Comparison physicochemical properties between the tap and reverse osmosis water to some areas in the city of Najaf

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Abstract- Comparing physicochemical properties between the tap and reverse osmosis (R.O) water to some areas in the city of Najaf is conducted. The results showed that the mean concentrations were in the order Zn > Co > Mn > Cd > Cr > (Pb, Cu), in all the tap samples. Whereas, the mean were in the order Co > Zn > Mn > Cd > (Cr , Pb, Cu), in all the R.O. The pH, salinity, EC, TDS, and turbidity values in Tap water ranged from 7.10 to 8.13, 0.4 to 0.8, 1291 µS cm-1 to 1860 µS cm-1, 776 ppm to 1137 ppm, 0.74 NUT to 1.75 NUT, respectively. Whereas, the corresponding values in R.O water ranged from 7.40 to 8.38,0, 86 µS cm-1 to 357 µS cm-1, 52 ppm to 215 ppm, 0.26 NUT to 0.74 NUT, respectively. The results showed that the values of the pH and Turbidity were within the recommendation limits. Whereas, TDS tap water value had exceeded the recommendation limits. The heavy metals (Cd, Co, Cr, Cu, Mn, Zn, and Pb) in water are measured and the results showed exceed the recommendation limits for cadmium in tap and R.0 water.

Keywords – Water, heavy metals, reverse osmosis, physicochemical properties

I. INTRODUCTION

Reverse osmosis (RO) is a good water purification technology that uses a semipermeable membrane and sometimes used to prevent formation of minerals on the surface of electrodes. These membrane technologies are not properly filtration methods. In RO, an applied pressure used to overcome osmotic pressure, a colligative property, which is driven by chemical potential, a thermodynamic parameter. RO can remove many types of molecules, ions from solutions, used in both industrial processes, and the production of potable water. Results are that the solutes are retained on the pressurized side of the membrane and the pure solvents allowed passing to the other side. To be "better selective", these membranes should not allow large molecules or ions through the pores, but should allow smaller component of the solution (solvent) to pass freely. In the osmosis process, the solvent moves from an area of low solute concentrations, through membranes, to an area of high solute concentrations. The movement of a pure solvent driven to reduce the free energy of the systems by equalizing solute concentrations on each side of membranes and generating osmotic pressure. Applying an external pressure to reverse the natural flow of pure solvent is RO. Key differences are found between RO and filtration. RO is involves a diffusive mechanism that separation efficiency is dependent on solute concentrations, pressure, and water flux rate. RO is uses in drinking water purification from seawater, removing the salt and, other effluent materials from the water molecules [1]. Reverse osmosis is a proven technology. One of the better known uses of RO is the removal of salt from seawater. Household RO units deliver small amounts (2 gallons d-1 to 5 gallons d-1) of treated water and waste 3 t0 7 times the amount of water treated. RO units remove many inorganic contaminants from household drinking water supplies. The removal effectiveness depends on the contaminant and concentration, the membrane selected, the water pressure and proper installation. RO units require regular maintenance and monitoring to perform satisfactorily during an extended period of time. Before purchasing an RO unit or any other water treatment equipment, test water to be certain it needs treatment and the equipment selected is appropriate to the problem requiring treatment [2]. Salts are leached from the body under the influence of drinking water with a low TDS. Because adverse effects such as altered water-salt balance were observed not only in completely desalinated water but also in water with TDS between 50 and 75 mg L-1, the team that prepared the 1980 WHO report (3) recommended that the minimum TDS in drinking water should be 100 mg L-1. The team also recommended that the optimum TDS should be about 200-400 mg L-1 for chloride-sulphate waters and 250 mg L-1 to 500 mg L-1 for bicarbonate waters. The recommendations were based on extensive experimental studies conducted in rats, dogs, and human volunteers. Water exposures included Moscow tap water, desalinated water of 10 mg L-1 TDS, and laboratory-prepared water of 50, 100, 250, 300, 500, 750, 1000, and 1500 mg L-1 TDS using the following constituents and proportions: Cl (40%), HCO3 (32%), SO4 (28%), Na (50%), Ca (38%), Mg (12%). The WHO in the 2nd edition of Guidelines for Drinking-water Quality evaluated calcium and magnesium in terms of water hardness but did not recommend either minimum levels or maximum limits for calcium, magnesium, or hardness [3]. The first European Directive established a requirement for minimum hardness for softened or desalinated water (≥ 60 mg L-1 as calcium) [4]. Soil and water are dynamic natural resources for the survival of people life and because its complex matrix is the prime receiver of the relentless pollutants such as heavy metals and every soil and water contain natural amounts of heavy metals, at concentration called a metal background [5, 6, 7]. This study aims to comparing physicochemical properties between the tap and reverse osmosis water to some areas in the city of Najaf.

II. MATERIALS AND METHODS

A total number of 8 water samples were collected from different location in Najaf city. The heavy metals in water were determined using a Flame Atomic Absorption Spectrophotometer-6300 AA, Shimadzu, Japan. The random sampling method was adopted at each site. The water samples were transferred to bottle, labeled, and taken to the laboratory for further analysis, for the measurement of Co, Cd, Pb, and Cr using atomic absorption spectrophotometer.

III. RESULTS AND DISSECTION

The heavy metal concentrations (ppm) in tap water samples are found as shown in Fig. 1. Fig. 1 shows that the highest Co (0.0410 ppm) was found in Alwafah sample, whereas the lowest (0.0029 ppm) was found in Sarray-Kufa sample. The highest Mn (0.0326 ppm) was found in Sarray-Kufa sample, whereas the lowest (0 ppm) was found in Nasser, Judaydah, Jameiah, and Bohydari samples. The highest Cr (0.0015 ppm) was found in Nasser and Abasyah samples, whereas the lowest (0 ppm) was found in other samples. The highest Cd (0.0086 ppm) was found in Messan sample, whereas the lowest (0 ppm) was found in Judaydah, Jameiah, and Bohydari samples. The highest Zn (0.2004 ppm) was found in Judaydah sample, whereas the lowest (0 ppm) was found in Abasyah sample. Whereas, Pb and Cu concentrations not detected in all tap water samples. The results showed that the mean concentrations were in the order Zn > Co > Mn > Cd > Cr > (Pb, Cu), in all the tap samples as shown in Fig. 1.

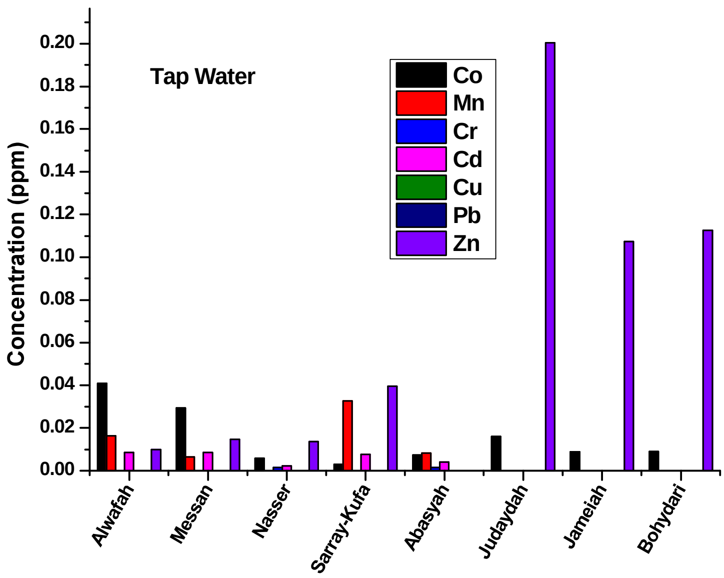

Figure 1. The heavy metals concentration of tap water samples

The heavy metal concentrations (ppm) in R.O. water samples are found as shown in Fig. 2. Fig. 2 shows that the highest Co (0.0264 ppm) was found in Messan sample, whereas the lowest (0 ppm) was found in Abasyah sample. The highest Mn (0.0163 ppm) was found in Nasser sample, whereas the lowest (0 ppm) was found in other samples. The highest Cd (0.007 ppm) was found in Sarray-Kufa sample, whereas the lowest (0 ppm) was found in Alwafah, Messan, Nasser, Judaydah, Jameiah, and Bohydari samples. The highest Zn (0.0094 ppm) was found in Judaydah sample, whereas the lowest (0 ppm) was found in Abasyah sample. Whereas, Cr, Pb, and Cu concentrations are not detected in all R.O. water samples. The results showed that the mean concentrations were in the order Co > Zn > Mn > Cd > (Cr , Pb, Cu), in all the R.O. samples as shown in Fig. 2.

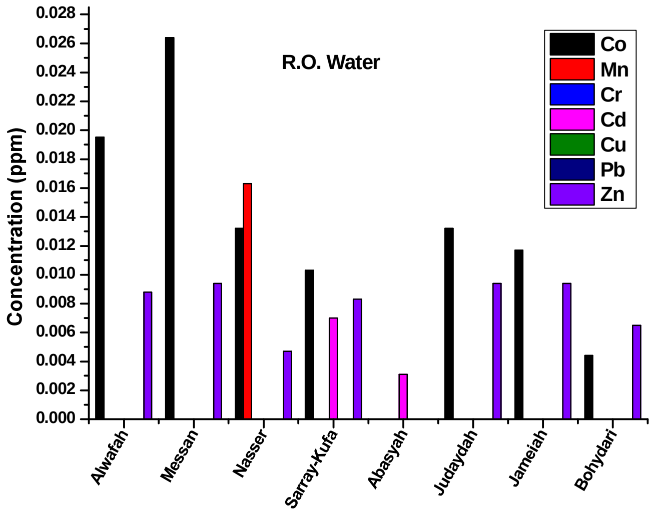

Figure 2. The heavy metals concentration of R.O water samples

Table 1 shows that pH, salinity, EC, TDS, and turbidity values in Tap water ranged from 7.10 to 8.13, 0.4 to 0.8, 1291 µS cm^{-1} to 1860 µS cm^{-1}, 776 ppm to 1137 ppm, 0.74 NUT to 1.75 NUT, respectively. Whereas, the corresponding values in R.O water ranged from 7.40 to 8.38,0, 86 µS cm^{-1} to 357 µS cm^{-1}, 52 ppm to 215 ppm, 0.26 NUT to 0.74 NUT, respectively. The corresponding values in Tap water higher than R.O water, excepted pH value, which it lowers than R.O water. The results showed that the values of the pH and Turbidity were within the recommendation limits [8]. Whereas TDS tap water value had exceeded the recommendation limits [8]. The heavy metals (Cd, Co, Cr, Cu, Mn, Zn, and Pb) in water are measured and the results showed exceed the recommendation limits for cadmium in tap and R.0 water [9, 10].

Table -1 The pH, salinity, EC, TDS, and turbidity of water samples

Sample Site	Water	pH	Salinity	EC (µS cm^{-1})	TDS (ppm)	Turbidity (NUT)
Alwafah	Tap	7.10	0.4	1300	781	1.73
	R.O	7.67	0.0	357	215	0.32
Messan	Tap	7.67	0.8	1860	1137	1.33
	R.O	8.27	0.0	196	118	0.55
Nasser	Tap	7.20	0.4	1291	776	0.79
	R.O	7.90	0.0	270	163	0.26
Sarray-Kufa	Tap	7.71	0.7	1785	1074	1.58
	R.O	8.32	0.0	131	79	0.72
Abasyah	Tap	7.79	0.6	1614	967	1.65
	R.O	8.38	0.0	91	55	0.34
Judaydah	Tap	7.50	0.4	1314	785	1.75
	R.O	8.00	0.0	86	52	0.74
Jameiah	Tap	7.50	0.4	1307	784	0.74
	R.O	7.40	0.0	160.3	97	0.35
Bohydari	Tap	8.13	0.7	1730	1040	1.27
	R.O	8.22	0.0	175	106	0.38
Tap	**Max**	8.13	0.8	1860	1137	1.75
	Min	7.10	0.4	1291	776	0.74
R.O	**Max**	8.38	0.0	357	215	0.74
	Min	7.40	0.0	86	52	0.26

IV. CONCLUSIONS

The highest Co, Mn, Cr, Cd, and Zn concentrations in tap water were found in Alwafah, Sarray-Kufa, (Nasser and Abasyah), Messan, Judaydah samples, respectively. Whereas, the corresponding concentrations in R.O water were found in Messan, Nasser, Sarray-Kufa, Messan, Judaydah samples, respectively. The pH, salinity, EC, TDS, and turbidity values in Tap water higher than R.O water, excepted pH value.

ACKNOWLEDGMENT

The author acknowledges the financial support of the College of Science of the University of Kufa. The author is grateful to Dr. Basim A. Almayahi, Department of Environment, College of Science, University of Kufa for assisting me throughout conducting the present research.

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