

# Desalination Water with Surfactant a New Method with Clear Vision

Moharam Barzegar Zenouz

International Research and Training Institute of Barzegar Zenouz, Unit 1, First floor Neyayesh complex, Neyayesh high way, 2nd Shahrans Square, Tehran1478665841, Iran, [info@bzrt.ir](mailto:info@bzrt.ir)

**Abstract:** Reverse osmosis (RO), multistage flash distillation (MSF), mediated electrochemical oxidation (MEO), electrolysis and ion exchange are in different condition indubitable RO is consider to be the best method (less than 0.8 \$ /m<sup>3</sup>). In this regard for production of desalination water degree of salinity, environmental and economical cost is the determining factors. International Research and Training Institute of Barzegar Zenouz have invented a new method of desalination. Desalination of water using surfactant in comparison with other methods in a wide range (700-60,000 ppm) makes it an acceptable method laboratory-scale and pilot plant. It makes sunny horizon for up grading technology and reaching to economical cost for each cubic meter of water. Importance of this technology will be more clear with demand of increase and drinking water. [Nature and Science 2009;7(11):86-90]. (ISSN: 1545-0740).

**Key Words-** Surfactant-RO-MED-MSF-Electrodialysis-Desalination-Ion exchange

## 1. Introduction

Energy is one of the most basic and mooted subject in development countries and access to useful water (drinking- industrial- agricultural) from view of economic is one of important developing instrument. In future the method of surfactant desalination of water makes concentrations lower than 700ppm which most rational and economical for ion deleting rather than present conventional methods. But it doesn't work for other impurities. Cost increases with increasing concentration. The electro dialysis and reverse osmosis from view of economical has preferable in concentration more than 5000ppm and distillation is an economical method for elimination of imparities in concentration in range of 100.000 ppm of course, mentioned method has own usage range according to necessity and economical warranty. With growing and developing technologies new methods can reduce cost and increase efficiency. RO has allocated the most efficiency, in high concentration and the cheapest among mentioned methods.

The following conventional methods for desalinate brackish water is investigable:

- 1) From view of ability and usefulness every method has its portion in desalinate.
- 2) Economical investigation for every method
- 3) Environmental investigation for above methods

- 4) Technological, mechanical and operational technique

## Brief description of conventional methods

### 1. Heating methods

Include multi stages suddenly chummy system methods, distillation with double effect and multi stage distillation,... basic operation is steam production, exchange steam energy with salinity water and its variation by making vapor causes reducing boiling point. The distillation method produces desalinate water. We can repeat these stages with more efficiency to reduce waste of energy, and reduce cost of exploitation.

In this method if stages increase, cost reduced and according to use of this methods in salinity and sea water below 50 ppm can be prepared achieving drinking water. Usually capacity of motion units diverse and units to capacity under 100000 m<sup>3</sup>/ day is useful.

Efficiency of heating unit is increased by:

- 1) Increasing number of stage
- 2) Increasing temperature of feed in preheating section
- 3) Increasing heat transfer
- 4) Corrosion prevention

Pretreatments for this method include screening (physical) and anti sediment, anti microbe material and remove of gases.

## 2. Reverse osmosis

In recent years, RO system has been developed with technology expanding and building of membranes with high efficiency to reduce the heating system stages.

RO method removes ions to 95% and microorganisms to 99% and dissolved solid, can replace for heating methods or is competitive technology.

RO operation is to transfer water from diluted media to concentrated media.

With membrane and concentrated media the liquid is raised in concentrated media, if pressure is enforced on concentrated media. By using mechanical instruments, reverse direction of motivation water is possible to pass salt ions by tape of membrane water with rather purity conduct. From salinity water to opposite side and therefore we can get desalinate water from sea water. It's clear that geometrical figure seam and type of membrane and remove pollution and solid ingredient type of membrane can influence on RO method. RO operation in used for desalinate of sea water for drinking, hospital requirement and industrial proportional to achieve quality water.

## 3. Electrodialysis.

Electrodialysis method is base on using direct electricity that can shift cation and anion opposite direction. According to splice of salt solution and line of demarcation in a process, electrodialysis parts were prepared:

- A) Pre treatment part
- B) Membranes
- C) Circulation pump
- D) The source of electricity
- E) Perfect treatment part after electrodialysis

## 4. Ion exchange (DI)

In this unit resin is used to interchange hydrogen with cations such as calcium, magnesium, sodium, salt solutions, OH with anion can exist in water. Certainly the material used this stage can be anions or cations acting although efficiency of weak resins comparing to strong resin but it is more effective in industries and more expensive resins, because the efficiency of weak resins are better than others. Recycling efficiency is usually less than 40% for strong resins, while it is 100% for weak resins. Weak resins can be recycled by using weak or strong acids or bases. Ion exchange units can be produced water with high purity, and less salt concentration which is preferable to other methods.

Using ion exchange method combined with the following techniques can eliminate pollution from water with higher pollution in water.

- 1-Flocculation of coagulation
- 2-Sedimentation
- 3- Aeration
- 4-Elimination algae
- 5-Hardness
- 6- Filtration
- 7-Absorbation
- 8-Disinfection
- 9-Micro filter
- 10-Ultrafiltratin
- 11-Nano filtration

## Different methods for water purification

Desalinated water and increasing pollution of under group water are main sources of desalinated water for creating the desalination unit which has the following costs:

- 1-Maximum cost of feed (30% the whole cost)
- 2-Pretreatment cost
- 3-Desalivation cost
- 4-Storing cost
- 5-Operation cost (energy, chemicals, consuming cost)
- 6-Human cost

According to pattern of sampling (using of sea water) the cost of investiture was estimated to be 1000 euro per  $m^3$ /day. This cost can be reduced by changing the geography surrounding, capacity and other parameters. Under the best conditions the cost of produced water can be estimated to be about 50cent/ $m^3$ . With RO method and kind of sensitivity, apply consumption ratio to purity and elimination of contamination in water the kind of treatment can be chosen. It's clear that the role of dependent cost plays important role in the choice of other method. Following are principles of environment in desalination of water. In planning & creation of an industrial desalination unit of place plays important role because environment and stable extension source of water consume energy, landfill and nearing to habitable can also play important role in economical & spoiling. One of the main factor that is related to desalination is minimum 20% liquid that should discharge waste in the open place and without planning in a discharging of waste. The pollution can increase in underground and surface water which show in Table 2.

**Applying surfactant for desanation of water**

According to worldwide requirement to desalination water and it’s importance, International Research and Training Institute has defined a project “Desalination of water with surfactant “ since 2000 and developed a new method successfully and obtained noticeable results. This method is registered as an innovation on 2008.06.13 in Registration Office for Company and Non Commercial Institute.

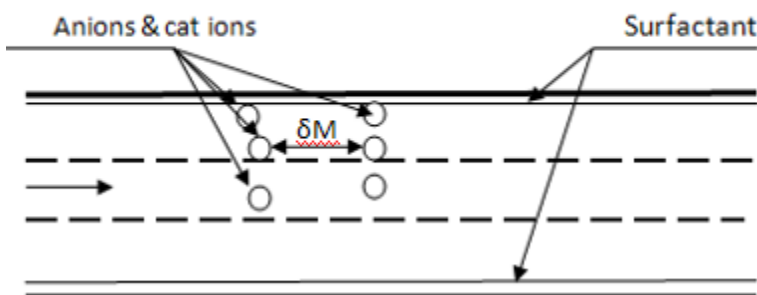
Table 1. Comparing of different desalination method

-	bacteria	suspended solid	range of desalinate	non ion dissolve solid	dissolve solid
distillation	unsuitable	unsuitable	concentrate & salinity 30000	suitable	suitable
ion exchange	unsuitable	unsuitable	very diluted<700ppm	unsuitable	very Suitable
reveres osmosis	very suitable	very suitable	30000<Salinity and brackish water	suitable	suitable
Electro dialysis	unsuitable	unsuitable	~ 7000	unsuitable	very suitable

Table 2. The method of disposal waste

Surface disposal	Disposal in surface water Floating disposal in water
Wastewater treatment plant disposal	-
Waste disposal to end of flow waste water treatment plan	-
Use of water	This method include spray, treatment and leakage lake
Injection to deep water	-
Waste disposal at evaporation lake	-
Disposal by removing total water	Use of evaporation mechanisms in order to change liquid disposal to solid and dry waste

**Figure.1.Desalination method using surfactant**



In this method there are two pipes with different diameters, the first pipe with fewer diameters is inside the second pipe, internal pipe with membranes is related to external. Internal surface of external pipe is coated by surfactant. Passing water from two pipes attracting anions and cations by surfactant, exhausting water from internal pipe has less salinity and exhausting water from external pipe with more salinity which is the base of desalination in this method. Effective parameters are:

Fluid velocity  
Pipes diameters  
Rate of salt concentration  
Temperature and ....

This Institute has prepared NaCl solutions with different concentrations from 700-60000 ppm and tested them. Electro conductivity is the base of measurement and concentration reduction has been measured in different section of pipe length and figure 2 has been found. As seen in the diagram salt reduction process has reduced with salt concentration reduction during the pipe length.

1) This new method works without using electricity and energy which is the most problem in water desalination. Of course, it is clear that this method needs minimum electricity for water pumping at inside and outside systems.

2) This method doesn't need so much raw materials in contrast to the other methods especially ion exchange.

3) This method does not have any complex technology, doesn't need experts and adversity personal for maintenance and service.

4) According to primaries forecast this method is cheaper than building cost of water desalination unit. According to some calculations, International Research and Training Institute of Barzegar Zenouz has used inexpensive materials for building of a pilot for every cubic m<sup>3</sup> meter which is about 50 percent cheaper than RO equipment cost equivalent to 500 Euro.

5) Achieving cost of a cubic meter of desalinated water with this new method is about 50 cent.

6) This method can be used in small volume and supply water for example for small villages. This method doesn't need energy and heavy and expensive equipments compare to the other methods.

7) This method has remarkably advantages from environmental point of view such as using low of electricity, heating and fixity surrounding temperature since this system doesn't need heating. This system approximately has natural sources, so doesn't have any especial effect on environment. And

doesn't have any risk on environment. In case of leakage and disposal, the waste water emission has about 40% desalination water.

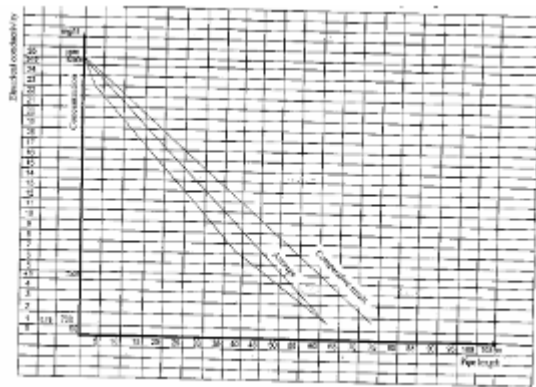


Figure 2. Approximately performance diagram of desalination unit according to testing condition.

### Conclusion

Using surfactant is a new method for desalination of water after passing necessary stages for industry. It has ability to enter the competition with ordinary methods. The cost of a cubic meter of desalinated water by RO method is the most desirable and available method in market, arriving to 40-50 cent since its invention in 40 years ago. It is clear that achieving cost of water by this invented method in center after optimization and achieving to product large amount of water will decrease the cost remarkably. Invested cost of this new method in pilot plant and first sample test is about 50 per percent of RO method that is 500 euro. Also achieving cost of water per cubic meter in this stage is about 40 cent that naturally every one of these figures gradually will decrease in mass production with engineering and optimization conditions in system. It should be mentioned that achieving cost of desalinated water per cubic meter by RO in system was more than 2\$ using method has decreased the cost to 40-50 cent now.

### Correspondence to:

Moharam Barzegar Zenouz

International Research and Training Institute of Barzegar Zenouz, Tehran 1478665841, Iran

Telephone: 0098 21 44339097

0098 21 44339019

Cellular phone: 0098- 9121997394

Email: [info@bzrt.ir](mailto:info@bzrt.ir)

## References

- [1] Gholfar B, Nosraty M. Desalination of sea water for industrial application. Engineering institute of Ministry Jihad- E- Agriculture.2008.
- [2] Rezai A, Musavi A. Evaluation membrane method in treatment of salt water and compare with other methods .Membran and fuel pill institute.2008.
- [3] Møllavialle J. Water treatment membrane processes. Odendaal P.E., WiesnerM.R.,McGrow Hill, 1996.
- [4] Candew P.T, Membrane processes: A technology Guide; Lem.s., Royal society of chemistry, 1998.
- [5] Cheryan M, Ultra filtration and Micro filtration Handbook, Technomoc Publishing Co,1998.
- [6] Wangnic K, A Global overview of water desalination technology the respective, 2000 .
- [7] Semiat R, Desalination: present and future, International water resources association water international, 200;25(1): 54-65.
- [8] Seawater desalination in California, California :// coastal commission, available in <http://www.coastal.ac.gov/index.html>.2007
- [9] Martini S. Nonionic surfactants:volume2.
- [10] Cross J. Nonionic surfactants, Chemical analysis:volume12.
- [11] Schick M. Nonionic surfactants: Physical Chemistry:volume23.
- [12] Eric J. Cationic surfactants: volume4.
- [13] Richmond JM. Cationic surfactants: Organic Chemistry:volume34.
- [14] Donn N. Rubinyh &Paulm. Cationic surfactants, Physical chemistry Holland:Volume 37.
- [15] Warner M. Anionic surfactants (in two part):Volume 7.
- [16] Schmitt TM. Analysis of surfactants, Principles of water treatment M. C. Amiri ph. D: Volume 40.
- [17] GleickP H. The world's water 2006- 2007.
- [18] Murakami M. Managing water for peace in the middle east.

Author information:

Moharam Barzegar Zenouz:

PhD of petrochemistry in the specialty of surfactant, he established International Research and Training Institute of Barzegar Zenouz in 1997, the goal is: Developing software and hardware to synthesize surfactant based products, research and innovation in these areas.

Till now the institution has 7 innovations and registered them in Registration Office for Company & Non Commercial Institute and more than 50% of this innovation are applicable and in mass production phase. There are six laboratories in this research institute (water,oil, drug, biotechnology, nano and environment)

