Chemistry 254
Experiment 4
Solubility of a solid

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Abstract

In this practical the temperature dependence on the solubility of benzoic acid is investigated. This is related to the enthalpy of solution by use of the Van 't Hoff equation

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1 Results

At 20 ℃ the concentration of benzoic acid was 0.02173 M, while at 30 ℃ it was 0.02929 M

The temperature independent ΔH^0 was calculated to be 22.064 kJ

A static export of the notebook containing all analysis and figures is availible at `https://adammenne.github.io/chemistry_254/practical_4/notebook.html`. With full source code availble at `https://github.com/AdamMenne/chemistry_254/tree/master/practical_4`

2 Discussion

The titrations carried out were consistent with both sets having standard deviations below 0.00014.

Appendix A Additional tasks

1. 0.02529

2. This rearrangement of the Van 't Hoff equation is possible due to the fact that $\frac{d\frac{1}{T}}{dT} = -\frac{1}{T^2}$

3. The Van 't Hoff plot for a reaction that has a temperature dependant standard enthalpy will not be linear. With an adequate sample size over an appropriate range of temperatures, a polynomial fit will allow the gradient at any temperature to be found, and thus the standard enthalpy of solution to be calculated.

Appendix B Flow Diagram

1. Heat a 25 cm^3 pipette with a hair dryer, attach cotton filter, and fill past the mark
2. Remover filter, wipe off crystals, and evacuate the pipette to the mark
3. Empty into Erlenmeyer flask, washing with ethanol, add 2 to 3 drops phenolphthalein
4. Titrate with 0.1 M $NaOH$
5. Clean pipette with ethanol followed by acetone, and dry
6. Repeat 3 times for both temperatures

Appendix C MSDS

Benzoic acid

- Corrosive, health hazard

- causes serious eye damage

- may cause respiratory irritation

- if in contact with skin or eyes wash for several minutes

Sodium hydroxide

- Corrisive

- may cause skin burns, eye damage

- if in contact with skin or eyes wash for several minutes