Chemical Garden

Purpose

In the movie “Finding Nemo”, we have seen the beautiful underwater world. If it is possible to bring this beautiful underwater world back to our home and preserve it forever, then how good it is! ! Now, this wish can be realized. After our efforts, we have reduced the beautiful underwater world into a beaker. Want to do it? Do not buy, teaching assistants teach you how to do it! !

Equation

$$xSiO_2 + 2NaOH \xrightarrow{heat} Na_2O \bullet xSiO_2 + H_2O$$

（$Na_2O \bullet xSiO_2$）Water glass

x : 0.5~4

Principle

Due to the presence of non-volatile solutes, the vapor pressure of the solution is often reduced, which in turn causes the boiling point of the solution to rise, the freezing point to drop, and the occurrence of different permeation effects. Do you still remember the previous properties test?

$\Delta T = K_f C_m \times i$). In the animal and plant life systems, infiltration is a very important phenomenon. The semi-permeable membrane is sufficient for the solvent molecules or other smaller particles to pass, the larger particles cannot pass, and the pressure for the solvent to enter the solution through the semi-permeable membrane is called the osmotic pressure ($\pi V = nRT \times i$). The cell membrane of red blood cells is a semipermeable membrane. In plasma, the osmotic pressure of red blood cells is equal to the osmotic pressure of 0.9% saline solution, so red blood cells do not undergo any change in 0.9% saline solution. This concentration of saline is called physiological saline. If the red blood cells are placed in distilled water, the red blood cells gradually inflate due to permeation, and as a result, the cell membrane cannot withstand expansion and burst.

The water glass is a liquid aqueous solution of sodium metasilicate (Na_2SiO_3). When a metal salt crystal is added, a hemisilicate film is formed on the surface of the crystal. This film has a semi-permeable membrane effect, and the water in the water glass

passes through this half. The permeation membrane penetrates into the crystal, and the permeated water dissolves the crystal, so that the semi-permeable membrane expands and breaks and flows out of the dissolved metal aqueous solution. The surface of the effluent liquid forms a semi-permeable membrane of hemisilicate, and the water penetrates and breaks again. The solution flows out, so the growth continues, resulting in the formation of a number of threads that form a beautiful chemical garden.

Procedure

1. In a 100 mL beaker, add 5 mL of water glass, and add 25 mL of water(water glass : water = 1:5).
2. Add half spoon ofmetal salt particles (copper sulfate, magnesium sulfate, nickel sulfate, iron(III) sulfate) to water glass solution. After standing for 5 to 10 minutes, the beautiful garden form appeared.
3. Try not to shake the bottle, otherwise the crystal column will break.
4. After leaving for a day, carefully remove the water glass and replace it with clean water, and the beautiful garden iscompleted.

Copper sulfate → blue magnesium
sulfate → white
nickel sulfate → green
iron sulfate (III) → yellow brown