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Desalination of Seawater Using the Reverse Osmosis Method by Utilizing the Static Pressure due to the Depth of the Sea

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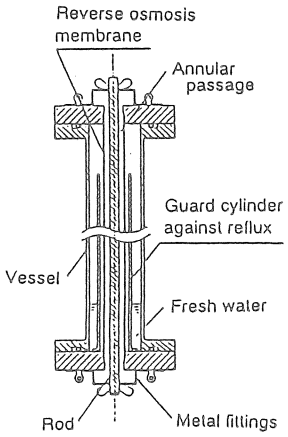
Summary

When a device containing the reverse osmosis membrane tubes, as shown in the figure, is put into the sea at a depth of 500-700 meters from the sea surface, it may be possible to get fresh water from seawater through the reverse osmosis membrane by utilizing the high static pressure at that depth. The concentrated seawater flows out from the membrane tubes by natural convection caused by concentration difference.



In order to increase the quantity of fresh water obtainable from seawater, it is necessary to increase the flow rate in the membrane tubes and thereby to decrease the concentration polarization which appears on the membrane surface. For this purpose, a cylindrical rod is put into the central axis of each membrane tube. In this research, a numerical analysis is conducted to clarify the characteristics of the natural convection occurring in the narrow annular passage between the membrane tube and the rod. As the first step, it is assumed that the narrow annular passage is the passage formed between two parallel plates, and concentration of the membrane surface is uniform.

The numerical results show that the flow rate increases with increasing tube length, and there exists the optimum clearance and length of the passage at which flow rate becomes maximum and mass transfer is accelerated. Therefore, the concentration polarization may be reduced by the selection of the appropriate clearance and length of the passage.

The above mentioned results are based on the assumption of constant concentration on the membrane surface. In future, numerical analysis will be performed with the variable concentration on the membrane surface.