

Power Production of Osmotic Pressure

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About the power production of osmotic pressure

- Osmotic pressure is the pressure caused by a difference in concentration.
- $P = RCT$ (P : osmotic pressure, R : gas constant, C : molarity, T : absolute temperature)

AIM

- To manufacture a film that has a large surface area and doesn't happen concentration polarization. Examine the amount of power generated in the flat film, which is the standard for this purpose, and consider the utility of osmotic power generation

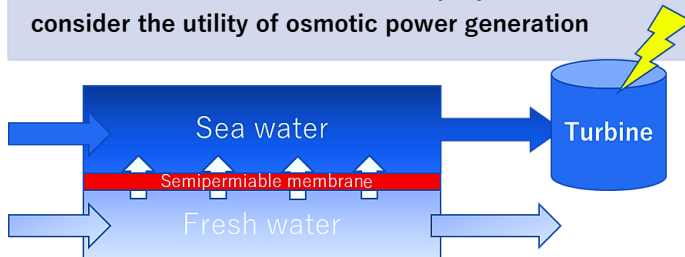


Figure1 Mechanism of osmotic power generation

EXPERIMENT 1 : METHOD

- AIM: We examined the relationship between time and the amount of permeated water based on the height of the water surface.
- METHOD: Prepare a 2.0 mol/L saline solution and place it in the experimental apparatus of Fig. 2. Check the change in height from the reference surface of the water surface every 5 minutes.

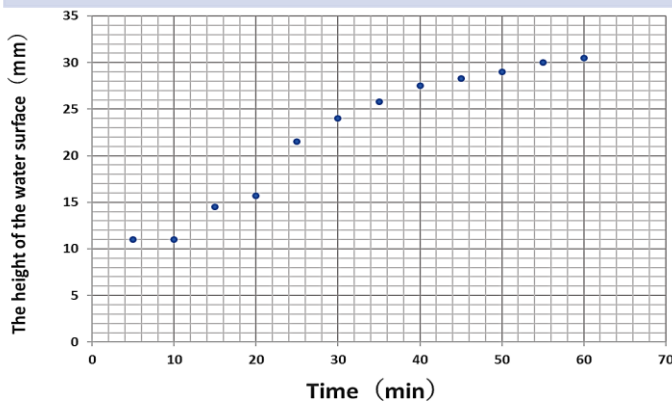


Figure2 Relationship between time and the height of water penetrated

Cause of Failure

- The solution leaked out because it was installed in the device while the membrane stretched.
- We used the semipermeable membrane of cellophane, instead of the actually used RO(revers osmotic)membrane that has very small holes.
- The pressure of the lid prevented the water surface to rise.

EXPERIMENT 2

- AIM :The relationship between time and amount the of permeated water was investigated based on the change in mass.
- METHOD : In the experimental setup of fig.3, 130.00g of a 2.00 mol/L saline was charged. We determined the amount of mass change.



Figure3 Experimental instrument 2

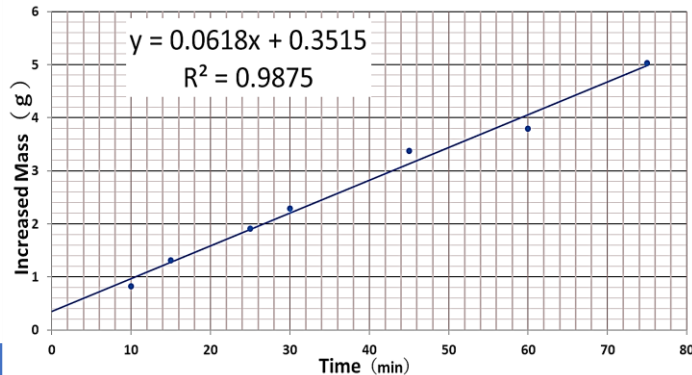


Figure 4 Relationship between time and mass of water penetrated

Consideration

- Permeability coefficient A ($m^3/(s \cdot m^2 \cdot Pa)$) : 2.86×10^{-14}
- Electricity power generation : $W = \eta \rho A F (\Delta \pi - \Delta P) \Delta P$
- (W : electricity power generation η : turbine efficiency ρ : density F : membrane area $\Delta \pi$: osmotic pressure ΔP : applied pressure)
- 0.06W (membrane:1m², temperature:20°C, saline:0.6mol/L). This electricity generation is inferior to other renewable energy.

Osmotic power Generation 0.06W/m²

Wind power Generation 1000W/unit

Solar power 140W/m²

Table1 Comparison with other renewable energies

Future prospects

- Use RO membrane
- Change membrane's surface shape
- Move the turbine to find real electricity generation

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