13.3 Supersaturated solution of sodium acetate trihydrate

Subjects: Solutions, supersaturation

Description: When a supersaturated solution of sodium acetate trihydrate is poured onto a seed crystal on a surface, it crystallizes. A column of crystallized material can be produced. Alternatively, a seed crystal is added to a solution, the solute precipitates.

Materials:

For Performing Demo:	For preparation or recycling of solution:
-Prepared supersaturated solution in 1L Erlenmeyer flask. -piece of hardboard -spatula -seed crystals of sodium acetate trihydrate‡	-175 grams sodium acetate trihydrate ($NaC_2H_3O_2.3H_2O$) ‡ -50 mL distilled water -2 L beaker* -hot plate* -500 mL Erlenmeyer flask -100 ml beaker
‡Located in general chemical storage cabinets *Shared items. Hot plates are located in the top drawer of the center bench opposite the chemical storage cabinets. The two liter beaker is located on the shelf above the prep shelf.	

Preparation of the supersaturated solution:
Fill the 2 liter beaker about three-fourths full of water and heat it on a hot plate to boiling. To prepare the solution, place 175 grams of sodium acetate trihydrate and 50 ml of distilled water in the 500 ml Erlenmeyer flask. Heat the mixture in the boiling water bath and swirl the flask occasionally until a clear homogenous solution is obtained. Invert the 100 ml beaker over the mouth of the flask and allow the solution to cool undisturbed until it reaches room temperature.

Procedure:
1. Place a few crystals of sodium acetate trihydrate or sodium acetate on the piece of clean hardboard and slowly pour the solution onto the crystals.
2. A mound of white solid should form. The solid will feel warm to the touch. If crystallization does not occur, add a few more crystals.

Disposal:
The supersaturated solution can be recycled. Cut up the solid and it put back into the flask. Restore the solution by heating it in a boiling water bath. The solution can be reused until it becomes contaminated. Over time, small amounts of water may need to be added to compensate for evaporation loss. Once disposal is warranted, place in an appropriate aqueous waste container.

Discussion:
A supersaturated solution holds more dissolved solute tan the amount in a saturated solution. These solutions are unstable and will crystallize from solution when disturbed.

In this experiment the composition of the solution is 88g sodium acetate/100g water. The 100 g water includes the added water and water of hydration.
The heat of solution of sodium acetate trihydrate is 19.7 +/-0.1kJ/mol. It is an endothermic process. Thus the crystallization process is exothermic and the crystals feel warm to the touch.

Safety: The solutions are hot enough to cause burns. Use gloves and goggles when performing the experiment. If sodium acetate touches your skin, rinse with water.

References:
1. B.Z. Shakhashiri; *Chemical Demonstrations: A Handbook for Teachers of Chemistry*; Wisconsin; Volume 3; 1989; p. 27-32 (procedure A)