

Reverse Osmosis Desalination System on board M.V. SEAFDEC

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I. Introduction

Quantity of water in human body is the factor of body fluid balancing. Our body is composed of about 60% of water. There is about 75% in our brain, Makes up 83% of our blood, 22% in our bones, Makes up 75% of our muscles, Helps to carry nutrients and oxygen to our cells, Moistens oxygen for breathing, Helps to convert food to energy, Removes waste from body etc.

Water on the Earth.

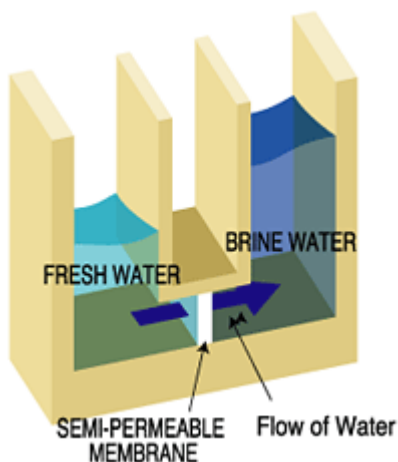
There is water in everywhere on the Earth, Total volume of water is available: The total volume of water on Earth is about 97.5% is sea water and 2.5% is freshwater. 70% of the planet's fresh water is frozen in the icecaps of Antarctica and Greenland; 30% is mostly found underground. Freshwater which is used by some sectors: Irrigation - 70%; Industry - 22%; Domestic use and 8%. Human water needs: The daily drinking water is required for each person is between 2 and 4 liters; it takes 2000 to 5000 liters of water to produce one person's food. Conserving water resources is 2% of freshwater will be produced via desalination by 2015.

Human cannot live without water at anywhere on Earth, also on board M.V. SEAFDEC. She had plan to storage and generate of water on board for crew living. Storage capacity fresh water tanks on board, capacity of drinking water tank is 46 tons, general fresh water tank about 93 tons. There are two system of fresh water maker on board.

1. Low pressure system,
2. Reverse osmosis desalination system (RO).

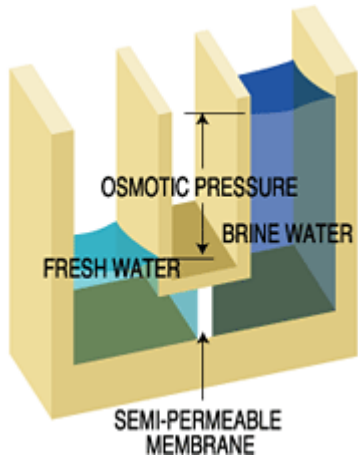
And now please let me to present you on Reverse osmosis desalination system.

II. Osmosis Method



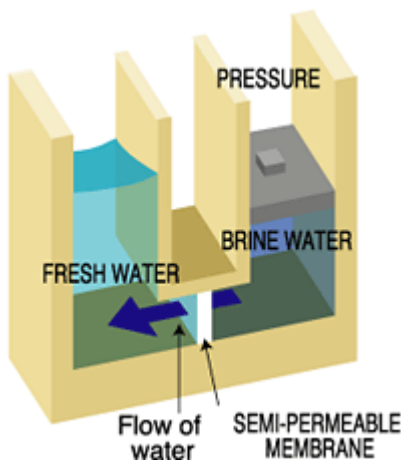
Osmosis is a natural phenomenon, the spontaneous passage of water through a semi-permeable membrane. When two fluids, fresh water and brine water, are separated by a semi-permeable membrane that is permeable to fresh water but not to salt, brine water will become more diluted by absorbing fresh water through the membrane or fresh water. It will start flowing through the membrane to the brine side. This process is named osmosis.

Osmotic Equilibrium



Osmotic pressure varies according to temperature and concentration of the brine water; however, as fresh water passes through the membrane, the levels of the two solutions become unequal. The resulting difference in pressure eventually brings the migration to a stop.

This pressure difference is called osmotic pressure of the brine water.

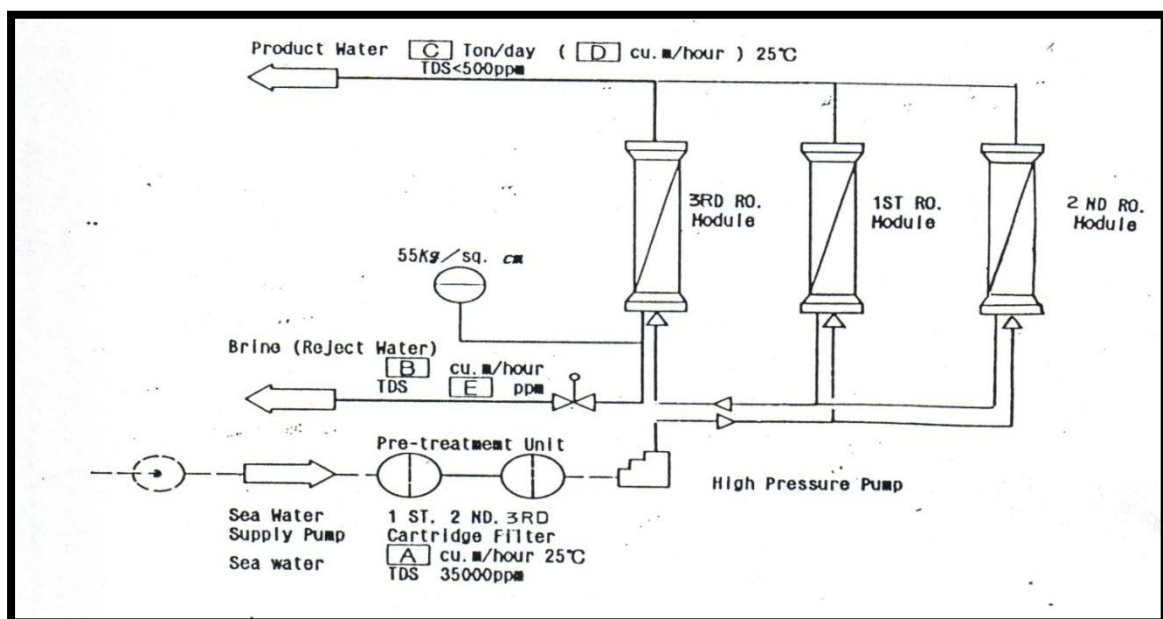


Reverse Osmosis

Reverse osmosis is the process of forcing the water from the salt waterside through a membrane to the fresh waterside by applying excess pressure.

This process is used in treating sea water to get fresh water.

RO WATER GENERATOR SYSTEM DIAGRAM ON BOARD M.V.SEAFFDEC



RO Generator System Expenditure on board

M.V.SEAFFDEC total working 42 days (1008 hours) desalination water 474,497 liters

Membrane cost is 0.10 baht/liter

Filter whole size of 1 micron and 50 micron for 1 set is cost 0.02 baht/liter

Electrical cost is 0.15 baht/liter

Distillation cost 1 liter is 0.27 baht / liters or 1 ton is 270 baht/m³

III. Results

Advantages

1. RO is the best solution for treating hard water.
2. RO is able to remove toxins such as lead, mercury, Fluoride, Arsenic, Chlorine which cause human body to be ill. Lead metal is able to make brain damage and anemia.
3. RO water filter is great for removing commonly found Cryptosporidium in lake, river and public supply water.
4. RO water can produce fresh water to make a cruise more longer than only storage capacity.

Disadvantages

1. Water wastage: substances which come out from the process will be disposed out of the vessel as waste water.
2. Expensive: RO water purifier is more costly when it is compared to UV water purifiers and RO water purifier consumes much more electricity.
3. Removes essential minerals: While RO water purifier removes dissolved impurities it removes natural mineral such as iron, magnesium, calcium and sodium which are essential to the human body and cause mineral deficiency to body.
4. Not kills bacteria, viruses: RO water purifier does not kill waterborne disease-causing bacteria and viruses. There is high probability that microorganisms can pass through RO membrane. (It is advisable to pass RO water through the UV water purifier to treat microorganisms)

IV. References

Murad, S., K. Oder, and J. Lin. 1998. "Molecular simulation of osmosis, reverse osmosis and electro-osmosis in aqueous and electrolyte solutions." *Molecular Physics* 95: 401-408.

Powles, J. G., and S. Murad. 1998. "The simulation of semi-permeable membranes: Osmosis, reverse osmosis and electro-osmosis in electrolyte solutions." *Journal of Molecular Liquids* 78: 225-231.

Powles, J. G., B. Holtz, W. A. B. Evans, and S. Murad. 1997. "Can osmotic pressure be negative?" *Molecular Physics* 90: 665-670.

Wang et al. (1996). *Am J Clin Nut* 69: 833-841

Mitchell et al. The Journal of Biological Chemistry, 1945: 625-637.

M.V. SEAFDEC Reverse Osmosis Recording Log book.

Sasakura's manual on board M.V. SEAFDEC.