Does The Mpemba Effect really happen?

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Introduction

The Mpemba effect is the unexplained phenomenon that hot water freezes faster than cold water.

Theory and Experiment "Reproduction of the Mpemba effect"

○Outline: ▸Define "freezing" as "reaching -10℃".
▸Freeze 5℃ and 35℃ water simultaneously and measure the time to reach -10℃.

Figure 1: The general temperature change

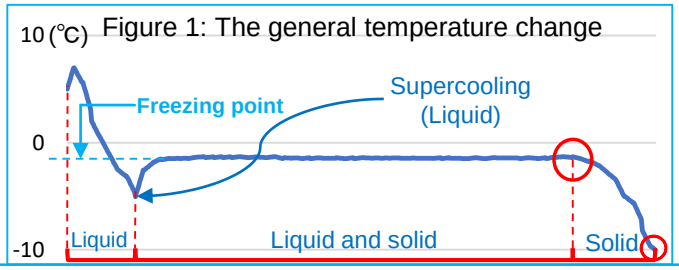
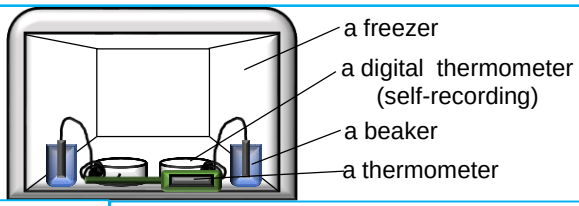


Figure 2: The device to measure the temperature of the central part of liquid

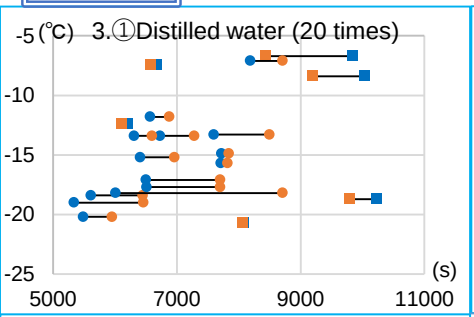
<The method>

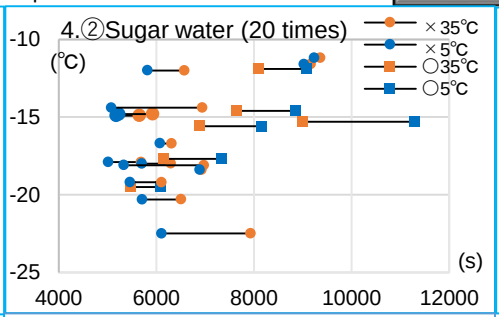
1. Put two beakers each of which is poured 5℃ and 35℃ distilled water, sugar water, and milk (40ml) into a freezer.
2. Measure the elapsed time to reach -10℃

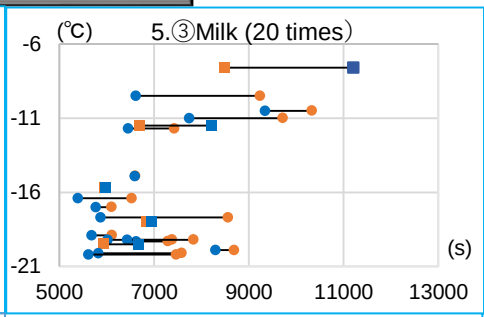


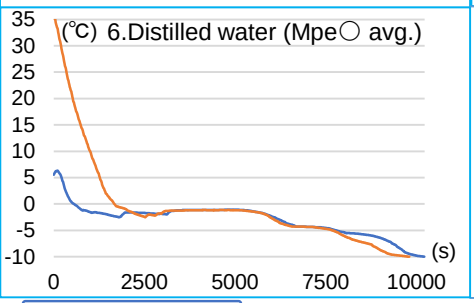
Results

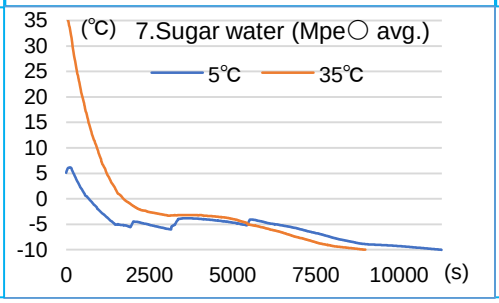
The vertical axis: the initial temperature in the freezer
The horizontal axis: the elapsed time to reach -10℃ ↴

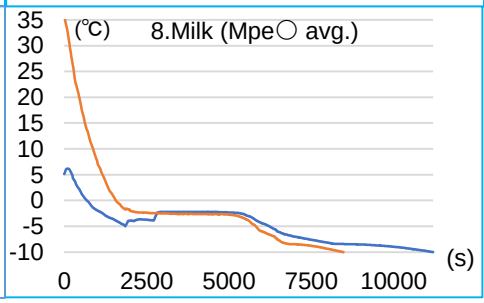












Discussion

▸ The probability of the Mpemba effect↴
①30% (6/20) ②30% (6/20) ③25% (5/20)
▸ The correlation between the initial temperature in the freezer and the difference in each elapsed time ↴
①**-0.51** ②**-0.28** ③**-0.25**

▸35℃ liquid is cooled below freezing point faster than 5℃ liquid.
▸ Regardless of the any kinds of liquid, the higher the initial temperature in the freezer is, the smaller the difference in each elapsed time is.

Conclusion

The Mpemba effect really happens, and it is a stochastic phenomenon.
I want to study about another condition under which it is likely to happen from now on.

References

・https://kimika.net/rr4reikyakukyokusen.html
"What is the cooling curve?"