

Requirement for crystallization

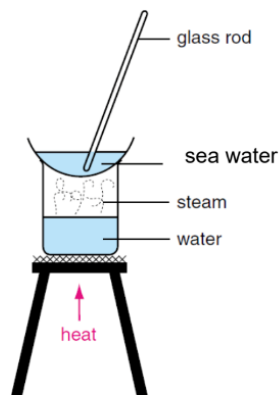
→ saturated solution
飽和的溶液

RCPHKMC 2021-2022 S.3 Chemistry

To extract ^①pure sodium chloride crystals from sea water, ^②crystallization is employed. 純 晶體

Step 1: Filter the insoluble solid from the solution by filtration.

Step 2: Warm the filtrated sea water in an evaporating dish until a saturated solution is obtained.



A saturated solution is a solution containing the maximum amount of solute at a certain temperature.

different solubility at different temperature
不同的溶解度

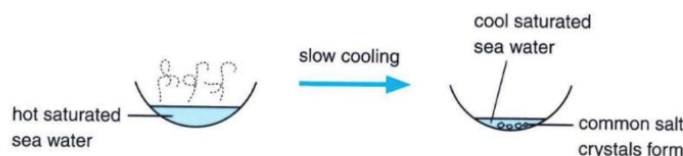
→ higher temperature
→ greater solubility

Note:

1. If the solution is not concentrated enough, no crystals will be obtained even after cooling.
2. To ensure the solution is saturated enough for crystallization, we dip a glass rod into the hot solution and take it out. If the immersed end becomes 'cloudy' with few seconds, the solution is saturated.

Step 3: Cool the solution slowly. Large sodium chloride crystals are obtained. (Crystallization)
^①pure

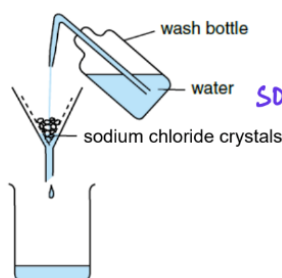
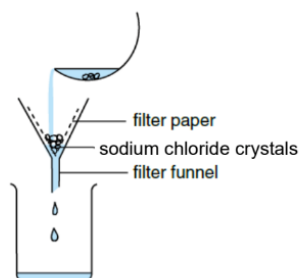
Crystallization is a method of separating a pure soluble solid (solute) from a solution. In crystallization, pure sodium chloride crystals can be obtained from a saturated solution of the filtered sea water.



Note:

1. If the solution is cooled quickly, small and less pure crystals will be formed.

Step 4: Filter off the crystals. Wash them with small amount of cold distilled water to remove soluble impurities on the surface, and dry them with filter paper.



Minimize the loss of sodium chloride because sodium chloride is soluble in water.
Dry the crystals using filter paper or oven

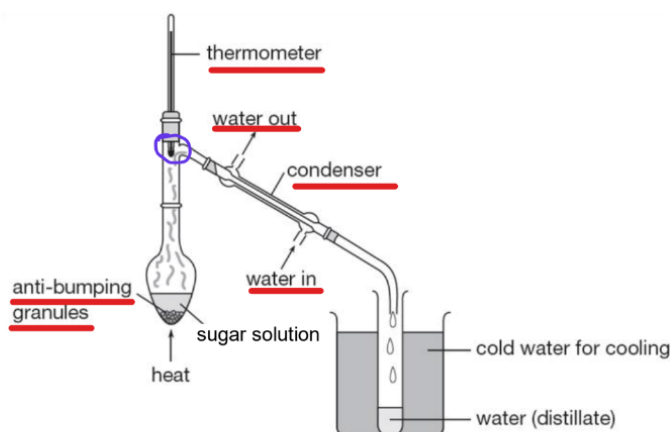
a). Mud and sodium chloride have different solubilities in water. Mud is insoluble in water while sodium chloride is soluble in water.

Example 2.1

- (a) Explain why filtration can be used to remove mud particles from muddy water but cannot be used to remove sodium chloride from sea water.
- (b) Describe briefly the procedure used to separate each component from a mixture of sand and sodium chloride.
- (c) You are given a sample of sugar solution.
- (i) Suggest and describe how pure water can be obtained from sugar solution.
- (ii) Draw a labeled diagram for the experimental set-up of the method stated in (i)

Answer

- (a) Sea water is a solution while muddy water is a suspension.
- The size of sodium and chloride ions in sea water is much smaller than that of the mud particles in muddy water.
- The ions in sea water can pass through pores in filter paper while mud particles cannot.
- (b) 1. Dissolve the mixture in distilled water.
2. Filter the mixture. Sand can be separated out from the mixture as residue.
3. Evaporate the filtrate to dryness, the solid obtained is sodium chloride.
- (c) (i) Pure water can be obtained by simple distillation. *Because sea water contains other solid impurities.*
- During distillation, sugar solution is heated to boil and water changes into steam. Then the steam is cooled and condenses into water which is collected as distillate.
- (ii)



Class Practice 2.3

1. Which of the following process is NOT used in extracting common salt from sea water?

- A. evaporation ✓
- B. distillation** : extract water from sea water
- C. crystallization ✓
- D. filtration ✓ remove soluble solid from sea water

2. When a glass of sea water is left on a table under room conditions for 10 days, what will be observed?

- A. Sea water becomes milky.
- B. Some crystals are formed.**
- C. Some white powder is formed.
- D. Sea water remains unchanged.

3. When a solution of sodium chloride is concentrated by heating for preparation of crystals, which of the following procedures can be used to check whether the solution is concentrated or not?

- A. Taste the solution to see if it is salty enough.
- B. Observe to see if the solution turns milky.
- C. Dip a glass rod into the solution, take it out to see if small crystals appear on the rod.**
- D. Measure the volume of the solution to see if it decreases at least by half of the initial volume.

salt to water ratio $\frac{30}{100} = 0.3$

4. If 100 cm³ of water can dissolve a maximum of 30 g of salt Y at room temperature, which of the following would produce a saturated solution?

greater than >0.3, saturated
smaller than <0.3, not saturated.

- (1)** Add 20 g of salt Y to 50 cm³ water at room temperature. $\frac{20}{50} = 0.4$
- (2)** Add 50 g of salt Y to 100 cm³ water at room temperature. $\frac{50}{100} = 0.5$
- (3) Add 40 g of salt Y to 200 cm³ water at room temperature. $\frac{40}{200} = 0.2$

- A. (1) and (2) only
- B. (1) and (3) only
- C. (2) and (3) only
- D. (1), (2) and (3)

5. Which of the following statements concerning a saturated sodium chloride solution is correct?

- (1) The boiling point of the solution is at 100°C → water
- (2) The amount of sodium chloride dissolved in water is the maximum at that particular temperature. ✓
- (3) The solution is so concentrated that it cannot dissolve any other substances. ✗

- A. (1) only
- B. (2) only**
- C. (1) and (3) only
- D. (2) and (3) only