Jacqueline Amaya Hernandez

Lab 8 – Evaporation and Intermolecular forces

December 5, 2019

**Abstract:**

In this experiment the temperature change in five different liquids were measured during the evaporation process. A temperature probe was used to measure the change in temperature in the liquid over time. The results concluded that the stronger the Intermolecular force the higher the boiling point.

**Introduction:**

Intermolecular forces are the force that holds two neighboring molecules together. The forces are held together by positive and negative electronegative charges. The strength of those charges is determined by the elements in the molecule. The weakest intermolecular force is London Dispersion which holds a polar molecule together for a short period of time and requires a low boiling point to break it apart. The middle force is Dipole-Dipole are a permanent force that is held together by the positive side of a molecule and the negative side of another with at least one electronegative element that pulls all other towards itself. Hydrogen-bonding is the strongest intermolecular force that requires the molecule to contain either OH, NH or FH. The point of this experiment was to determine how the strength of an Intermolecular Force effects the boiling point of a specific molecule. Also, to compare the five liquids to each other and determine how the intermolecular force influenced the results.

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**Experimental:**

The five liquid chemicals, n-pentane, 1-propanol, 1-butanol, 1-pentanol and 2-pentanone were placed in test tubes. A small square piece of filter paper was tightly wrapped around the tip of the temperature probe and a rubber band was used to hold it in place. The temperature probe was placed in the first test tube filled with n-pentane. The probe was held in the tube until the graph on the Logger Lite software had bottomed out at the maximum temperature. Once the temperature had reached a steady point the probe was removed and gently set onto the lab table. After 600 seconds the temperature had bottomed out to its minimum point on the graph. The maximum original temperature was subtracted from the final minimal temperature. The final number from the equation resulted in the temperature change during the evaporation process. The process listed above was repeated for each of the five liquids and the data was recorded.

**Results**

| | **$T_1$ (Max) (°C)** | **$T_2$ (Max) (°C)** | **$\Delta T$ (°C)** |
|---|---|---|---|
| **n-pentane** | **25.3** | **1.2** | **-24.1** |
| **1-propanol** | **25.3** | **16.4** | **-8.9** |
| **1-butanol** | **25.0** | **17.5** | **-7.5** |
| **1-pentanol** | **26.1** | **22.3** | **-3.8** |
| **2-pentanone** | **24.7** | **13.5** | **-11.2** |

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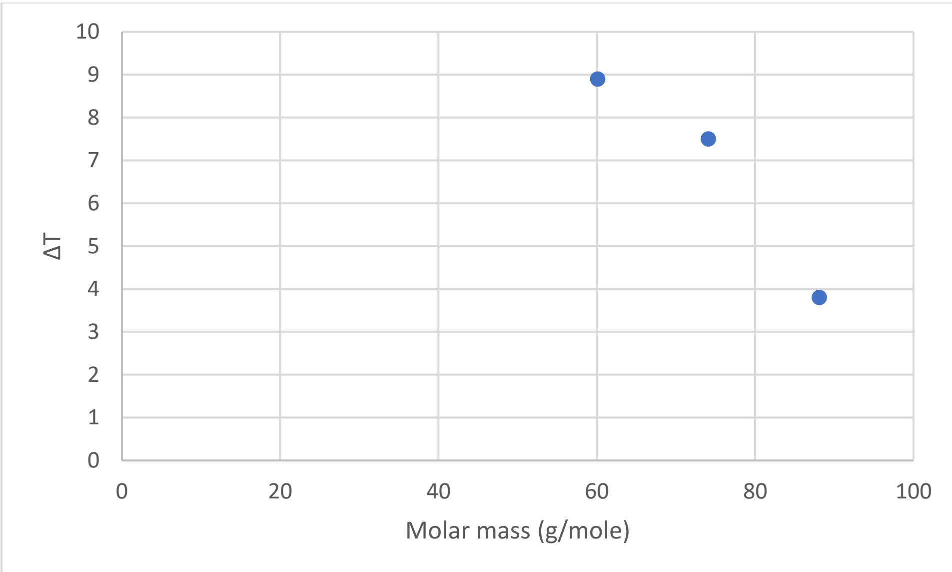


**Discussion**

Two of the liquids, n-pentane and 1-butanol, have nearly the same molar masses, but significantly different ΔT value. N-pentane demonstrated a low ΔT boiling point comparing it to 1- butanol who demonstrated a higher boiling point. This could have been because of each of the substance intermolecular force. Based on the data presented above it demonstrates that 1-propanol, 1-butanol, and 1-pentanol demonstrated stronger intermolecular force of attraction because they all have a have a Hydrogen bonding, which causes them to have a higher intermolecular force. The ones who showed a weaker intermolecular force was both n-pentane and 2-pentanone, they demonstrated a weaker bond because both substances don't have a Hydrogen bonding, they only have a London dispersion forces (LDF). Overall, according to the data presented, the following intermolecular force were ranked form strongest to weakest :1-pentanol, 1-butanol, 1-propanol, 2-pentanone, and n-pentane. As it seen in the figure above, when the three alcohol masses increase the ΔT decrease. This can be caused because the alcohol versus have a greater molecular force.

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**Conclusion**

This experiment was about determining the intermolecular force of attraction depending on the data of $\Delta T$. The result support the overall experiment, which was determined to be that with a lower $\Delta T$ the stronger the intermolecular force because they obtain the OH, which contains Hydrogen bonding.