



Prize Winner

Crystal Investigation

Year 9-10

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School**



HOW DOES THE ENVIRONMENT TEMPERATURE AFFECT THE FROWTH OF CRYSTAL?

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Pembroke School

ABSTRACT:

A crystal is a solid material whose components (such as atoms, molecules, or ions) are arranged in a highly ordered microstructure, forming a lattice that extends in all directions. The process of forming crystals through the crystal growth mechanism is called crystallization.

This experiment uses control variates, aims to test how does the environment temperature affect the growth of crystal.

There are two same beakers of same solution of potash alum, with same crystal seeds in there, and one of them is put into a room-temperature quiet place. The crystal progress is observed and recorded every day for size and clarity. The results are compared at last.

The results showed that the warmer temperature the crystal grows in, the clearer the crystal will be. The cooler temperature the crystal grows in, the bigger the crystal will be.

INTRODUCTION:

The topic is "How does the environment temperature affect the growth of crystal?" This experiment is designed to use the same solution of potash alum within environment temperature to test their growing status difference. If there is a difference, then find out how does the environment temperature affect the growth of crystal. (The warmer temperature the crystal grows in, the clearer the crystal will be. The cooler temperature the crystal grows in, the bigger the crystal will be.)

Aim

To investigate the relationship between the environment temperature and the growth status of crystal.

Background Information:

The solute of the solution ($KAl(SO_4)_2 \cdot 12H_2O$) which can then crystallize the crystal is potash alum ($KAl(SO_4)_2$) and the solvent is water. Potash alum is generally soluble in hot water, the solubility of potash alum in water is 195 g/100ml at 80°C, and the solubility increases with temperature increases. Also, from the research, crystal growth also requires light, the crystals will grow more quickly than in the dark. Warm air temperature aids water evaporation. Again, that will cause the crystals to grow more quickly than in cooler temperature.

Hypothesis

If environment temperature affects the growth status of crystal, then the warmer the environment temperature is, the bigger the crystal will grow. The growth rate of crystal in warmer environment is bigger than in cooler environment, because the vapor can evaporate more quickly.

Variables:

Independent Variable

Temperature where the solution is placed. (°C)

Dependent Variable

The growth status of crystal (size mm, clarity.)

Controlled Variable	How to keep this variable from changing

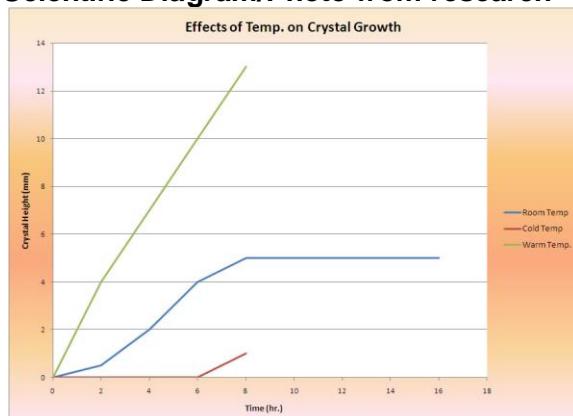
Equal solution.	Using same amount of water and same amount of equal purity chemical in same beaker.
Same crystal seed.	When choosing the crystal seed, try to find two similar same and clarity seeds.
Keep environment same except warmth.	Same dry, and noiseless environment where can achieve sunlight.

Potential Hazard	How to prevent/ reduce the danger
Use of glasses	Touch and pick them carefully when using, after finished, place them back into a safe place.
Use of hot water.	Pour hot water carefully.
Use of medicine.	Potash alum is not poisonous but still need to use correctly, clean the place after finishing, and wash hands and apparatus.

List of Materials & Apparatus

potash alum
 evaporating dishes
 beakers
 glass rods
 kettle for hot water
 medicine spoon
 tweezers
 transparent thin fishing line
 oven

Scientific Diagram/Photo from research



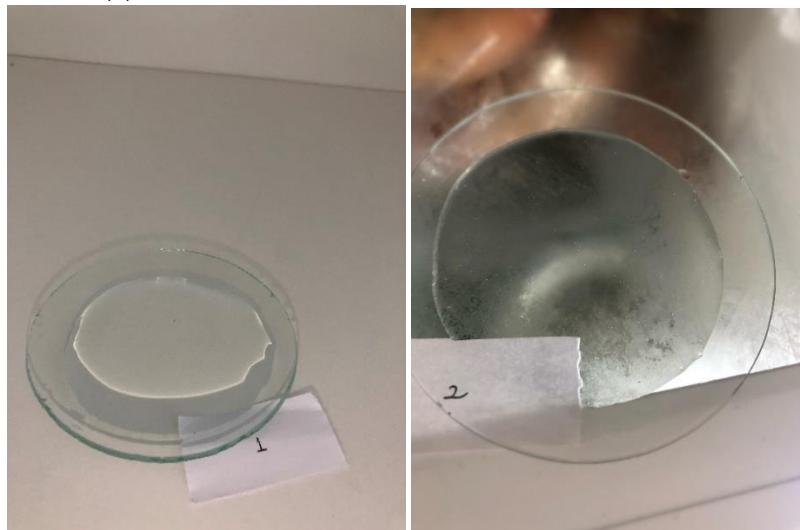
Method

1. Prepare the materials ready. Use kettle to prepare some boiling water.
2. Pour hot water into one beaker with 20 ml measured. Use medicine spoon to take potash alum into beaker, stir it slowly with glass rod and keep adding potash alum until there is no more can be solved (some suspended medicine in solution). Use oven to heat the beaker 15 seconds. Take the beaker out and add one more spoon of alum, stir the supersaturated solution slowly.
3. Let the beaker stand still for a while to make sure all the solid residue is settled at the bottom.
4. Pour only some of the upper clear aqueous solution onto two evaporating dishes evenly. Label the dishes using number one and two. Place the dish one into a room-temperature cabinet overnight. Place dish number two into fridge overnight.
5. Take the evaporating dish out of cabinet the next day. Pour out the solution left, check the little crystal seeds that crystalized on the dish. Use tweezer to pick up one crystal seeds in each dish with best size and clarity.
6. Contract the fishing line around these two crystal seeds, and tie a chopstick on the other side of fishing line.
7. Prepare new solution with of 40 ml water, and 2 full spoons of alum in two beakers which labelled one and two. Stir the solution slowly and keep adding alum until there is no more alum can be dissolved, let the beakers stand still for a while so all matter is settled. Use oven to heat the beaker 15 seconds. Take the beakers out and add one more spoon of alum in each, stir the supersaturated solution slowly.
8. Stuck the chopstick which tied the crystal seed from dish number one on the top of the beaker number one so the seed will suspend in solution. Same method for crystal number two and beaker number two. Place beaker number one into a room-temperature cabinet overnight. Place beaker number two into fridge overnight.
9. Observe the progress of crystal growth in two beakers every day and record the result. After observing, put the beakers back to the place they were.
10. If the crystal didn't grow much compare with last day. That may because the solution is no longer saturated, now saturated solution need to be configured. Also, the solution need to be configured once the solution evaporate
11. After observing the growth in 10 weeks, collect the result and analysis.
12. Clean the apparatus and put them back.

Observation result recording:

1. DAY ONE: 2022.03.11

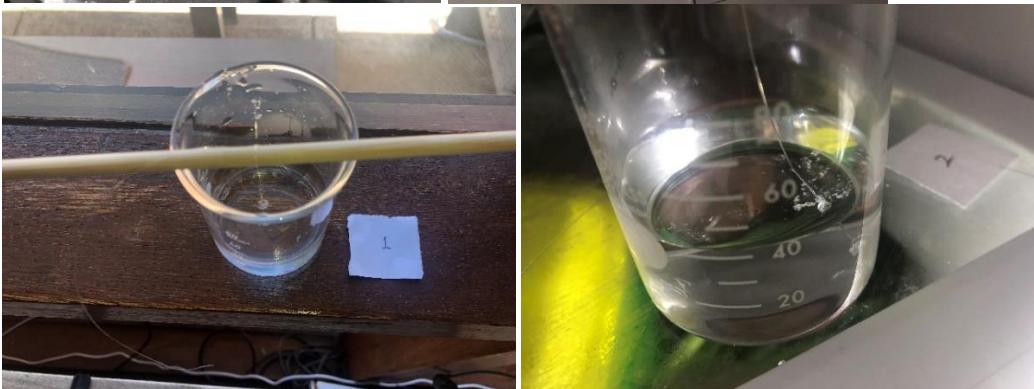
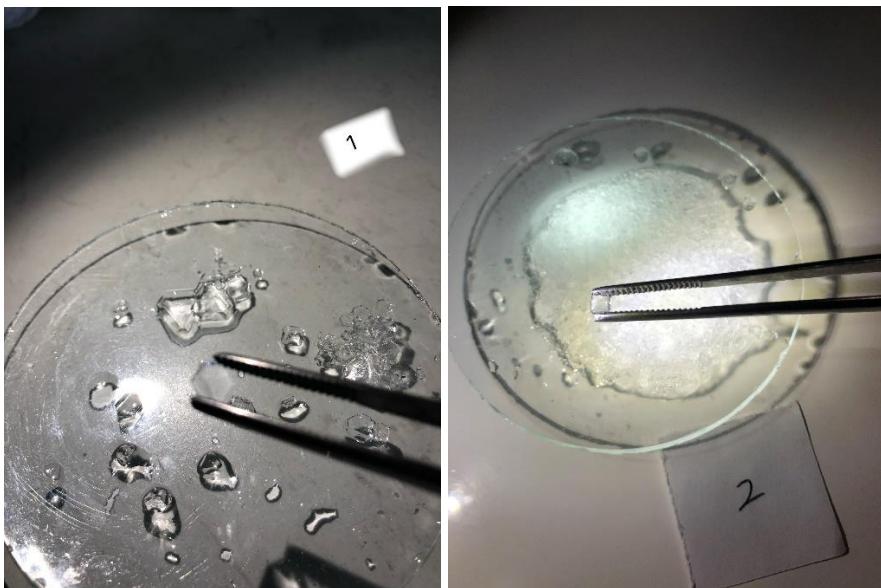
Did method 1,2,3 and 4.



2. DAY TWO: 2022.03.12

Did method 5, 6, 7, 8.

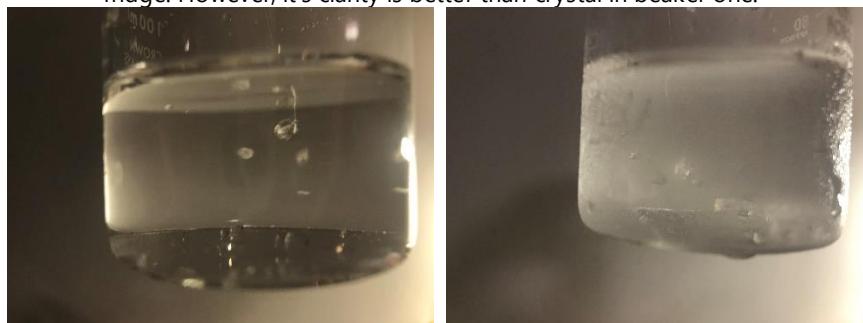
The observation today is the crystal seeds that crystalized in warmer temperature (dish 1) is much bigger and have sharpness of edges. However, the number of crystal seed in cooler temperature (dish 2) is more than in dish one.



3. DAY THREE: 2022.03.13

Start method 9.

The observation today is the crystal that grown in room temperature (beaker one) is smaller than the crystal grown in fridge (beaker two). Also, the edges of crystal in room are not as sharp as the crystal in fridge. However, it's clarity is better than crystal in beaker one.



4. DAY FOUR: 2022.03.14

The observation today is just as yesterday, the crystal in room temperature is smaller than crystal in fridge, and the edges are not as sharp as in fridge. But it is clearer.

The solution in beaker one decreases a lot so it was added some more solution.



5. **DAY FIVE: 2022.03.15**

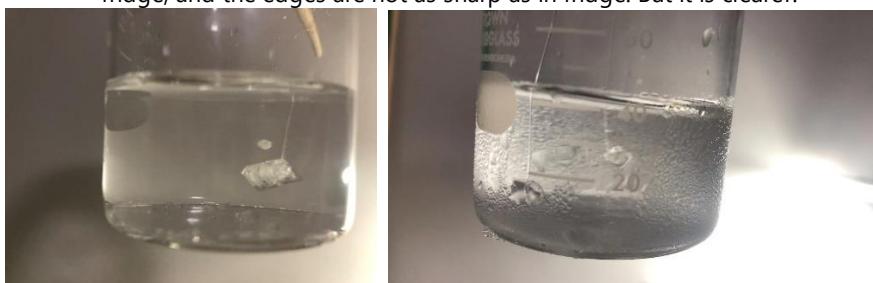
The observation today is just as yesterday, the crystal in room temperature is smaller than crystal in fridge, and the edges are not as sharp as in fridge. But it is clearer.

The solution in beaker two decreases a lot so it was added some more solution.



6. **DAY SIX: 2022.03.16**

The observation today is just as yesterday, the crystal in room temperature is smaller than crystal in fridge, and the edges are not as sharp as in fridge. But it is clearer.



7. **DAY SEVEN: 2022.03.17**

The observation today is just as before, the crystal in room temperature is smaller than crystal in fridge, and the edges are not as sharp as in fridge. But it is clearer.



8. **DAY EIGHT: 2022.03.18**

The observation today is just as before, the crystal in room temperature is smaller than crystal in fridge, and the edges are not as sharp as in fridge. But it is clearer.



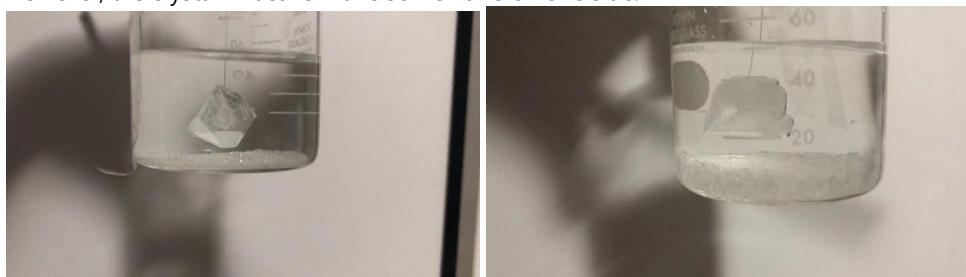
9. **DAY NINE: 2022.03.19**

The observation today is just as before, the crystal in room temperature is smaller than crystal in fridge, and the edges are not as sharp as in fridge. But it is clearer.



10. DAY TEN: 2022.03.20

The observation today is just as before. The crystal in both beakers have a huge progress on size. However, the crystal in beaker have some flaws on one side.



11. DAY ELEVEN: 2022.03.21

The observation today is just as before. Due to the size of two crystals grew a lot. The difference of clarity between two beakers is more obvious.



12. DAY TWELVE: 2022.03.22

The observation today is just as before, the crystal in room temperature is smaller than crystal in fridge, and the edges are not as sharp as in fridge. But it is clearer.



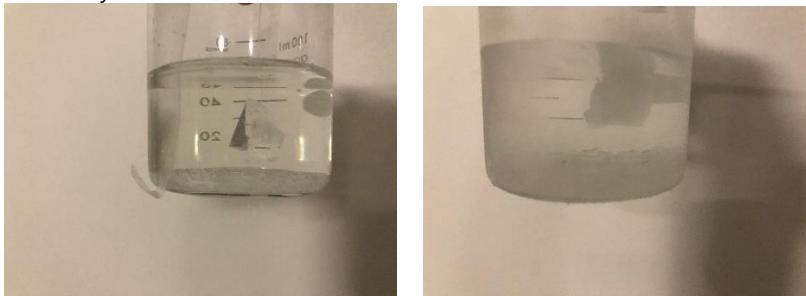
13. DAY THIRTEEN: 2022.03.23

The observation today is the crystal in beaker one grow a bit but crystal in beaker two barely grow. The solution in beaker one decreases a lot so it was added some more solution.



14. DAY FOURTEEN: 2022.03.24

The observation today as same as yesterday. The crystal in beaker one grow a bit but crystal in beaker two barely grow. They look almost similar in size, crystal in beaker one just a bit smaller than another. The clarity in beaker one is better.



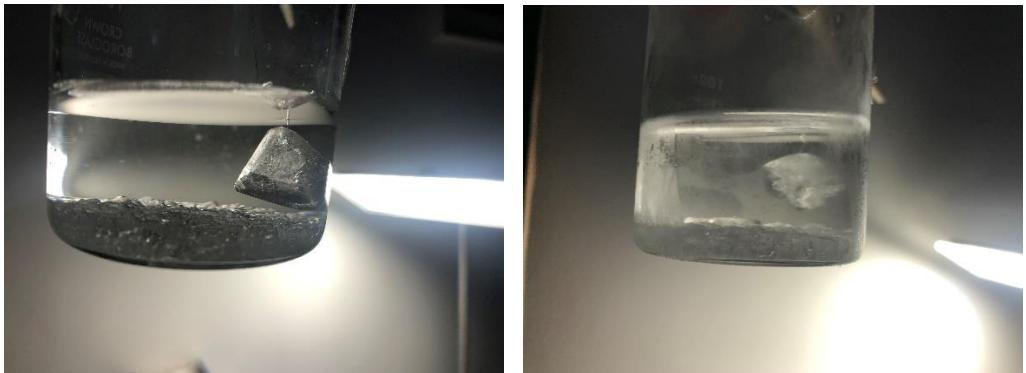
15. DAY FIFTEEN: 2022.03.25

The observation today as same as yesterday. The crystal in beaker one grow a bit but crystal in beaker two barely grow. Crystal in beaker one just a bit smaller than another. The clarity in beaker one is better.



16. DAY SIXTEEN: 2022.03.26

The observation is the crystal in beaker one grow a bit but crystal in beaker two barely grow. Crystal in beaker one is just same as another. The clarity in beaker one is better, and the sharpness of edge become better.



17. DAY SEVENTEEN: 2022.03.27

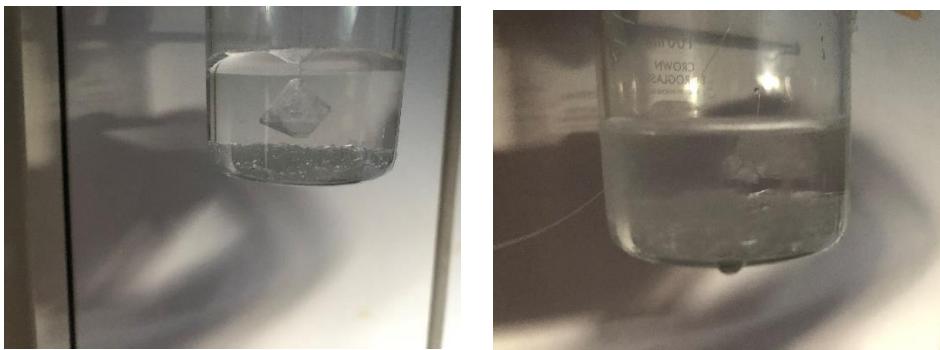
Both of the crystals barely grow. The clarity in beaker one is better, and the sharpness of edge become better. The sharpness of edges of crystal in beaker two seems blurrier.



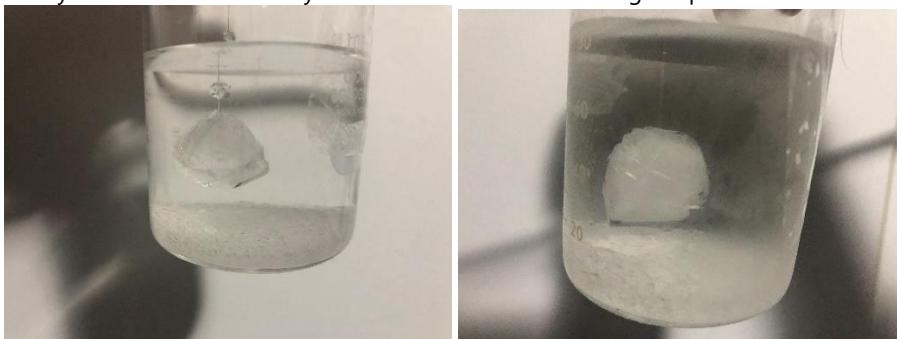
18. DAY EIGHTEEN: 2022.03.28

The observation today is same as yesterday.

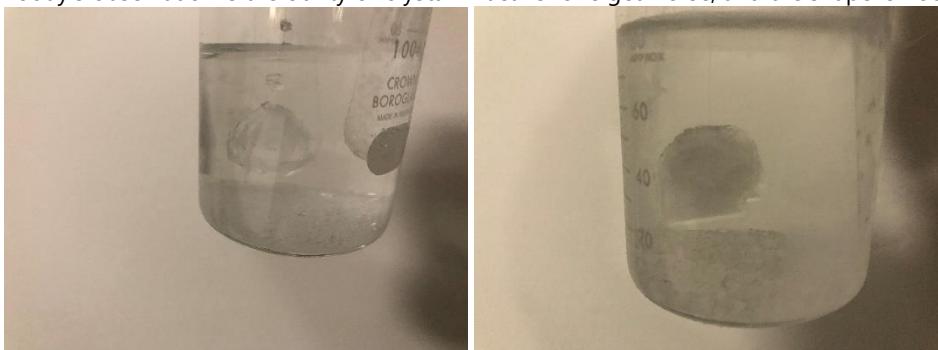
There is no enough water in beaker two so more solution is added.

**19. DAY NINETEEN: 2022.03.29**

Today's observation is the crystals in both beakers has a huge improvement in size.

**20. DAY TWENTY: 2022.03.30**

Today's observation is the clarity of crystal in beaker one get worse, and the shape is not that perfect.

**21. DAY TWENTY-ONE: 2022.03.31**

Today's observation is same as yesterday.

To work out why the crystal in beaker one has a worse clarity than before, the guess is because it is put next to the window and the weather these days are getting cold, that effect the clarity. The beaker one is moved in to room to make the room temperature of it warmer, just like before.

**22. DAY TWENTY-TWO: 2022.04.01**

Today's observation is the new layer from beaker one is clearer than yesterday. The guess is correct.



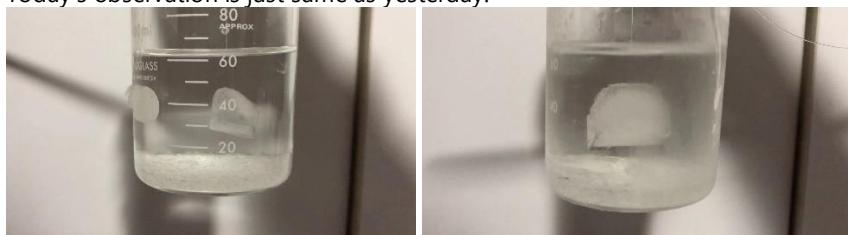
23. DAY TWENTY-THREE: 2022.04.02

Today's observation is both crystals didn't have a obvious progress in size.



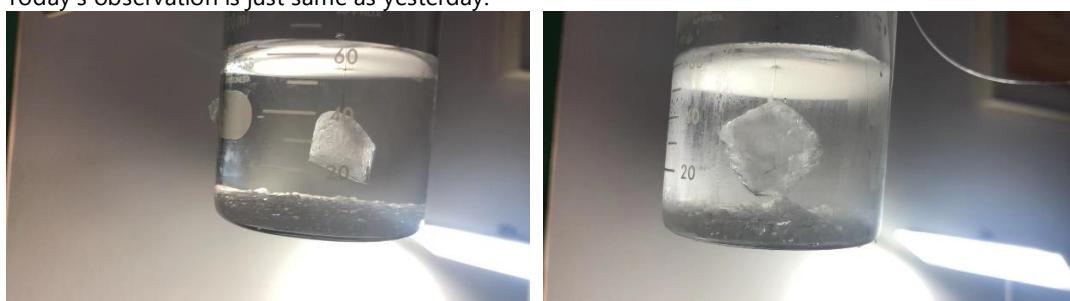
24. DAY TWENTY-FOUR: 2022.04.03

Today's observation is just same as yesterday.



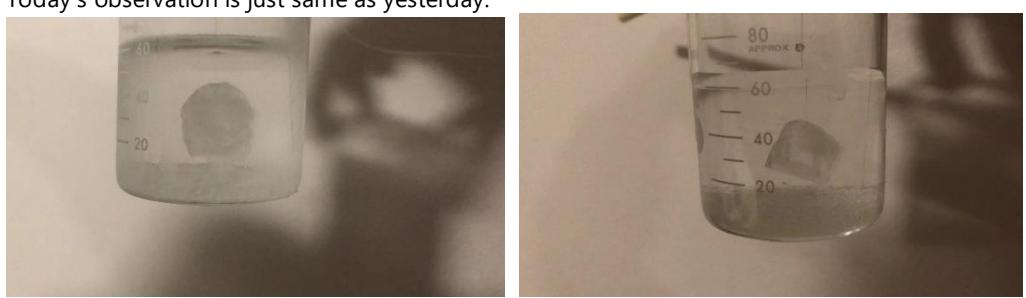
25. DAY TWENTY-FIVE: 2022.04.04

Today's observation is just same as yesterday.



26. DAY TWENTY-SIX: 2022.04.05

Today's observation is just same as yesterday.



27. DAY TWENTY-SEVEN: 2022.04.06

Today's observation is just same as yesterday.



28. DAY TWENTY-EIGHT: 2022.04.07

Today's observation is just same as yesterday.



29. DAY TWENTY-NINE: 2022.04.08

Today's observation is just same as yesterday.



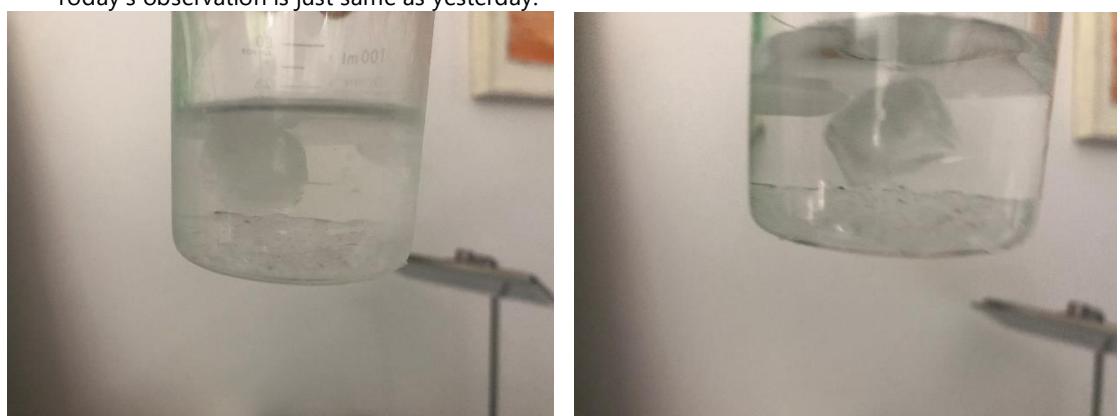
30. DAY THIRTY: 2022.04.09

Today's observation is just same as yesterday.



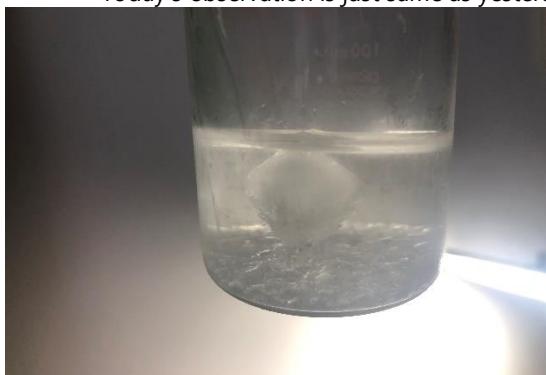
31. DAY THIRTY-ONE: 2022.04.10

Today's observation is just same as yesterday.



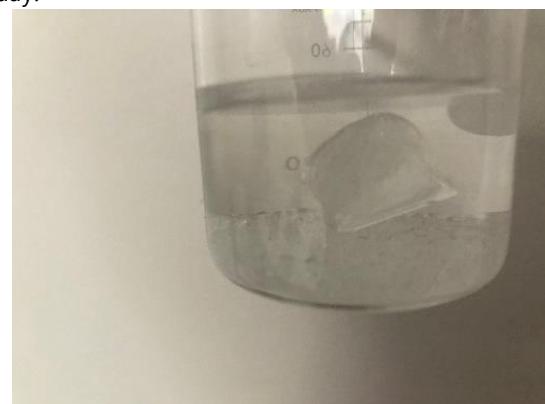
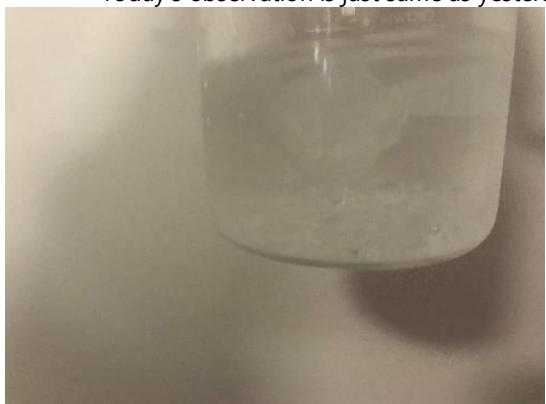
32. DAY THIRTY-TWO: 2022.04.11

Today's observation is just same as yesterday.



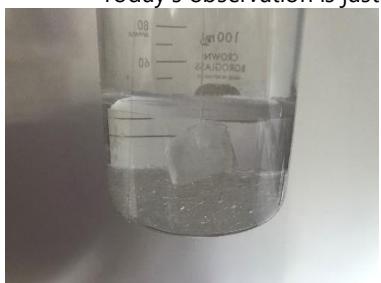
33. DAY THIRTY-THREE: 2022.04.12

Today's observation is just same as yesterday.



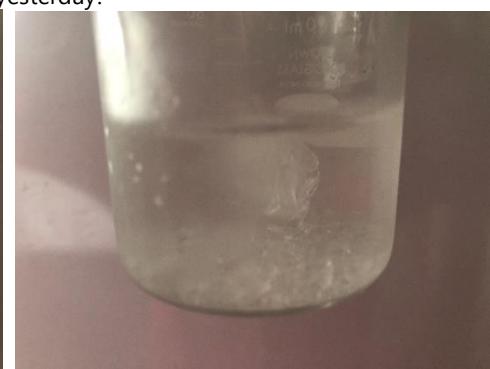
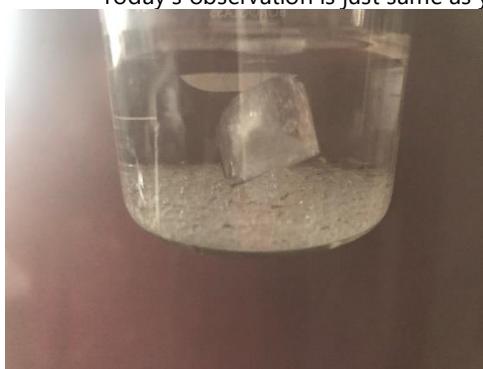
34. DAY THIRTY-FOUR: 2022.04.13

Today's observation is just same as yesterday.



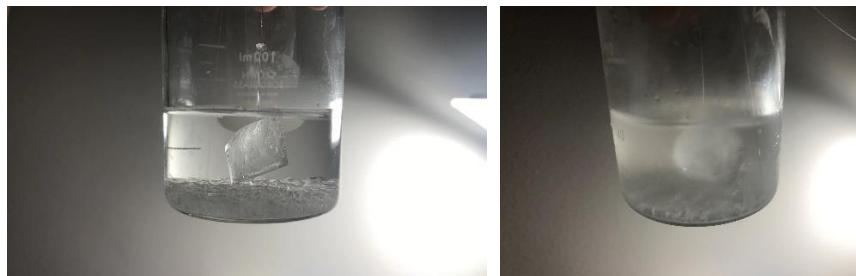
35. DAY THIRTY-FIVE: 2022.04.14

Today's observation is just same as yesterday.



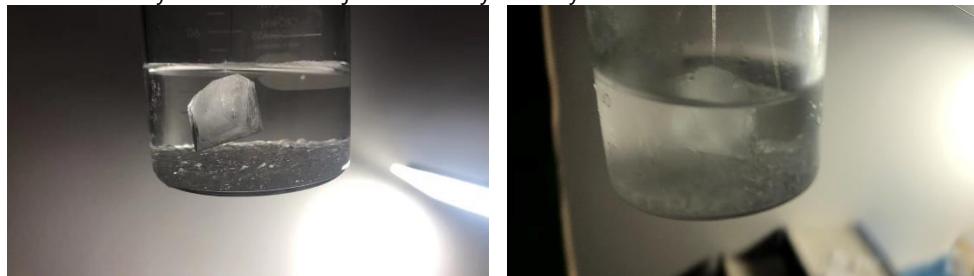
36. DAY THIRTY-SIX: 2022.04.15

Today's observation is just same as yesterday.



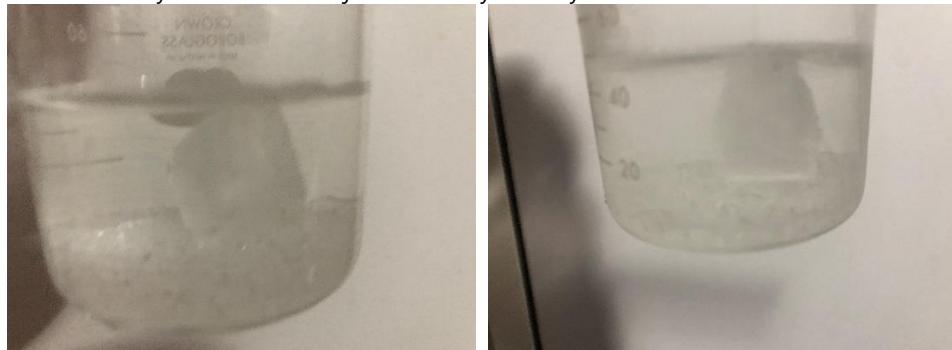
37. DAY THIRTY-SEVEN: 2022.04.16

Today's observation is just same as yesterday.



38. DAY THIRTY-EIGHT: 2022.04.17

Today's observation is just same as yesterday.



39. DAY THIRTY-NINE: 2022.04.18

Today's observation is just same as yesterday.



40. DAY FORTY: 2022.04.19

Today's observation is just same as yesterday.

There is no enough water in beaker two so more solution is added.



41. DAY FORTY-ONE: 2022.04.20

Today's observation is just same as yesterday.



42. DAY FORTY-TWO: 2022.04.21

Today's observation is just same as yesterday.



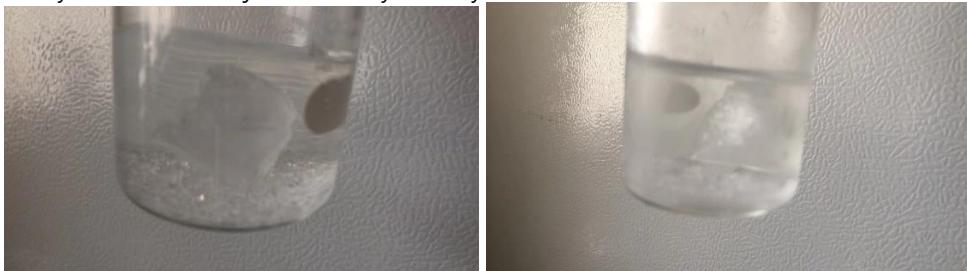
43. DAY FORTY-THREE: 2022.04.22

Today's observation is just same as yesterday.



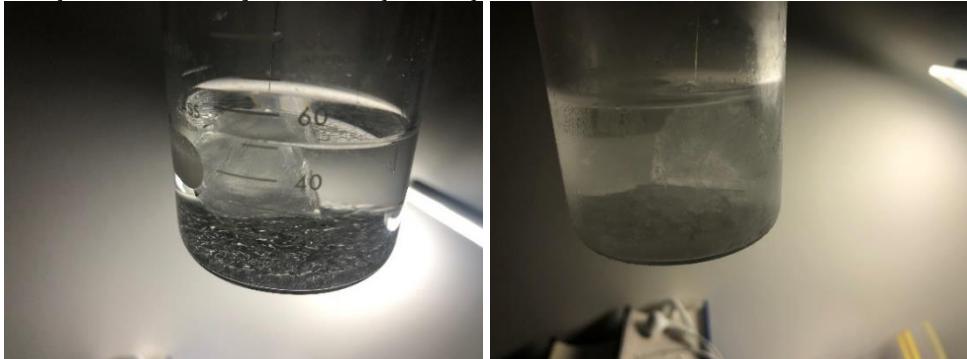
44. DAY FORTY-FOUR: 2022.04.23

Today's observation is just same as yesterday.



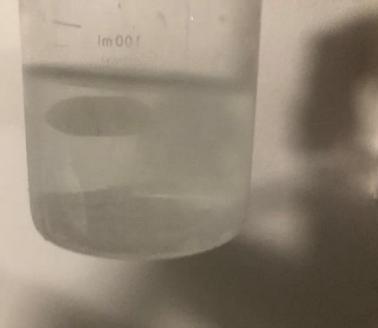
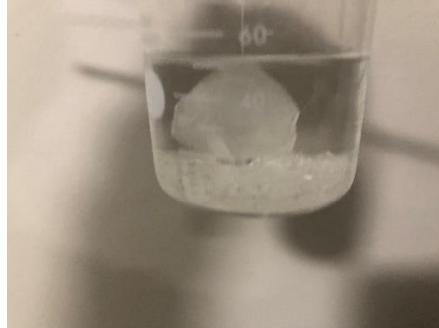
45. DAY FORTY-FIVE: 2022.04.24

Today's observation is just same as yesterday.



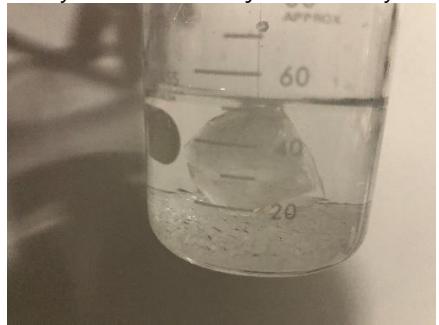
46. DAY FORTY-SIX: 2022.04.25

Today's observation is just same as yesterday.



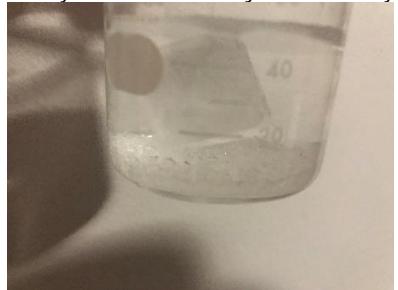
47. DAY FORTY-SEVEN: 2022.04.26

Today's observation is just same as yesterday.



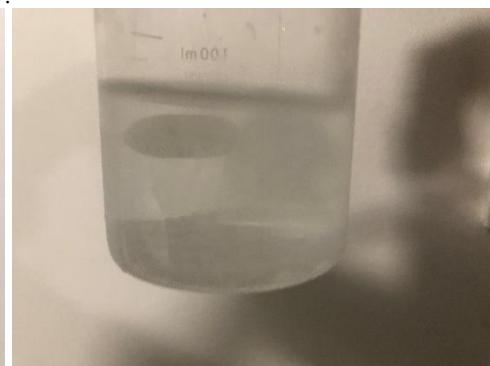
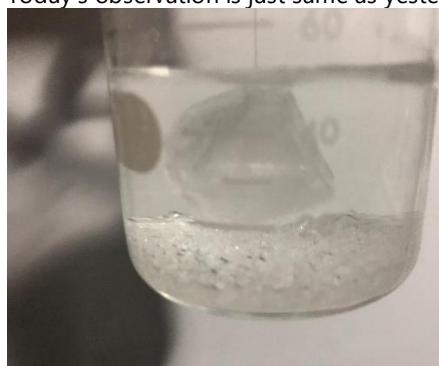
48. DAY FORTY-EIGHT: 2022.04.27

Today's observation is just same as yesterday.



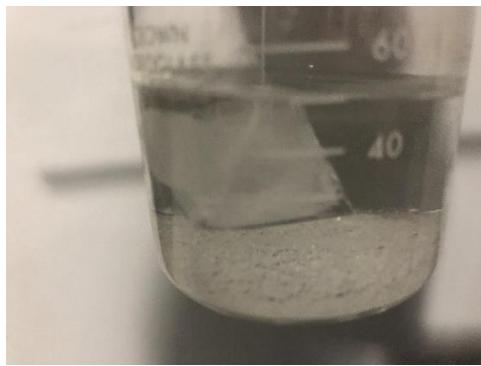
49. DAY FORTY-NINE: 2022.04.28

Today's observation is just same as yesterday.



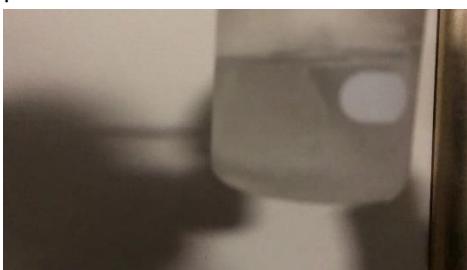
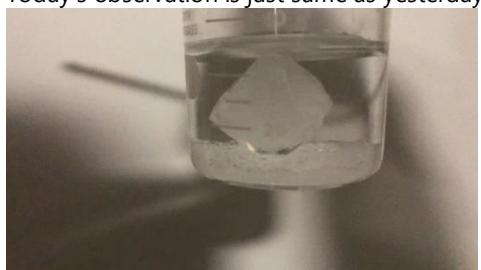
50. DAY FIFTY: 2022.04.29

Today's observation is just same as yesterday.



51. DAY FIFTY-ONE: 2022.04.30

Today's observation is just same as yesterday.



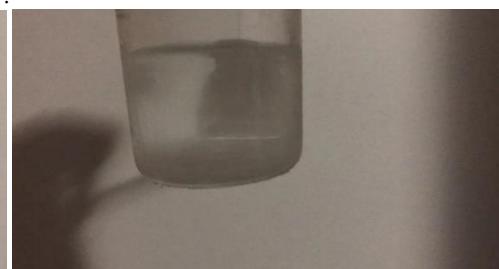
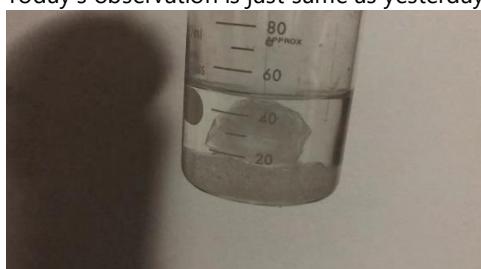
52. DAY FIFTY-TWO: 2022.05.01

Today's observation is just same as yesterday.



53. DAY FIFTY-THREE: 2022.05.02

Today's observation is just same as yesterday.



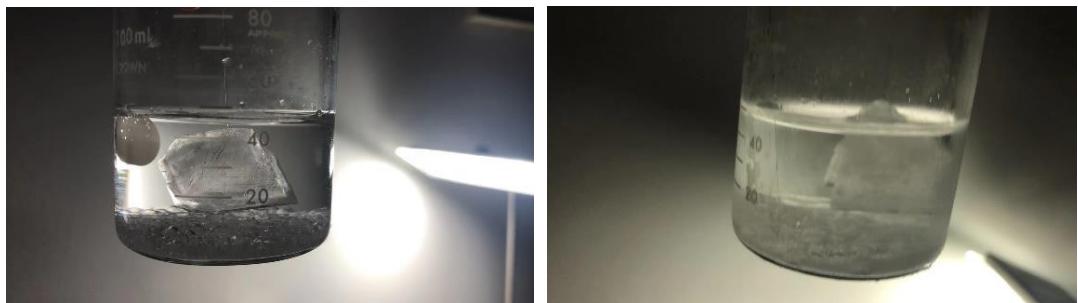
54. DAY FIFTY-FOUR: 2022.05.03

Today's observation is just same as yesterday.



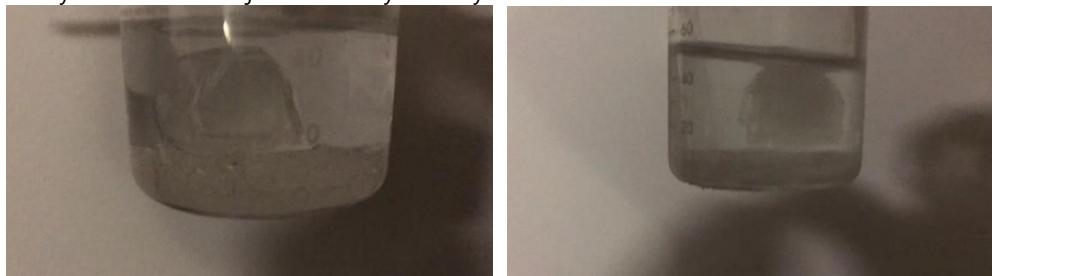
55. DAY FIFTY-FIVE: 2022.05.04

Today's observation is just same as yesterday.



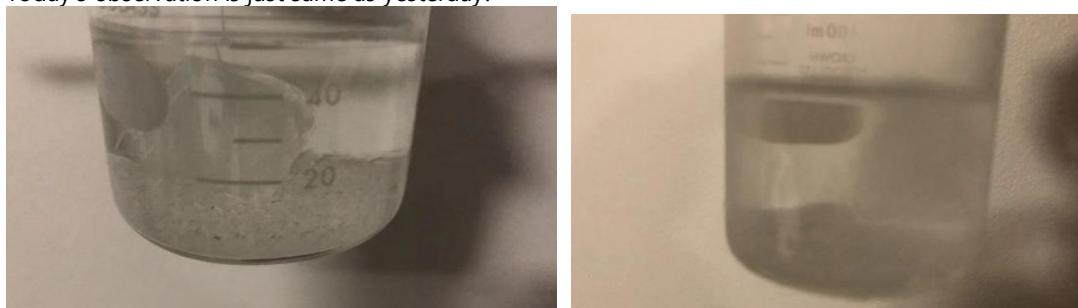
56. DAY FIFTY-SIX: 2022.05.05

Today's observation is just same as yesterday.



57. DAY FIFTY-SEVEN: 2022.05.06

Today's observation is just same as yesterday.



58. DAY FIFTY-EIGHT: 2022.05.07

Today's observation is just same as yesterday.



59. DAY FIFTY-NINE: 2022.05.08

Today's observation is just same as yesterday.



60. DAY SIXTY: 2022.05.09

Today's observation is just same as yesterday.



61. DAY SIXTY-ONE: 2022.05.10

Today's observation is just same as yesterday.



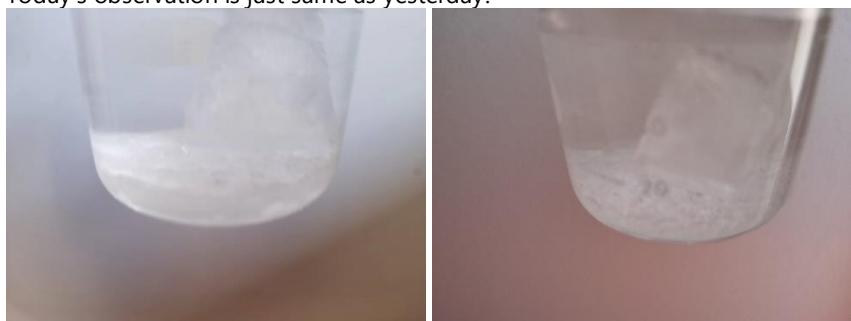
62. DAY SIXTY-TWO: 2022.05.11

Today's observation is just same as yesterday.



63. DAY SIXTY-THREE: 2022.05.12

Today's observation is just same as yesterday.



64. DAY SIXTY-FOUR: 2022.05.13

Today's observation is just same as yesterday.



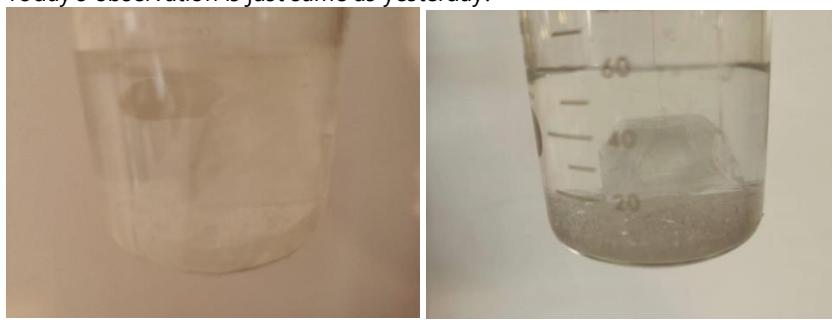
65. DAY SIXTY-FIVE: 2022.05.14

Today's observation is just same as yesterday.



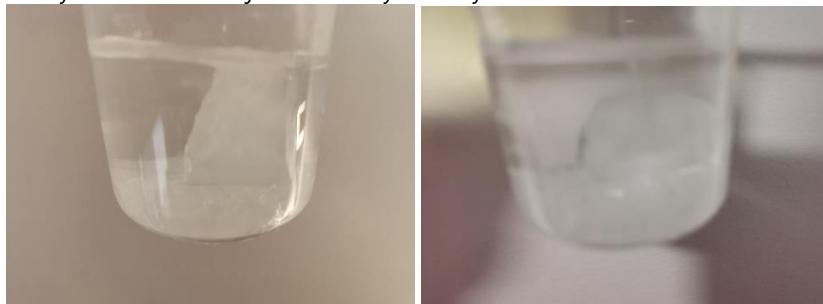
66. DAY SIXTY-SIX: 2022.05.15

Today's observation is just same as yesterday.



67. DAY SIXTY-SEVEN: 2022.05.16

Today's observation is just same as yesterday.



68. DAY SIXTY-EIGHT: 2022.05.17

Today's observation is just same as yesterday.



69. DAY SIXTY-NINE: 2022.05.18

Today's observation is just same as yesterday.



70. DAY SEVENTY: 2022.05.19

Today's observation is just same as yesterday.

**71. DAY SEVENTY-ONE: 2022.05.20**

Today's observation is just same as yesterday.

**Conclusion:**

The temperature does affect the growth of crystal. The warmer temperature the crystal grows in, the clearer the crystal will be. The cooler temperature the crystal grows in, the bigger the crystal will be.)

Reference list

<https://en.wikipedia.org/wiki/Crystal>

<https://shop.kremerpigments.com/elements/resources/products/files/64100e.pdf>

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<http://www.csun.edu/~an6862/coursework/695/Growth%20and%20Development/Growth%20&%20Development.htm>

<https://www.thoughtco.com/crystal-growing-troubleshooting-problems-602158>