

Research on Ethanol and Ice Cryogens

Kurioka Yui Shimomura Hayato Nakayama Tatsuki
Fujibayashi Tomoya Yoshida Akito

Abstract

Last year, we researched the relationship between ice melting time and liquid concentration. After researching, we learned that ice melts quickly in ethanol, and is used as a cryogen. We tested the conditions: “① cools fast, ② cools efficiently, ③ sustains low temperatures, and ④ low amount of ethanol required.”

1 Experimental method

In Experiment 1, we investigated the rate at which ice melts in water and ethanol. We put ten 1g pure water ice cubes in a glass beaker. The 50ml of pure water or 99.5% pure ethanol at different temperatures were added and stirred. Then, we measured the time taken for the ice to melt.

In Experiment 2, we examined changing the ratio of ethanol to ice. We placed a styrofoam cup in a container to reduce heat escaping. We added ten 1g pieces of pure ice and 2.5g~20g of ethanol was added and mixed. We measured the temperature change and the mass of the melted ice in 8 minutes.

2 Results and Discussion

In Experiment 1 when the liquid temperature was higher than 12 °C, the ice melted faster in water because ethanol had a lower specific heat and density.

On the other hand, when the liquid temperature was lower than 12 °C, the ice melted faster in ethanol because ethanol had a lower freezing point.

In Experiment 2 we found that the lower the mass of ethanol, the faster it cooled. Also, we found that the lower the mass of ethanol was, the lower the temperature was. Moreover, we found that the lower the mass of ethanol, the longer the duration. Lastly, we found that the cooling efficiency does not depend on the mass but depends on the contact area.

3 Conclusion

The ratio of ethanol to ice which was suitable for these conditions was about 8.4g of ice to 10g of ethanol under the experimental conditions.

4 References

· Goitsuka Y. 2021. Cryogen - Entropy introduction experiment - Chemistry and education · Kinura Y. 2019 “Ice + Alcohol” gets cold-On the rocks and cryogen Chemistry and Education · Kyoto Momoyama high school Global science club About the heat of mixing in ethanol-water system

5 Key words

· cryogen · specific heat