water reserved in the pottery jars was within the limits of the specifications of Iraqi and American drinking water and the World Health Organization.

Magnesium (Mg): There were significant differences between the studied water types, while differences were not recorded between the hours of water retention in the pottery jars and raw water, except with the desalination water sample. The raw water concentration was recorded 3.29 mg L^{-1}. But after three Hours of water retention, the concentration was 6 mg L^{-1} shows a significant difference for concentration after hours of retention. The concentration of the parameter after an hour of retention in the pottery jars was higher than it was in raw water and then returned to decrease slightly at the second hour, and then rose in the third hour at the desalination and Badaa samples only. In Euphrates and Shatt Al-Arab samples, the concentration stability was recorded at the second hour. The study showed that the desalination water sample was within the limits of the specifications of Iraqi and American drinking water and the World Health Organization, while Badaa sample exceeded the limit of specifications slightly.

Chlorine (Cl): The water types recorded significant differences between them, while no significant differences were recorded between the hours of water retention in the pottery jars, with raw water except at the desalination water sample, in which the Cl concentration of raw water rose from 19.17 to 32.4 $mg.L^{-1}$ after the passage of three hours retention. The results have been shown an increase in the concentration of the parameter after one hour of water conservation in the pottery jars of all types of water, then at the second hour a slight decrease in concentration occurred, and while the change stopped at the Euphrates and Shatt Al-Arab samples. This change continued at the desalination and Badaa samples towards the increase at the third hour to stop there. The desalination water preserved in pottery jars of this parameter was the only one within the limits of the specifications of Iraqi and American drinking water and the World Health Organization.

Dissolved 0xygen in water (DO): Measurements of dissolved oxygen continued recorded at the hours of water retention in pottery jars of the study water types more than 6 hours, unlike other parameter indicated that DO continued to rise in concentrations for more than three hours, and in hours was not sufficient to stop the increase in concentrations. The changes were observed up to 12 hours. Statistical analysis showed significant differences in the studied water types for this parameter except between desalination water at Iraqi jars with Iranian jars, and between Badaa with Shatt Al-Arab water. There were significant differences between raw water and hours of water retention in pottery jars of different water types starts from fifth hour and upwards. DO was different from the rest of the parameters, as the change in this parameter did not stop with two or three hours as it happened with the rest of the parameters but continued for more than that.

Infiltrated water: The infiltrated water concentrations from pottery jars at all parameters for the studied water samples recorded a very large increase compare to the existing concentrations at raw water, as well as existing at retention water in Pottery jars, and thus disproved the misconception that infiltrated water from pottery jars is a purification process

Table 2. Dissolved oxygen concentrations for the study water types before and at the hours of water reservation in pottery jars

Different water types	Time reservation/ Parameters	Raw water	First hour	Second hour	Third hour	Fourth hour	Fifth hour	Sixth hour	Seventh hour	Eighth hour	Ninth hour	10 hours	11 hours	12 hours
Desalination water (RO) Reverse Osmosis Iraqi pottery	T (^{0}C)	19	20.2	19.8	20.5	20.5	20.1	19.9	19.7	19.5	19.6	19.4	19.6	19.6
	DO mg.L^{-1}	8.51	8.64	8.68	8.74	8.77	8.81	8.78	8.85	8.79	8.82	8.8	8.83	8.73
	Mean							8.75^b						
	DO Saturation Ratio %	92.5	95.7	96	96.6	96.9	97	96.4	97.5	96.7	97.1	96.2	97.2	94.9
Desalination water (RO) Reverse Osmosis Iranian pottery	T (^{0}C)	18.9	19.8	19.7	19.5	19.8	19.7	19.5	19.6	19.8	19.7	19.6	19.6	19.6
	DO mg.L^{-1}	8.6	8.74	8.81	8.84	8.89	8.98	9.02	9.08	9.04	9.08	9.05	9.08	9.03
	Mean							8.94^a						
	DO Saturation Ratio %	93	96	96.9	97.2	97.7	98.2	98.7	99.7	99.3	99.7	99.5	99.7	99.2
Badaa water (Tigris River)	T (^{0}C)	22.5	22.4	21.8	21.3	20.7	20.4	20.2	20.5	20.2	19.8	19	19.5	19.3
	DO mg.L^{-1}	7.47	7.63	7.82	7.97	8.09	8.15	8.18	8.15	8.21	8.35	8.41	8.42	8.46
	Mean							8.10^{ab}						
	DO Saturation Ratio %	87	88.1	89	90	90.2	90.4	90.5	90.4	90.6	91.1	91.6	91.8	91.9
Euphrates River	T (^{0}C)	22.5	21.8	21.4	21.3	20.9	20.4	20.5	20.1	20	19.4	19.3	19.7	19.6
	DO mg.L^{-1}	7.73	8.03	8.21	8.23	8.29	8.37	8.34	8.4	8.46	8.57	8.58	8.66	8.69
	Mean							8.35^c						
	DO Saturation Ratio %	89.3	92.4	92.7	92.8	93	93.2	92.4	93.5	93.7	94	94.1	94.3	94.6
Shatt Al - Arab water	T (^{0}C)	20	20.4	20	20.1	20.1	20.2	20	20.1	19.8	19.7	19.6	19.6	19.5
	DO mg.L^{-1}	7.17	7.62	7.71	7.75	7.81	8.02	7.98	8.02	8.21	8.3	8.35	8.47	8.49
	Mean							7.99^{ac}						
	DO Saturation Ratio %	79.6	84.9	85.1	85.8	86.5	88.6	88.3	88.6	90.2	91	91.2	92.4	92.5
The least Significant difference At 0.05	Concentration of parameters with reservation period	-	Raw-1st hr	Raw-2ndhr	Raw 3rd hr	Raw-4rth hr	Raw-5th hr	Raw-6th hr	Raw-7th hour	Raw-8th hr	Raw-9th hr	Raw-10thhr	Raw-11thhr	Raw-12thhr
		-	0.39± 0.271	0.2± 0.271	0.14± 0.271	0.09± 0.271	0.04± 0.271	0.04± 0.271	0.03± 0.271	0.02± 0.271	0.01± 0.271	0.00± 0.271	0.00± 0.271	0.00± 0.271

Different water types	RO Iraqi-RO Iranian	RO Iraqi-Badaa	RO Iraqi- Euphrates	RO Iraqi-Shatt al - Arab	Badaa- Euphrates	Badaa-Shatt al - Arab
	0.07 0.103$^{\#}$	0.00 0.103$^{\#}$	0.00 0.103$^{\#}$	0.00 0.103$^{\#}$	0.02 0.103$^{\#}$	0.29 0.103$^{\#}$

a, b, c, ab, ac: Coefficients of variance analysis of the retention water.

Changes in Water Quality after adding water from the same sample to the Pottery Jar

The data was collected on total dissolved salts, electrical conductivity, pH and dissolved oxygen, at one water source for the raw water sample, as well as at hours of water retention in the pottery jar and after three hours which is the hour when most of the parameters stop changing, and water was added from the same sample of raw water and the parameters measurements were taken and the process was repeated at the fourth hour, where the measurements were taken, and then water was added for few minutes after fourth hour (Table 3). The concentrations of the parameters studied before and during hours of keeping indicated that water as well as after the addition of water to the pottery jar. There was no change even after adding 0.75 of the amount of water to 0.25 for the sample of water preserved in the pottery jar, and therefore the added water after a few minutes had taken the same concentrations of the studied parameters at the water in the pottery jar.

Comparing the water quality of the Iraqi with Iranian pottery jars: According to what is available in the markets, the Iranian pottery jars were competitive in the market for the Iraqi pottery jars, so the goal was to find out which types were the best in influencing the water quality and its specifications, and on this basis the measurements were taken for specific parameters, and the changes during water conservation were compared in the case of Iraqi .Two types of pottery jars

Table 3. Concentrations of the parameters before and at the hours of water reservation as well as after adding water to the pottery jar

Parameters/Hours	TDS (mg.L^{-1})	EC (μs/cm)	pH	DO (mg.L^{-1})	DO saturation ratio (%)	T °C
Raw water	1610	3220	7.6	6.81	75.6	20.1
First hour	1635	3270	7.7	7.24	80.7	20.1
Second hour	1630	3260	7.77	7.32	80.8	20.2
Third hour	1630	3260	7.77	7.37	81.6	20.2
After adding water at third hour	1630	3260	7.77	7.37	81.6	20.2
fourth hour	1630	3260	7.77	7.42	82.2	20.1
After adding water at fourth hour	1630	3260	7.77	7.42	82.2	20.2

Table 4. Comparing Iraqi and Iranian pottery jars

Parameters/Hours	T (°C)	DO (mg.L^{-1})	DO saturation ratio (%)	TDS (mg.L^{-1})	PH	EC (μs/cm)
Iraqi pottery						
Raw water	20.2	7.67	84.02	2070	7.8	4140
First hour	19.4	7.87	84.5	2100	8	4200
Second hour	19.1	7.89	84.6	2080	8.1	4160
Third hour	19.8	7.96	85	2105	8.2	4210
Weight of empty pottery jar (kg)			1.395			
Pottery jar capacity (ml)			2000			
Price (ID)			10000			
Iranian pottery						
Hours	T (°C)	DO mg.L^{-1}	DO Saturation	TDS mg.L^{-1}	PH	EC
Raw water	20.2	7.67	84.02	2070	7.8	4140
First hour	19.3	8.01	86.4	2080	8.1	4160
Second hour	18.9	8.24	88.1	2075	8.2	4150
Third hour	19	8.92	98.1	2085	8.3	4170
Weight of empty pottery jar (kg)			1.370			
Pottery jar capacity (ml)			2340			
Price (ID)			5000			

found in the markets were compared, namely Iraqi pottery jars and Iranian pottery jars at one sample of water as shown in Table 4, which shows the comparison between the Iraqi and Iranian pottery jars, where the raw water concentrations were recorded during three hours of water retention in the pottery jars, and the studied parameters were: TDS, EC, DO, pH. The Iranian pottery jars excelled in the value of PH parameter as well as the concentration of dissolved oxygen in water DO on Iraqi pottery jars. The increase in salts and conductivity was lower in Iranian jars than Iraqi ones. In addition to other features, the Iranian jar is lighter in weight and also accommodates more volume of water than Iraqi jar, and above that it is sold on the market at half the price of the Iraqi pottery jar, and therefore the Iranian pottery jars were better than the Iraqi pottery jars. There were only two types available in the market, so the comparison was limited to only them.

CONCLUSIONS

The pottery jar showed its ability to raise the PH value of the water samples during water retention period in the jar, and convert the acidic water to the alkaline. The pottery jar showed its ability to raise the dissolved oxygen concentration with water retention hours for water samples according to the salts concentrations. The parameters: TDS, EC, K, Na, TH, Ca, Mg, Cl, PH, and DO were recorded at all samples, an increase in their concentrations with the hours of preservation in the pottery jars, while the turbidity parameter showed a decrease in the concentrations of all study samples.

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