



Highly Commended

Crystal Investigation

Year 5-6

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St Andrew's School





Crystal Investigation 2020

Entry # 0611-060

James Cross

Year 6 - St Andrew's School, Walkerville

Background

What makes a good crystal?

A crystal is a solid material with atoms and molecules arranged in a consistent repeating pattern (Home Science Learning). To grow large single crystals of aluminium potassium sulphate (alumin), a seed crystal must first be grown (Otago). This is done by creating a solution from water and alumin. A seed crystal is used as a base to grow a large single crystal. Without a seed, crystals form slowly from random intermolecular interactions.

When the seed is placed in a saturated or supersaturated solution, it acts as a nucleation site. This decreases the time needed to grow a crystal and directs growth to a single region (Helmenstein, 2020). A crystal is characterised by the orderly, repetitive arrangement in three dimensions of the ions, atoms, or molecules that make up the crystal (Katz).

In this investigation, I will dissolve the aluminium potassium sulphate (alum) in boiling distilled water. Boiling water will be used as research shows solubility increases as temperature rises (Beck, 2020). I will continue to add spoonfuls of alum until the solution reaches saturation - this is the point when no more of the alum dissolves (Beck, 2020)

I will pour off the liquid solution into another beaker to grow a seed crystal, then monitor it closely. My aim is to grow a multi-sided, clear crystal. The RACI website states the aim is an octahedral shape.

Hypothesis

By turning the crystal regularly, a better shaped crystal and greater size will be created.

Apparatus

- Glass beakers x 2
- Distilled water - 1 litre
- Heat source (kettle or microwave)
- Spatula
- Aluminium potassium sulphate (called alum, it is a metal sulphate composed of potassium, aluminium and sulphate ions in the ration 1:1:2 (PubChem).)
- Paper towel
- Elastic band

Safety

1. Boiling water: Ensure parent supervision to avoid spilling boiling water, which can burn. If a spill occurs, put skin under cold water as soon as possible then seek assistance.
2. Aluminium potassium sulphate: It could irritate eyes. Wear safety glasses when creating solution. Store alum in a safe place and out of reach of children.
3. Glass beakers: If broken, the shattered glass could cause cuts. Handle beakers carefully.

Method

1. Heat distilled water in a kettle to boiling point.
2. Pour 200ml of water in a glass beaker and record water and room temperature.
3. Mix aluminium into water till dissolved.
4. Drain liquid into another clean beaker, leaving un-dissolved aluminium in original beaker.
5. Repeat steps 2 to 4 and name them 1 and 2.
6. Place solutions in a room temperature space.
7. Cover with a paper towel with elastic band around top of beaker.
8. Take observations every 1 to 3 days for a month.
9. Remove any seed crystals forming during the month, pouring solution into a new beaker and moving the growing crystal.

Results

A multi-sided, mostly clear crystal was grown. It has at least eight sides. In the space of a month, I have watched it grow 1.4cm. Its biggest side is about 1.7cm. It also is nearly 1cm on one side. It has a distinctive triangle on one of its sides.

The crystal is that it has the appearance of having a smaller crystal growing on top of one of its triangular sides. This may have occurred on one of the two occasions smaller crystals were found surrounding it.

Unfortunately, there are cloudy areas within the crystal. Turning it regularly did not prevent it gaining one very flat side or the clarity. As I did not hang it from a thread to grow, this was the same result as had been achieved in past years.

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Date	Observation	Room temp	Action	Crystal	Water temp	Size
Start	Starting date	Starting date	Starting date	Starting date	Starting date	Starting date
Jul 5	Liquid solution	20°C	Nothing	No signs	16°C	Nil
Jul 6	Liquid solution	20°C	Nothing	No signs	17°C	Nil
Jul 7	Liquid solution	20°C	Nothing	No signs	17°C	Nil
Jul 8	Liquid solution	19°C	Nothing	No signs	18°C	Nil
Jul 9	Liquid solution	19°C	Nothing	No signs	18°C	Nil
Jul 10	Few dots	20°C	Nothing	One or two dots of seeds	18°C	Nil
Jul 12	A few seeds just visible	18°C	Nothing	Just dots visible	18°C	Nil
Jul 13	Small seed crystals forming at base		Nothing	Multi sided, clear		N/a
Jul 14	Lots of small crystals formed around big crystal.	24°C	Emptied solution, removed big crystal without touching, removed all small formations, pouring solution back into beaker and adding big crystal	Multi sided, clear	15°C	N/a
Jul 15	Seed crystal visible	20°C	Nothing	Small but multi sided	16°C	3mm
Jul 16	Crystal looks same	20°C	Nothing	multi sided	16°C	4mm
Jul 17	Crystal grown a little	21°C	Nothing	Multi sided small clouds	16°C	5mm
Jul 18	C	21°C	Nothing	Multi sided small clouds		
Jul 19		22°C	Nothing	Multi sided small clouds		
Jul 20	Grown in size substantially and grown even more mini crystals around it	21°C	Remove main crystal and poured solution into clean glass beaker, ensuring small seeds left in first beaker.	Multisided, small clouds of fog	16°C	7mm at widest
Jul 21	Grown in size by around half and grown small crystal on the side of it	20°C	Nothing	Multi sided medium small clouds of fog		Same size
Jul 22	Minimal change in size	20°C	Nothing	Multi sided medium small clouds of fog	17°C	About 8mm
Jul 23	minimal change in size	19°C	Nothing	Multi sided medium small clouds of fog		Measures 1.1 at widest points
Jul 24	No visible change			Same		Measures 1.2 at widest points
Jul 25			Nothing	Multi sided medium small clouds of fog		Measures 1.2 at widest points
Jul 26	Minimal change in size	18°C	Angled it differently	Multi sided medium small clouds of fog		Measures 1.25 at widest points
Jul 27	Same size	20°C	Nothing	Multi sided medium small clouds of fog		1.25
Jul 28						
Jul 29	Slight change	19°C	Turned to try to even shape	Cloudy appearing in centre	17°C	1.3cm at widest
Jul 31	Little change	18°C	Turned crystal	Multi sided, getting more rectangle in shape on one side	18°C	1.32cm

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Aug 3	Minimal change in size	16°C	Turned crystal. ensuring sitting on one of smallest sides.	Multi sided medium small clouds of fog		Measures 1.4 at widest points
Aug 4	Minimal change in size	18°C	Turned crystal	Multi sided medium small clouds of fog		Measures 1.4 at widest points
Aug 7	Slight size change	16°C	Small crystals appearing on bottom, emptied solution into another beaker and added crystal.	Rotated crystal to try to even shape, one side becoming flatter than others	18°C	Becoming more oblong, about 1.5 on widest side.
Aug 9	End of investigation	19°C	Removed crystal	Has about eight sides, most with sharp edges, two sides flatter than others, cloudy parts internally, triangular shapes among sides.	18°C	About 1.7cm at widest - when sitting on one of these two sides it is about 1cm high.

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July 14:
One bigger seed has grown while there are many other smaller, mostly hexagonal and other multi-sided seed crystals almost forming a puzzle like pattern.



July 20:
Tiny seed crystals are again growing around main crystal. Solution was poured into another beaker then main crystal was gently added.



August 7:
Tiny seed crystals again appear on bottom of the beaker. The solution is again poured into a clean glass beaker and gently moving main crystal.

Conclusion

Throughout my experiment, I have seen significant changes in how the crystal has grown compared to my 2019 crystal investigation. This has included improvements in shape and size. It is not a octahedral shape but turning the crystal has improved the shape.

Throughout the 2020 investigation, I recorded frequent observations on changes in my crystal. There weren't significant changes day to day but significant changes were noticed over time.



The experiment was conducted for about five weeks. I have seen many changes in shape and size but minimal changes in how the crystal has formed (how it started). If I had been able to grow the crystal hanging on a thread, the shape may have been improved. Its weight on one side may have been one of the reasons it always fell on one side as I attempted to move the crystal several times each week.

The solution was saturated and other small "seeds" grew from time to time. This made it necessary for me to pour the saturated solution into a clean glass beaker and move the growing crystal on two occasions.

I think the solution was correct and saturated. But it was growing technique that needed to be changed to improve the growth of the crystal. Attempting to attach the seed crystal to a thread hanging in the solution would be a good start for future investigations to get the more octahedral shape. The best parts of the crystal I grew are its sharp sides. Growing it on the bottom of the beaker has achieved two flatter sides rather than multi equal shaped sides.

References

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