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Water treatment by using natural pressure in reverse osmosis (Suggested strategies)

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Abstract: Water is a vital resource that usually has limitations. Freshwater is almost constant in specific geographical areas, which covers limited areas. The use of saline water is a way to deal with water shortage. Membranous process probably turns saltwater in to fresh one. One of the most minuscule membranes in separating process is osmosis membranes. In reverse osmosis, the water moves from higher concentration to the lower one due to the pressure entering the salt water, furthermore, water moves against the Salts concentration gradients and natural direction osmosis. Pure water passes through the membrane, thus, salt remains in the other side of the membrane. In the United States of America, which has allocated, over 17% of the world desalination of salinity, reverse osmosis is the dominant method in desalting. In this process, in addition to salt ions the other substances in water such as suspended particles, viruses, minerals, organic matter and microbes are separated from the water. In this method, pressure must be increased by rising the amount of solute in water. Thus, the required pressure for desalination is 10 to 15 bars for the brackish water and about 54 to 80 bars for seawater.
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1. Introduction

Water is a vital resource that usually has limitations. Freshwater is almost constant in specific geographical areas, which covers limited areas. The use of saline water is a way to deal with water shortage. Membranous process probably turns saltwater in to fresh one. One of the most minuscule membranes in separating process is osmosis membranes. In reverse osmosis, the water moves from higher concentration to the lower one due to the pressure entering the salt water, furthermore, water moves against the Salts concentration gradients and natural direction osmosis. Pure water passes through the membrane, thus, salt remains in the other side of the membrane. In the United States of America, which has allocated, over 17% of the world desalination of salinity, reverse osmosis is the dominant method in desalting [3]. In this process, in addition to salt ions the other substances in water such as suspended particles, viruses, minerals, organic matter and microbes are separated from the water. In this method, pressure must be increased by rising the amount of solute in water. Thus, the required pressure for desalination is 10 to 15 bars for the brackish water and about 54 to 80 bars for seawater [4]. Therefore, the purpose of this research is utilizing the pressure, which is available at harvested areas. Moreover, Based on the obtained results, the most efficient and practical options for the regional and climatic conditions is suggested to be a small step to improve water crisis.

2. Material and Methods

In reverse osmosis systems, water is injected inside the semi-permeable membranes with tiny pores (about42 microns) by using power pumps. These pores can prevent the molecules, which are larger than water molecules from passing through, so the water that is almost pure flows from one side, and the condensed water (high salt) flows on the other side **(Figure1).** A reverse osmosis device simply consists of the following parts:

A-A semi-permeable membrane that lets water molecules pass through.

B- A control valve in the track of liquid concentrate (brine) to control the degree of concentration C-A water pump to provide the necessary pressure This study has tried to offer some guidelines to create the necessary pressure of reverse osmosis without pumps. In this method the existing pressure, that is naturally created or by using devices, is used in those areas to obtain the necessary reverse osmosis.

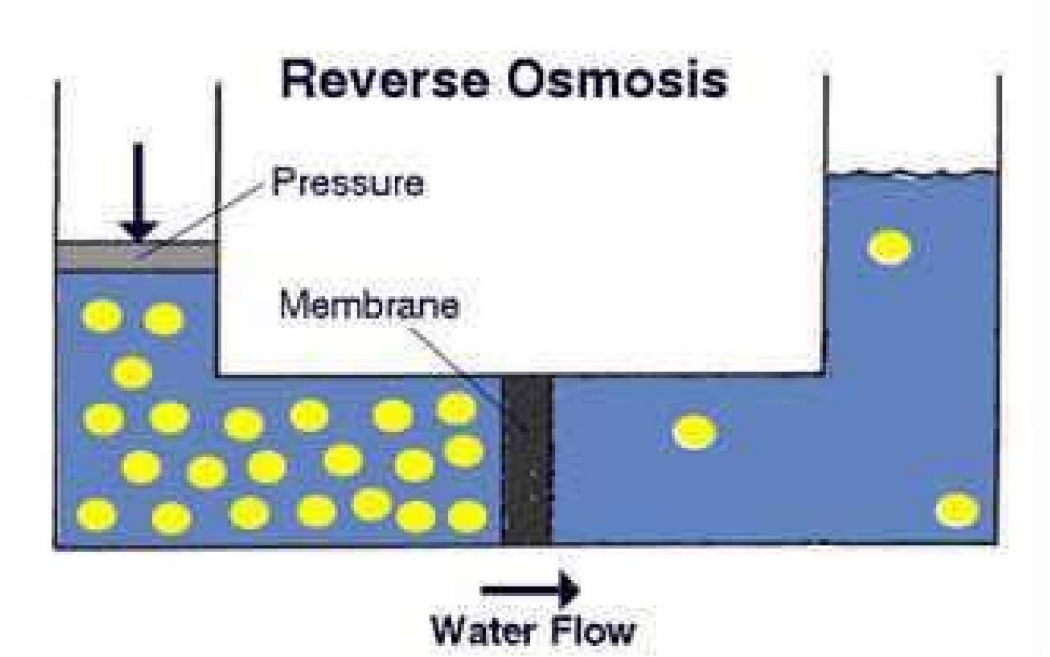

Figure 1. Reverse osmosis process[1].

1.1. The use of natural pressure

2.1.1. The use of the pressure in confined aquifers or artesian groundwater: when there is water in confined aquifers **(Figure2),** using natural pressure in these layers can be fruitful for harvesting water in reverse Osmosis method.

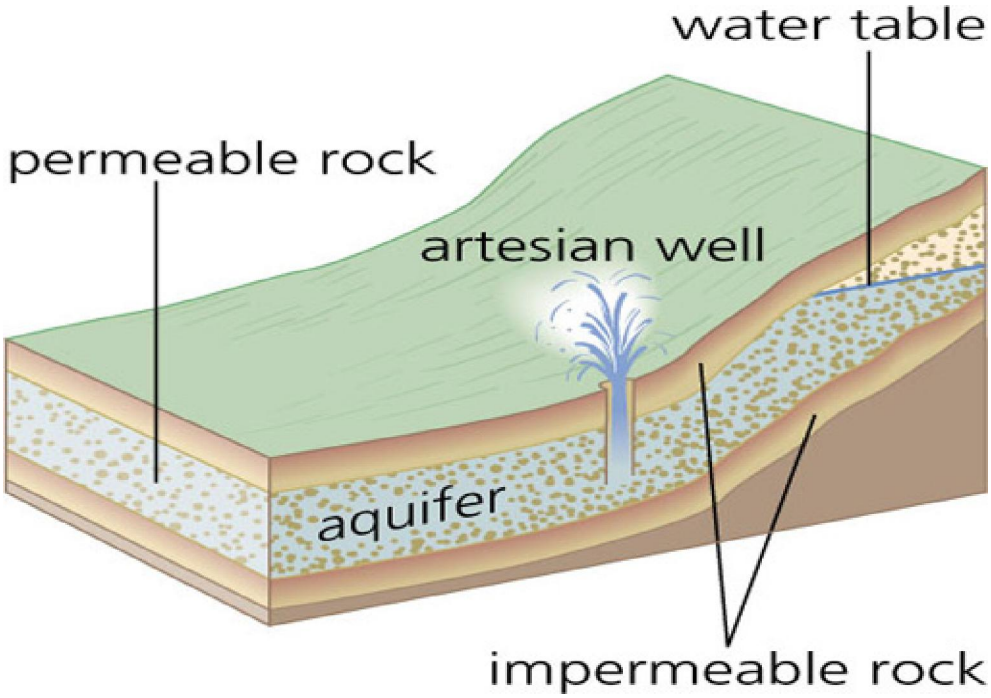

Figure 2. confined aquifers or artesian groundwater

2.1.2.The use of pressure created by sea water : in this method, according to Figure3 small Channels were dug inside the salt water source (the sea,…) and water is transmitted there. As shown in **figure 5** small channels (B) are made in the vicinity of saline water source (A) and water is transported inside the channel. The seawater with natural pressure passes through the filter, which has been embedded in the walls of the channel (C). Sometimes it can provide the pressure required for the reverse osmosis process; therefore, fresh water can be picked out from the membrane (D).

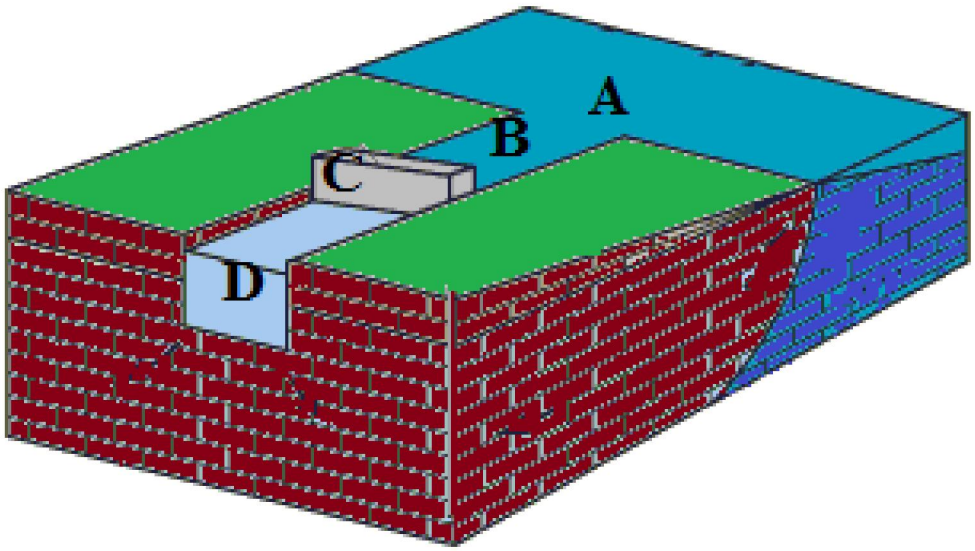

Figure 3. The small channels in the way of the water of the sea [2]

A-The saline water source
B-The small, deep channels
C-The wall in the path of channel
D-The water passing through the membrane embedded in channel walls

2.2. The pressure caused by creating height or using natural height

The more the depth in the liquid, the more the pressure .The created pressure can be used for water purification in the reverse osmosis method .By considering the density of the brine pressure the required height to make the pressure is reduced. By using the formula for Liquid Pressure, the required height to create the necessary pressure in reverse osmosis is to be calculated. (If you go down10 meters, the pressure increases by 14.7 psi (1 bar).

$P=P_0 + pgh$

P = Final Pressure
P_0 = Initial Pressure
p = density of liquid
g = Acceleration of gravity
h =The height of the liquid

3. Results

There will be problems when applying the proposed methods, but because the treatment is done in situ, there won't be the problems existing in construction of water treatment facilities, including the transfer of salt water. It also reduces some problems such as excretion of saline waste, which is one of the problems of the method of de-salinization. However in the methods presented, water flow is connected to the main water source furthermore, their concentration of residual and deposition of calcium

carbonate and calcium sulfate decreases because the water flow is connected to the main source of water. Another advantage of this method is the use of it, in the areas of the wells with salt water.

Nowadays scientists are seeking to explore freshwater resources beneath the sea .Thus, what suggested is to study the effectiveness of the type and thickness of sea floor sediments in RO phenomenon in order to harvest fresh water underneath sea floor[5].

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