ISSN:2319-6890 (O), 2347-5013(P)
2-3 March 2020

Domestic Ro Reject Management in Urban and Rural Areas

Jay Solanki, Guided by Assistant Prof. Shivam Kapoor
Environment Engineering, Government Engineering College, Bhuj, India

ABSTRACT: ***The technological advancement in applications of membrane processes was efficiently explored in recent decades due to huge demand for potable water. However relatively little improvements have been reported in the management and handling of the major by-product, called reject water brine. The disposal or management of desalination brine is expensive and faces major environmental challenges. In spite of the scale of this economical and environmental problem, the options for brine management have been limited. This brief review presents an overview of existing methods on the brine treatment, minimization, and disposal practices based on the newest and most updated technologies. In addition, the review outlines the advantages and disadvantages of most common treatment and disposal methods from an environmental perspective.***

Keywords: *Reject Water, Reverse Osmosis, Brine treatment, RO concentrate*

I. INTRODUCTION

In introduction includes the background of reverse osmosis system and need of the system with aim and objective of study.

1.1. Background

Water resources present naturally in the environment can be generally divided into fresh water and saline water according to the amount of dissolved solids it contains. Quality and quantity of different water resources are of high importance, many efforts are being made to have good estimates of water resources at both worldwide and country levels. Information on the quantity of major water resources is present in table 1.

Freshwater is the water naturally found on Earth's surface and in underground aquifers such as surface water, fresh groundwater, and glaciers, and mainly characterized by its low content of dissolved solids. These water sources are considered to be renewable resource, by effect of natural water cycle. The quantity of freshwater present on Earth is around 2.5%only of the total water present on Earth.

Surface water is the water present in rivers, fresh lakes, and wetlands; the main source of surface water is by precipitation in the form of rain, snow etc. Surface water is characterized by low content of dissolved salts generally below 500 mg/L. Surface water represents only around 0.3 % of the total freshwater present on Earth's surface. Fresh ground water is the water located under the Earth's surface i.e. subsurface water which is mainly located in pores or spaces of soil and rocks, or in aquifers below the water table. It is mainly characterized by its low suspended solids. In many places groundwater contains high content of dissolved salts compared to that of surface water; with salinity level around 500-2,000 mg/L. Groundwater represents around 0.76 % of the total water present on Earth, and around 30 % of the freshwater available on Earth.

Water or ice present in glaciers, icebergs, and icecaps represents the vast majority freshwater, this huge amount of water is currently unused and locked up in southern and northern poles. Up to date there are no efforts has been made to make use of such water resources due to the high cost associated with its processing as it is

ISSN:2319-6890 (O), 2347-5013(P)
2-3 March 2020

mainly present in very distant areas or at very high altitudes.

Brackish groundwater is the water located under the Earth's surface and it is characterized by its higher salinity than that of fresh groundwater with values of 2,000-10,000 mg/L. It is mainly present in aquifers that are much deeper than that of fresh groundwater. Brackish groundwater represents around 0.93% of the total water present on earth.

Saline or salty water is the water that contains considerable amount of salts and it is mainly found in oceans, seas, saline or brackish groundwater, and saltwater lakes. Saline water represents the majority of water resources in terms of quantity with around 97.5 % of the total water present on Earth. the salinity of seawater varying from one location to another, from around 21 g/L in the North Sea to 40 - 45 g/L in the Arabian Gulf and Red Sea, and even up to 300 g/L as in the Dead Sea.

Water Resource	**Volume, (1000 km^3)**	**Percent of total water**	**Percent of total Fresh water**
Saline water:			
Oceans/seas	1,338,000	96.54	-
Saline/ brackish groundwater	12,870	0.93	-
Salt water lakes	85	0.006	-
Freshwater:			
Glaciers and permanent snow covers	24,064	1.74	68.70
Fresh groundwater	10,530	0.76	30.06
Fresh lakes	91	0.007	0.26
Wetlands	11.5	0.001	0.03
Rivers	2.12	0.0001	0.006

Table 1: Estimates of major water resources on Earth (Gleick, 2001)

The majority of world population use surface water or groundwater as the main source for domestic, agriculture, and industrial water supplies. The most common surface water resources are rivers, and lakes. However, the most common groundwater sources are pumped wells or flowing artesian wells. In absence of surface water supply, it is clear that the use of ground water becomes essential especially in the case of rural communities. Underground reservoirs constitute a major source of fresh water, in terms of storage capacity; underground aquifers worldwide contain over 95% of the total fresh water available for human use.

1.2. Need of Study

Over the past 10-15 years due to crises of potable water, there has been a world-wide increase in the number and size of water treatment plants utilizing reverse osmosis (RO) membrane technology for the production of potable water from brackish or saline water. Reverse osmosis is membrane technology widely applied in water desalination, production of potable water. This technology has the advantages of membrane processes such as modular construction and small footprint, which allow the combination with other treatment processes. The technology employs semi-permeable membranes that allow separating a solution into two streams: permeate, containing the purified water that passes through the membrane, and concentrate, the portion that contains salts and retained compounds and therefore needs a suitable and environmentally friendly management option.

The characteristics of the waste stream, named concentrate, retentive or brine, depend on the quality of the feed water, the quality of the produced water (recovery varies from 35% to 85%), the pre-treatment method (added

ISSN:2319-6890 (O), 2347-5013(P)
2-3 March 2020

chemicals) and cleaning procedures used. Then constituent concentrations in the retentive are found to be double or higher than that in feed water. Brine disposal in coastal desalination plants has been solved by direct discharge to seawater. In desalination plants, generation of brine is about 55% of collected seawater. Recent estimates suggest that up to 25 million m^3 of desalinated water is produced daily around the world. Representative examples of large membrane reverse osmosis seawater desalination plants with ocean outfalls for concentrate discharge are the 3,30,000 m^3/day plant in Ashkelon, Israel; the 1,36,000 m^3/day Tuas Seawater Desalination Plant in Singapore; the 64,000 m^3/day Larnaka Desalination Facility in Cyprus, and the majority of the large desalination plants in Spain, Australia and the Middle East. Environmental impacts of concentrate discharge are emphasized rather than other impacts such as land use or impacts of noise pollution because concentrate discharge can serve severe effects to environmental media. The impacts of concentrate discharge for various media are shown in figure 1.

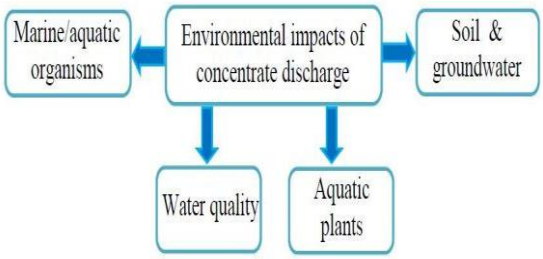

Figure 1: Possible effected Medias from concentrate discharge

1.3. Aim and Objective

Aim: The project aims at the RO reject management in rural and urban areas.

Objectives: To develop the technique for reuse of rejects water. To develop the solar evaporation pond or deep injection well for disposal of RO rejects water. To develop method for treatment of rejects water in industry so that it can be reused for any other purposes.

II. MATERIALS AND METHODS

2.1. Study area:

We had done our survey in different rural and urban areas, which are shown in map given below.

First place that we had visited was Junagadh (Gokuldham society) which is urban area and after that we had covered Ahmedabad (Naherunagar and Lilapur) and Bhuj(Juni Ravalvadi) which are in rural area. The reason for selecting the places which has described above where people were using RO system even when TDS level was low there, and because of that water wastage is more in those places.

2.2. Methods

While we were surveying we had checked TDS of source water, treated water, and rejected water by using TDS meter. A TDS meter indicates the total dissolved solids (TDS) of a solution, i.e. the concentration of dissolved solid particles.

Dissolved ionized solids, such as salts and minerals, increase the electrical conductivity (EC) of a solution. Because it is a volume measure of ionized solids, EC can be used to estimate TDS. Dissolved organic solids, such as sugar, and microscopic solid particles, such as colloids, do not significantly affect the conductivity of a solution, and are not taken into account.

ISSN:2319-6890 (O), 2347-5013(P)
2-3 March 2020

III. CASE STUDY

2.3. Survey was conducted in the rural and urban area

The survey was conducted in rural and urban areas regarding source of water, TDS of the treated water and TDS of reject water.

2.3.1 Survey in urban area

The Reverse Osmosis technology is providing to be an important solution for drinking water treatment in urban Gujarat. Small sized RO system with capacity <20 lph are used by individual families whereas medium to large sized plants(>100 lph) are being used for public consumption. We have inspected urban area of Junagadh, where we went door to door of each house situated in the areas and took the TDS test of the drinking water. We have even discovered that some of houses use the RO system and few where directly in taking the water from the source. Further we have found that rejected RO water is used as in the other domestic purposes such as washing, cleaning, gardening, many variants of RO systems where found during the survey.

Domestic Ro Management In Rural And Urban Area			
Location	**Lilapur**	**Nehrunagar**	**Bhuj**
No Of House Visited	**17**	**10**	**27**
No Of R.O Users	**11**	**0**	**5**
No Of R.O Non-Users	**06**	**10**	**22**
TDS in Water Source			
100-500	**2**	**2**	**23**
500-1000	**15**	**15**	**4**
1000-1500	**0**	**0**	**0**
1500-2000	**0**	**0**	**0**
TDS in R.O Permeate			
0-100	**5**	**5**	**0**
100-500	**6**	**6**	**5**
500-1000	**0**	**0**	**0**

III. CONCLUSION

Since direct disposal of RO concentrates from desalination plants is recognized as a practice with adverse impacts on marine ecosystems, the search for environmentally friendly management options is a technological challenge. As the composition of the concentrate is closely related to its source, and the selection of the most suitable treatment is based on the concentrate composition.

With regard to RO concentrates from desalination plants traditional technologies, such as solar evaporation easy to operate but with a large requirement of land area. In summary, several technologies for concentrate treatment are emerging and some may offer the potential of enhanced water recovery and reduced concentrate. However, no one technology is appropriate for all instances.

It should be noted that both energy consumption and treatment costs are highly site specific; nonetheless, these broad ranges are presented for general guidance and comparative purposes. In selecting potential concentrate minimization technologies, the end user must select based on water quality characteristics, concentrate water recovery goals, disposal options available, permitting requirements, and site-specific characteristics such as available infrastructure, space, and skilled workforce.

IV. REFERENCES

1. *Ahmed, M., Arakel, A., Hoey, D., Thumarukudy, M.R.,Goosen, M.F.A., Al-Haddabi, M., Al-Belushi, A., (2003) Feasibility of salt production from inland RO desalination plant reject brine: a case study. Desalination 158, 109-117.*
2. *Christopher, J. G., Pei, X., Yoram, C., (2010) Sustainability Science and Engineering (2), The Netherlands Linacre House, Jordan Hill, Oxford OX2 8DP, UK.*
3. *Gleick, P. H., (2001) The World's water 2000-2001: The Biennial Report on Freshwater Resources, Island Press, ISBN 1-55963-792-7, Washington, DC, USA.*

ISSN:2319-6890 (O), 2347-5013(P)
2-3 March 2020

4. *Hajbi, F., Hammi, H., M'Nif, (2010) Reuse of RO desalination plant reject brine. Journal of Phase Equilibria and Diffusion 31(4), 341-347.*
5. *Ji, X., Curcio, E., Al Obaidani, S., Di Profio, G., Fontananova, E.,Drioli, E., (2010) Membrane distillation-crystallization of seawater reverse osmosis brines. Separation and Purification Technology 71 (1), 76-82.*
6. *Macedonio, F., Katzir, L., Geisma, N., Simone, S., Drioli, E.,Gilron, J., (2011) Wind-Aided Intensified evaporation (WAIV)and membrane crystallizer (MCr) integrated brackish water desalination process: advantages and drawbacks. Desalination 273 (1), 127-135.*
7. *Pe´rez-Gonza´ lez, A., Urtiaga, A.M., Iba´n˜ ez, R., Ortiz, I., (2012) State of the art and review on the treatment technologies of water reverse osmosis concentrates. Water Research 46 (2), 268-281.*
8. *Squire, D., (2000) Reverse osmosis concentrate disposal in the UK. Desalination 132, 47-54.*
9. ***Book:** Metcalf and Eddy*