

Growing NaCl Salt Crystals

If one looks closely at table salt, one sees tiny crystals that tend to have an orthorhombic shape, one with right-angle corners. We can grow larger crystals by dissolving salt in water and then allowing the water to slowly evaporate. If the evaporation is too fast, the crystals formed are numerous and small, but under the right conditions of slow evaporation and constant temperature, larger crystals will grow.

When a few grams of table salt (NaCl) is put in 100 grams (= 100 mL) of water at room temperature, it quickly disappears. Its sodium and chloride atoms separate into sodium ions and chloride ions and spread throughout the water. As more salt is added, it takes longer to dissolve until, at 35.9 grams at 20 °C, no more salt will dissolve no matter how long one waits. If water is heated to boiling, another 4 grams can be dissolved.

Our procedure will therefore be to carefully measure 38 g of salt, and then add 100 g of hot water (about 80° C). When stirred, all of the tiny salt crystals should disappear into the water (dissolve). As the solution cools back to room temperature, about 2 g of salt should then come out of the solution (precipitate) and settle at the bottom of the beaker. We will then pour the solution through a coffee filter into another beaker so that we will finally have a saturated salt solution with no extra salt. That solution will be poured into a large plastic container laying on a flat side.

As the water in the solution evaporates over the following weeks, NaCl crystals will grow. With luck, some will be over a centimeter in size.

Growing Sucrose Crystals

Growing sucrose crystals should be very similar except that sucrose is much more soluble in warmer water:

2.00 g/mL at 25 °C 2.59 g/mL at 50 °C 3.46 g/mL at 75 °C

I have not yet done this myself, but the result should be "rock candy."

Growing Pretty Blue (and toxic!) Crystals

Cupric sulfate (Copper(II) Sulfate) $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ forms pretty blue crystals which would be wonderful except that copper sulfate is toxic and small children would be tempted to pop some into their mouths. Cupric sulfate can be found in the garden supply section of a hardware store as it is used as a fungicide among other uses. Its solubility in water is

0.231 g/mL at 0 °C 0.32 g/mL at 20 °C 1.14 g/mL at 100 °C

We will use cupric sulfate to demonstrate a technique of copper plating later in the course.

Note: The solubility of a great many substances is listed at http://en.wikipedia.org/wiki/Solubility_table.