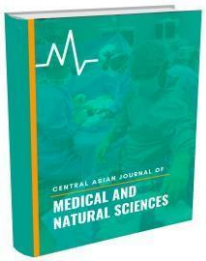

CENTRAL ASIAN JOURNAL OF MEDICAL AND NATURAL SCIENCES
https://cajmns.centralasianstudies.org/index.php/CAJMNS
Volume: 05 Issue: 03 | July 2024 ISSN: 2660-4159

Evaluation of Drinking Water Reverse Osmosis in the City of Al-Nasiriyah Using Bioassay

Murooj Abbas Buhlool AL-Ghizzi

University of Thi Qar, Iraq
* Correspondence: murooj.abbas@sci.utq.edu.iq

Abstract: The quality of drinking water is a priority in most countries. Drinking water is crucial for food production and must be free from harmful substances, while also having a composition that is beneficial to health (Cybulski et al., 2021). The research problem is represented by the low quality of drinking water in Reverse Osmosis (RO) drinking water filtration stations, represented by its physical and chemical characteristics in the city of Al-Nasiriyah and its impact on the general health of the city's residents. Given the importance of RO drinking water used within a wide segment, the current study aims to evaluate the toxicity of water with chemical pollutants and its suitability for drinking for residents of the city of Al-Nasiriyah using the bioassay method.

To obtain toxicological results for this water in the current study in the city of Nasiriyah and at the various water filtration stations, samples were taken from water distributors in six different areas in the city of Al-Nasiriyah in 2024, which are Al-Shuhada, Al-Shumukh, Industrial Housing, Al-Salihiyah, Al-Rafidain, and Al-Mutnazah) which are brought from stations. Toxicity, both acute and cumulative, was recorded in almost all samples, but the highest was at station 4 (Al-Abada station) in the Salhiya area, where the percentage of coefficient deviation from the growth rate was (88.23%) after 24 hours and (88.33%) after 96 hours, with a stimulating effect. This may be due to the presence of high concentrations of nutrients such as phosphates and nitrates in the aforementioned station, or as a result of water pollution during its distribution. While toxicity was recorded with an inhibitory effect in samples (1,2,3), but with a percentage of deviation coefficient lower than what was recorded in station (4), while station (6,5) was the least toxic station. The current results indicate the need to pay attention to stations for filtering and treating drinking water because they do not conform to the standard specifications for drinking water due to the dependence of a large number of the population on them.

Keywords: *Drinking Water, Reverse Osmosis RO, Al-Nasiriyah City, Bioassay.*

Citation: Murooj Abbas Buhlool AL-Ghizzi. Evaluation of Drinking Water Reverse Osmosis in the City of Al-Nasiriyah Using Bioassay Central Asian Journal of Medical and Natural Science 2024, 5(3) 543- 549.

Received: 05h June 2024
Revised: 05th June 2024
Accepted: 07th June 2024
Published: 12th June 2024

Introduction

Water represents the basic element that creates conditions suitable for life and its continuation, therefore issue of fresh water occupies the list of priorities in the interest of countries as well as researchers and specialists in this matter (Katko & Rajala, 2005), present and future, including the study area, in order to achieve good suitability for drinking water, especially after the increase in water consumption and the increasing human requirements for it.

Drinking water supplies essential elements like zinc, iron, manganese, and copper, but it can also carry harmful substances (Vriens et al. 2017). To ensure the highest quality, the water delivered to households through supply networks must be treated effectively. The success of this treatment is vital for consumer health, prompting ongoing advancements in water and wastewater treatment

technologies. The efficiency of these facilities is enhanced by combining them to obtain better technologies (Crini andLichtfuse 2019).

The use of mineral water and reverse osmosis water is considered an alternative to bottled water at the present time due to the latter's inefficiency in filtration and sterilization processes. Therefore, the current study was intended to determine the biological suitability of drinking water from reverse osmosis plants in the city of Al-Nasiriyah by studying its toxicological properties using the biological screening method. The goal of this study is to reverse the vulnerability of water to chemical pollution through a biological examination as a result of environmental warnings about contamination of drinking water in purification plants distributed to residential areas.

Evaluating the toxicity of various types of pollutants has become more accurate through the widespread use of biometrics, especially micropollutants in aquatic systems (Chatterji, 2007). To obtain a direct measure of the degree of toxicity of any compound at low concentrations, biological tests are used. Since biological methods are more sensitive than chemical methods, it is preferable to determine the potential effects of micropollutants through biological methods. Biological methods can work in two ways: in vitro and in vivo. The use of cellular mechanisms in vitro is one way to detect chemicals, while in vivo methods evaluate the comprehensive effects of a toxic substance on entire organisms, thus giving a direct measure of environmental impacts (Besten, 2016). In vivo tests are diverse and varied at different trophic levels, such as bacteria, algae, algae, crustaceans and fish, to evaluate the effects of toxic compounds on growth, reproduction, feeding activity and mortality (Kienle, 2011).

The great importance of microalgae as an essential biological product has given them increasing use as model organisms in bioassays (Aguirre-Martínez, 2015; Ginebreda, 2010; Margot, 2013) and as a food source for higher trophic level organisms. Preserving microalgae is essential for maintaining integrated aquatic ecosystems. It should be noted that the relatively high sensitivity of fish and crustaceans to micropollutants makes them commonly used in ecotoxicological studies (Wijk, 2009). Previous research on algal toxicity included both single algal species and natural algal populations containing multiple species, which served as representative test organisms (Goldman, 1972; Miller, 1975).

One of the abilities that algae have is the ability to recognize various pollutants., such as pesticides and heavy metals, which are strong inhibitors of acetylcholinesterase and alkaline phosphatase. These enzymes are found in Chlorella vulgaris, a green alga from the Chlorophyceae group, chosen for its stability in producing biological signals. The chlorophyll fluorescence from its photosynthetic activity allows for the determination of pesticides (Vedrine et al., 2003), while the inhibition of its alkaline phosphatase and esterase enzymes can identify heavy metals (Durrieu, 2003) and organophosphorus insecticides (Chouteau et al., 2005), respectively. This approach also detects shifts in the

composition of natural microalgal communities and works as an indicator to assess environmental condition changes, as seen in marine (O'Connor, 2013), freshwater ecosystems (Sabater et al., 2000), and wetlands (Stevenson et al., 2002).

Study problem: The research problem is represented by the low quality of drinking water in RO drinking water filtration stations, represented by its physical and chemical characteristics in the city of Al-Nasiriyah and the impact of this on the general health of the city's residents.

Aim of the study :Evaluating the toxicity of water with chemical pollutants and its suitability for drinking for residents of the city of Nasiriyah using the bioassay method.

Materials and Methods

Study area:

The current study was conducted within Nasiriyah city, where samples of drinking water (Reverse Osmosis) were collected from different areas and RO drinking water filtration stations in 2024. Distributed as follows:

Sample (1) from the Al-Shuhada area, Al-Rawan station

Sample (2) from Al-Shumukh area, highway station

Sample (3) from the industrial housing area, Dhi Qar University intersection station

Sample (4) from the Salhiya area, Al Obada station

Sample (5) from Al-Rafidain area, Al-Ubadah station

Sample (6), Al-Montazah area, Al-Zaylat station

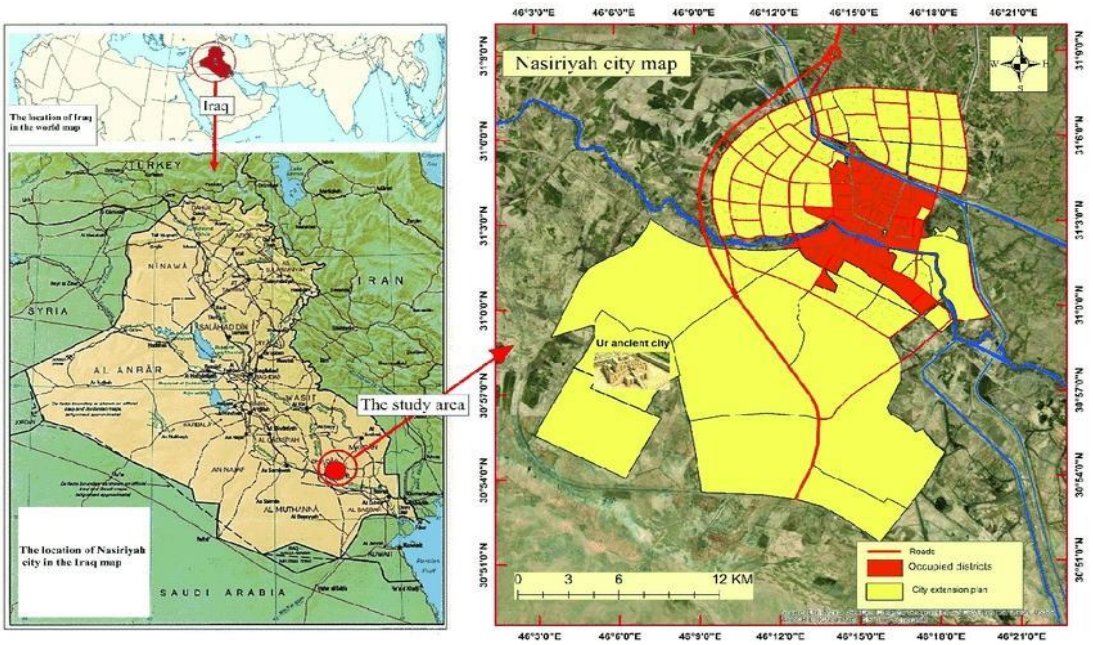

Figure 1. Shows the residential areas from which the study samples were collected within the city of Al-Nasiriyah.

The method of work

These samples were taken using bottles washed with clean water for the purpose of ensuring that no external chemical pollution occurred from it. They

were transferred to the Advanced Environmental Laboratory in the Department of Biology / College of Sciences, and a toxicity test was conducted using a bioassay method on the intial day of taking the samples, where the numbers of cells *Chlorella vulgaris* algae were calculated for intial day and after (24, 48, 96) hours for the purpose of calculating the growth rate and growth deviation coefficient. The bioassay was performed according to the (R 52.24.808-2014).

Results and Discussion

According to the results of the current study, different growth rates of the algae *Chlorella vulgaris* were obtained for RO drinking water samples, where the highest growth rate of the algae *Chlorella vulgaris* in sample 4 was (1.98) after 96 hours compared to the other samples, while Growth rate in sample 1 was (0.4) after 48 hours.

The effect of drinking water RO on *Chlorella vulgaris* differs from growing the algae in natural water, but despite this, the results indicated resistance to this algae and it was able to grow and the growth rate increased after 96 hours. This may be attributed to the presence of nutrients that helped the algae to grow in the environment. It is abnormal, especially in stations (5 and 4), where a difference in growth rates was recorded, and this may be attributed to pollution from RO water distributors in residential areas.

Table 1: Growth rates of *Chlorella vulgaris* algae in the studied samples.

Time	control	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	Sample 6
24 hrs.	0.97	0.92	0.85	0.67	0.5	0.39	0.36
48 hrs.	0.9	1.06	0.65	0.53	0.49	0.5	0.52
96 hrs	0.92	0.69	0.44	0.52	0.48	1.05	0.61

The percentage of growth deviation parameters of the alga *Chlorella vulgaris* out of control was recorded, and the highest values were in sample 4 (88.23%) after 24 hours (acute toxicity with a stimulating effect) and after 96 hours it was (88.33) (chronic toxicity). As for the lowest values of the deviation coefficient for the growth rate, it was recorded in samples 5 and 6 after 24 hours, and with an inhibitory effect, as in station 5, toxicity was recorded after only 48 hours, while in station 6, toxicity was recorded after 48 and 96 hours, as for samples 1, 2, and 3. Toxicity with an inhibitory effect on cell growth was recorded throughout the period, but at lower percentages than station 4.

The high deviation in growth rates from control rates indicates the presence of acute and chronic toxicity with an inhibitory and stimulating effect, especially since the growth rates indicated that it was an environment closer to the natural environment that is not subject to adequate purification, which therefore indicates the presence of chemical pollutants and nutritional elements such as nitrates and phosphates in the drinking water RO. This was attributed to the

inefficiency of filtering drinking water RO and pollution from drinking water distributors and its sources, such as river water, as it is the main source of drinking water used within the city of Al-Nasiriyah.

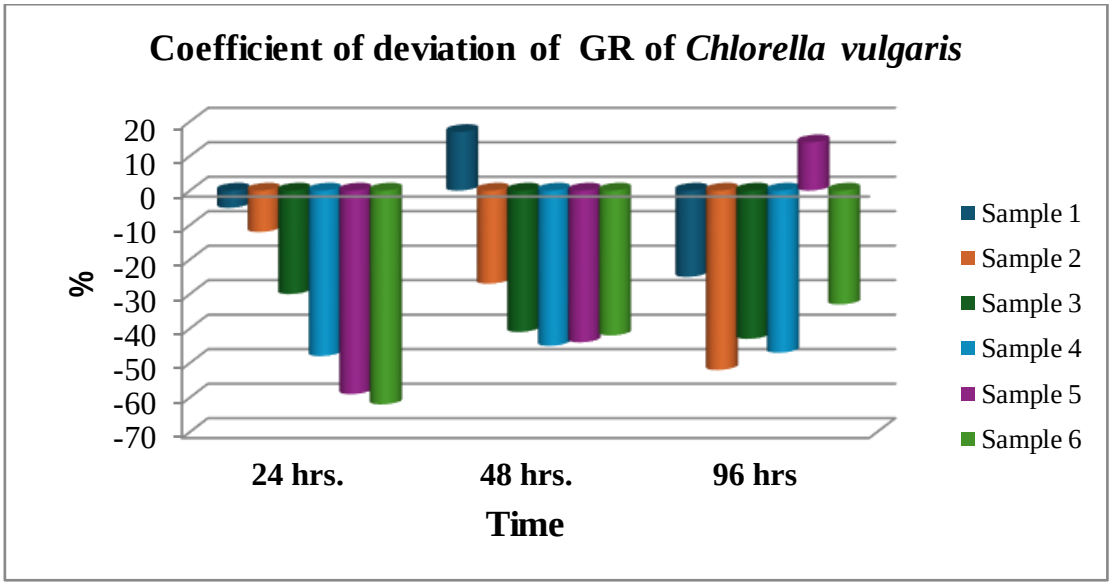

Figure 2. Percentage coefficient of deviation of the growth rate (GR) of *Chlorella vulgaris*

Conclusion

The current study confirmed the environmental expectations regarding the quality of drinking water (RO) in the city of Al-Nasiriyah within the residential areas studied, as it recorded the presence of toxicity of both acute and chronic types and it was an encouraging environment for the growth of algae, which confirms that drinking water is in great need of treatment and follow-up due to the importance of drinking water (RO) for the adoption of a wide number of the population in this city.

Reference

[1] A.K. Chatterji, Introduction to Environmental Biotechnology (2nd Revise), PrenticeHall of India Pvt. Ltd., New Delhi, 2007.

[2] P.J. den Besten, M. Munawar, Ecotoxicological testing of marine and freshwater ecosystems: emerging techniques, Trends and Strategies, CRC Press, Florida, 2016.

[3] C. Kienle, R. Kase, I. Werner, Evaluation of bioassays and wastewater quality: in vitro and in vivo bioassays for the performance review in the Project "Strategy MicroPoll" (Dübendorf), (2011).

[4] G.V. Aguirre-Martínez, M.A. Owuor, C. Garrido-Pérez, M.J. Salamanca, T.A. Del Valls, M.L. Martín-Díaz, Are standard tests sensitive enough to evaluate effects of human pharmaceuticals in aquatic biota?

Facing changes in research approaches when performing risk assessment of drugs, Chemosphere 120 (2015) 75–85, http:// dx.doi.org/10.1016/j.chemosphere.2014.05.087.

[5] A. Ginebreda, I. Munoz, M.L. de Alda, R. Brix, J. Lopez-Doval, D. Barcelo, Environmental risk assessment of pharmaceuticals in rivers: relationships between Hazard indexes and aquatic macroinvertebrate diversity indexes in the Llobregat River (NE Spain), Environ. Int. 36 (2010) 153–162, http://dx.doi.org/10.1016/j. Envint.2009.10.003.

[6] J. Margot, C. Kienle, A. Magnet, M. Weil, L. Rossi, L.F. de Alencastro, C. Abegglen, D. Thonney, N. Chevre, M. Scharer, D.A. Barry, Treatment of micropollutants in Municipal wastewater: ozone or powdered activated carbon? Sci. Total Environ. 461–462 (2013) 480–498, http://dx.doi.org/10.1016/j.scitotenv.2013.05.034.

[7] D. van Wijk, M. Gyimesi-van den Bos, I. Garttener-Arends, M. Geurts, J. Kamstra, P. Thomas, Bioavailability and detoxification of cationics: I. Algal toxicity of Alkyltrimethyl ammonium salts in the presence of suspended sediment and humic Acid, Chemosphere 75 (2009) 303–309, http://dx.doi.org/10.1016/j.chemosphere.

[8] W.E. Miller, J.C. Greene, T. Shiroyama, E. Merwin, Use of algal assays to determine Effects of waste discharges in the Spokane River system, Biostimulation Nutr. Work, US Environmental Protection Agency, 1975(660/3–75–034).

[9] N.E. O'Connor, Impacts of sewage outfalls on rocky shores: incorporating scale, Biotic assemblage structure and variability into monitoring tools, 2013.Ecol. Indic. 29:501-509.

[10] T. S. Katko and R. P. Rajala . Priorities for fresh water use purposes in selected countries with policy implications." IJ of Water Resources Development. (2005) 21, 2: 311-323.

[11] R 52.24.808-2014. Assessment of the toxicity of land surface waters using biotesting using chlorophyll a / E.N. Bakaeva, N.A. Ignatova, G.G. Chernikova. Enter 2014-04-23.

[12] W. E. Miller, J. C. Greene, T. Shiroyama, and E. Merwin. 1975. The use of algal assays to determineeffects of waste discharges in the Spokane River system. Proc. Biostimulation and NutrientWorkshop, USEPA, 660/3-75-034.

[13] J. C. Goldman, D.B. Porcella, E.J. Middlebrooksand D.F. Torien. 1972. Review: The effect of carbonon algal growth- Its relationship to eutrophication.Water Res. 6:637-679.46.

[14] C. Vedrine , J.C. Leclerc, C. Durrieu, C. Tran-Minh, Biosens. Bioelectron. 18, 457 (2003).

[15] C. Durrieu J. Appl. Phycol. 15, 289 (2003)

[16] C. Chouteau, S. Dzyadevych, C. Durrieu, J.M. Chovelon, Biosens. Bioelectron., 21, 273 (2005).

[17] N.E. O'Connor, Impacts of sewage outfalls on rocky shores: incorporating scale, biotic assemblage structure and variability into monitoring tools. Volume 29, June 2013, Pages 501-509.

[18] R. J. Stevenson, F. R. Hauer. Integrating Hydrogeomorphic and Index of Biotic Integrity Approaches for Environmental Assessment of Wetlands. Journal of the North American Benthological Society 21(3):502. September 2002. 21(3):502.
DOI:10.2307/1468486

[19] S. Sabater, J. Armengol, E. Comas, F. Sabater, I. Urrizalqui & I. Urrutia. (2000). Algal biomass in a disturbed Atlantic river: water quality relationships and environmental implications. Science of The Total Environment 263, 185-195.

[20] B. Vriens, A. Voegelin, D. J. Hug, R. Kaegi, L.H.E. Winkel, M.A. Buser, M. Berg. Quantification of element fluxes in wastewaters: a nationwide survey in Switzerland. (2017) Environ Sci Technol 51(19):10943−10953. https://doi.org/10.1021/acs.est.7b01731

[21] G. Crini, E. Lichtfouse. Advantages and disadvantages of techniques used for wastewater treatment. Environ Chem Lett . (2019) 17:145–155.
https://doi.org/10.1007/s10311-018-0785-9.

[22] J. Cybulski, A. Witczak, K. Pokorska-Niewiada.Essential and Toxic Elements in Drinking Water: Water Treatment and Wastewater Treatment. Research Square. 10 (2021).CC BY 4.0.
DOI:10.21203/rs.3.rs-975033/v1