Change in boiling point of water with molarity

Introduction This is experiment verifies the effect of common salt on the boiling point of water. In it beakers filled with the same of amount of distilled water containing different amounts of dissolved common salt are used and the aim is to determine the boiling point of the aqueous solution in each beaker. The expectation is that the aqueous solution with more dissolved NaCl will boil at a higher temperature.

Methods and Materials

Four beakers were taken and labelled A, B, C and D respectively. All the beakers were filled with 100ml of distilled water measured with a standard test tube. In the beaker A NaCl was not dissolved. Concentration of this solution was expressed as 0 molar aqueous solution (0M). In beaker B 5. 8gms of NaCl was dissolved and hence a 1 molar aqueous solution (1M) was obtained. In the beaker C 17. 4gms of NaCl was dissolved and hence a 3 molar aqueous solution (3M) was obtained. Lastly in the beaker D 29. 0gms of NaCl was dissolved and the molarity of this aqueous solution was 5M. Then the beakers were heated on a burner and the temperature at which boiling commenced was recorded with a thermometer.

Results

The boiling point of water in the beakers A, B, C, D were observed to be 100oC, 101. 4oC, 103. 12o C, 105. 2oC respectively.

The above results can be summarized as follows in a tabular form

Beaker Label

A

B

C

D

Molarity of aqueous solution

0M

1M

3M

5M

Boiling point of water observed

100oC

101. 04oC

103. 12oC

105. 2oC

Graphically these values are:

Discussion and Conclusions

It is very clear that boiling point of the solution increases with molarity of the aqueous solution. It implies that the boiling point of water and the amount of dissolved salt, or molarity of the solution, are in direct proportion. If the increase in temperature were to be denoted by t and the molarity of the aqueous solution by M and if k were to be a constant, then,

t = kM

On using the observed values it can be seen that for beaker A and Beaker B,

t = 101. 04oC - 100oC = 1. 04oC

kM = k* 1

t = kM

1. 04oC = k* 1

Therefore, k = 1. 04 degrees Celsius litres per mole.

Hence a relationship between the increase in boiling point of water and the

molarity of the aqueous solution has been established as given by the equation just derived.

t = 1. 04*M.

These results prove the assumption that the aqueous solution with more dissolved NaCl will boil at a higher temperature.

Whilst conducting the experiment care has to be taken to ensure that,

1) Each of the four identical beakers contains 100ml of water.

2) This water should be distilled.

3) The salt should be pure and not a homogenous mixture.

4) The exact amounts of salt to get 0M, 1M, 3M, 5M aqueous solutions respectively should be dissolved in the water in the beakers. The formula Molarity = Moles of solute/Liters of Solution should be used for this purpose1.

If above precautions are not followed then there will be a variation in results depending on the extent of error in the quantities of salt and water.

Some of controlled variables are Normal Pressure of 1 atmosphere, Identical beakers in all regards like made of same dimensions and material, The burner level, Pure distilled water, etc. The independent variable was the molarity and the dependent variable was the temperature.

Hence it can be concluded that the boiling point of water increases with increase in the amount of dissolved NaCl.