



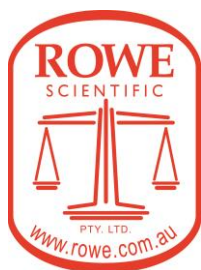
Highly Commended

Crystal Investigation

Year 5-6

Zachary Hill

Hawthorndene Primary School



Crystals of light and darkness

Research question

How does light and darkness effect the growth and clarity of the crystals?

Materials used


- Crystal deodorant (Dermal therapy from Terry White)
- Distilled water (from Coles)
- Hammer
- Plastic container
- Callipers
- Digital scale
- Measuring cups
- 2 pencils
- Coffee Filter paper
- Funnel
- 2 small jars
- 1 big jar
- 1 pot
- Pen
- Paper
- Fish gut
- Laptop



Background


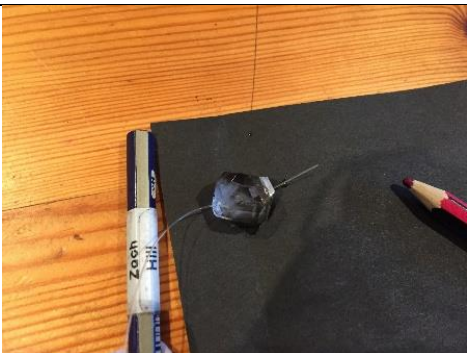

Potassium alum also known as potassium alum sulphate or aluminium sulphate is a substance used for making crystals, water purification, leather tanning, dyeing, fireproof textiles, baking powder and crystal deodorant.





Method

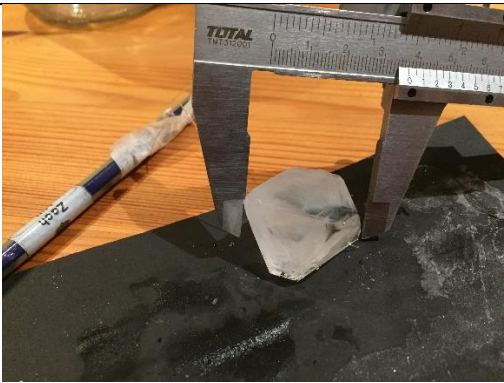
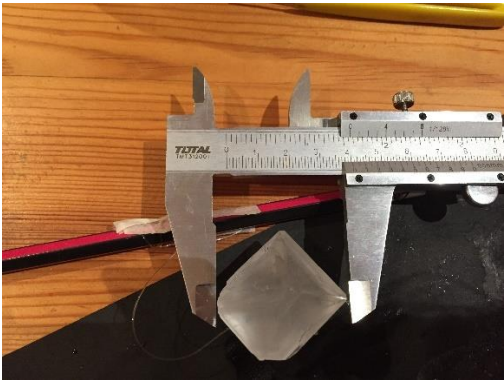

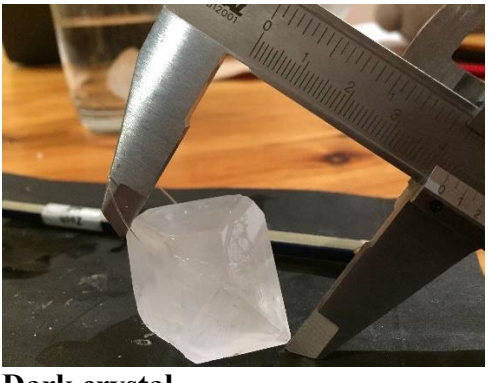
I followed the Royal Australian Chemical Institute (RACI) guidelines to growing a crystal. This was 30g of alum per 200ml of water. I used the Crystal suspension method of growing my crystals. I used a bookshelf to grow my crystals in. I put the light crystal on one of the shelves without any covering so it could get lots of natural light but no sunlight. I covered another shelf with black material so it would always be dark and put the other crystal in there. The specifics of growing my crystals are in my logbook.

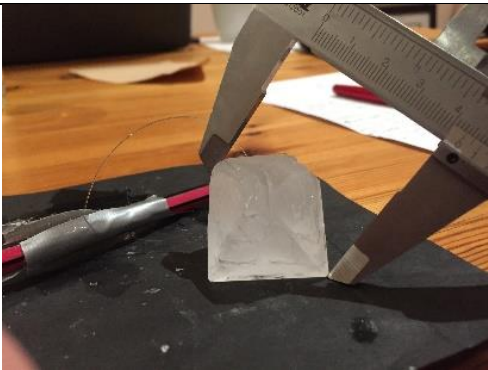



| Date and time | Observations and actions | Crystal characteristics | Photos |
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| 20-28 May 2023 | <p>For about a week I tried to grow crystals, but nothing would work. These are the things that I tried:</p> <ul style="list-style-type: none"> ➤ warm water ➤ hot water ➤ distilled water ➤ tap water ➤ filter paper ➤ leaving the solution for longer than recommended. <p>Eventually I decided to try a different alum. I bought an alum crystal deodorant from the pharmacy.</p> | |  |
| 29 May 5:30pm | <ul style="list-style-type: none"> ➤ I placed an alum crystal deodorant in a 1L yoghurt container and crushed it with my hammer. Once powder had formed, I used a sieve to collect the powder in a bowl. I did that repeatedly. ➤ I measured 500ml of distilled water and then heated it up in a double boiler on the stove (did not let it boil). ➤ I took it off the stove and put it in a 1L jar. ➤ I measured out 75 grams of my alum on a digital scale. I stirred the alum into the water until it was all dissolved. I filtered out the impurities with a coffee filter paper | - | |





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| | <p>and a funnel into a big jar.</p> <ul style="list-style-type: none"> ➤ I measured out 200ml and put it in a shallow glass dish and in a bookshelf and left it. ➤ I left the rest in the big jar and PUT THE LID ON to stop the dust getting in. | | |
| 30 May 1:00pm | <ul style="list-style-type: none"> ➤ There were quite a few crystals growing on the bottom and some tiny crystals grew on the top of the water. ➤ I used tweezers to take the crystals out and then weighed them to see how much alum we would need to add back in when we used the solution again. (The weight was 20 grams). ➤ Next, I chose the best two (the octahedrals and clearest two) and put them to the side. I chose a few spares for if something went wrong and put them in a plastic container. I put the rest in another plastic container in case we needed to crush them for more alum powder later. ➤ Next, I got some fish gut and the best 2 crystals and with the help of my mom we were able to tie the fish gut onto the crystals. ➤ I poured the old solution into the jar with the rest that I had not used yet. ➤ I reheated it and added 20g of alum into the | <p>The best two were clear and both were octahedral shapes.</p> | <p>-</p>   |




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| | <p>jar and dissolved it into the solution.</p> <ul style="list-style-type: none"> ➤ I used another filter paper and funnel and poured 250g of the solution into 2 smaller jars. ➤ I tied the end of fish gut without a seed crystal to a pencil. I tied the one that was going to be the light crystal to a red pencil and the dark crystal to a grey pencil so I would know which was which. I waited for a long time for the solution to cool down so it would not dissolve the seed crystals. ➤ I put the seed crystals into the jars and put one in a light place and the other in a dark place. | |  |
| 31 may 5:00 pm | <ul style="list-style-type: none"> ➤ It seems like after the first day the crystals had stopped growing. ➤ Seed crystals had formed at the bottom of my suspension. ➤ There was a big seed crystal on the light crystal's fish gut. ➤ I removed the two big crystals to measure them. ➤ I removed the seed crystals from the bottom of the jars. ➤ I weighed the seed crystals and put them with the rest of the seed crystals. ➤ I measured and weighed the two big crystals and recorded it. ➤ I poured the two jars' contents into a big jar | <p>Light crystal</p> <ul style="list-style-type: none"> ➤ 2.1 cm ➤ 5 grams ➤ Octahedral ➤ Smooth sides ➤ Sharp edges ➤ Flattened points ➤ Outside is clear but the inside is cloudy. <p>Dark crystal</p> <ul style="list-style-type: none"> ➤ 1.5 cm ➤ 2 grams ➤ Octahedral ➤ Points are flat but top is the flattest ➤ Smooth sides ➤ Clear on outside but cloudy on inside. Dark crystal is |   |

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| | <p>and heated it up on the stove.</p> <ul style="list-style-type: none"> ➤ I added more of my alum into the jar to replace the alum that had crystalized out. I needed to add 20 grams (13 g seeds +2 dark +5 g light). ➤ I shared the contents of the big jar into the 2 small jars and waited about 30 mins for it to cool down. ➤ I lowered the 2 crystals into their jars and put them back in there places. | <p>clearer than the light crystal.</p> |  <p>Dark crystal</p>  <p>Light crystal</p> |
| <p>4 June 4:00</p> | <ul style="list-style-type: none"> ➤ My crystals had stopped growing ➤ There were seed crystals at the bottom of my jars. ➤ I repeated the same procedure as on 31 may but made some small changes. <ul style="list-style-type: none"> ➤ I needed to crush some of my seed crystals I had set aside for more alum powder. ➤ I needed to dissolve 36 g of alum back into the solution. | <p>Light crystal</p> <ul style="list-style-type: none"> ➤ 2.8 ➤ 14 g ➤ Smooth sides ➤ Smooth points ➤ Some of outside is clear but the rest is cloudy. <p>Dark crystal</p> <ul style="list-style-type: none"> ➤ 2.7 ➤ 13 g ➤ smooth sides ➤ some pointy edges <p>some of it is clear but the rest is cloudy.</p> |  <p>Dark crystal</p>  <p>Light crystal</p> |

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| <p>14 June 4:00</p> <p>+</p> | <ul style="list-style-type: none"> ➤ They had stopped growing after the first day. ➤ The crystals were lying at the bottom of the jars because the fish gut had unravelled. ➤ I repeated the same procedure from 4 June and made a couple changes. <ul style="list-style-type: none"> ○ I needed to crush another crystal deodorant for alum. ○ I just left the seed crystals in the solution and dissolved them back in on the stove. ○ I needed to dissolve 18g of alum (9g + 9g). | <p>Light crystal</p> <ul style="list-style-type: none"> ➤ 23g ➤ 3.7 cm ➤ Smooth sides ➤ Smooth points but some are pointy <p>Dark crystal</p> <ul style="list-style-type: none"> ➤ 22 g ➤ 3.4 ➤ some smooth sides on side looks like it has a step in it. ➤ some pointy points. |  <p>Dark crystal</p>  <p>Light crystal</p> |
| <p>19 June 4:00</p> | <ul style="list-style-type: none"> ➤ The dark crystal was on the bottom of the jar. ➤ The dark crystal had 4 seeds on it. ➤ I repeated the same procedure as last time just a few changes. <ul style="list-style-type: none"> ○ I needed to dissolve 15 g of alum into the jars. | <p>Light crystal</p> <ul style="list-style-type: none"> ➤ 30 g ➤ 4.1 cm ➤ Had 2 seeds on it ➤ Uneven edge ➤ 2 steps on edges ➤ 1 4 uneven points ➤ 4 sharp points <p>Dark crystal</p> <ul style="list-style-type: none"> ➤ 30 g ➤ 4.1 cm ➤ One edge has completely disappeared ➤ Other edges and points are sharp ➤ One edge where I took a seed crystal of is now chipped. |  <p>Dark crystal</p>  <p>Dark crystal</p> |

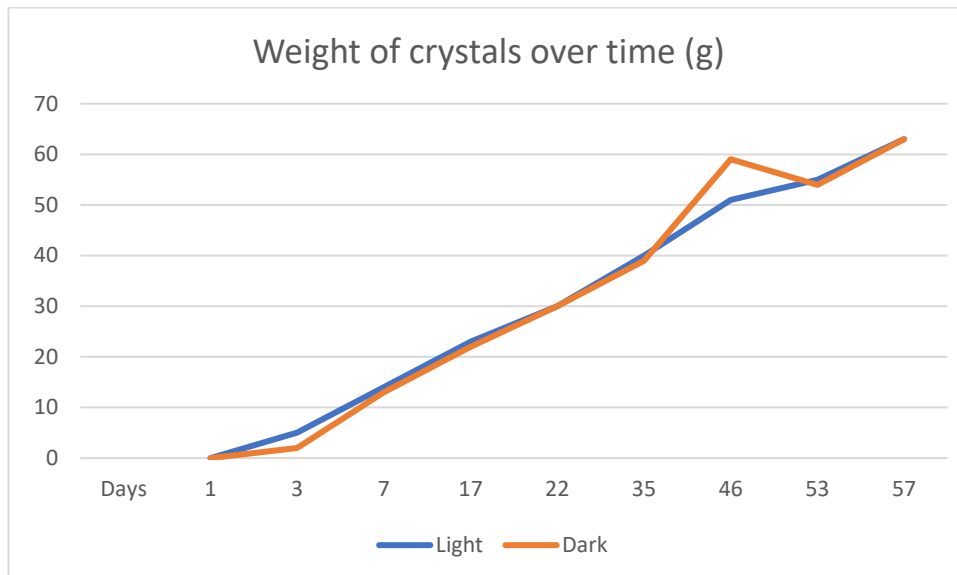
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| | | |  <p>Light crystal</p> |
| 2 July 12:00 | <p>➤ There was only 375 ml out of 500 ml due to evaporation.</p> <p>➤ It was the exact same procedure except two changes.</p> <ul style="list-style-type: none"> ○ I added 125 ml of water to make it 500 ml. <p>I added 20 g of alum.</p> | <p>Light</p> <ul style="list-style-type: none"> ➤ 4 uneven sides ➤ 3 pointy points ➤ 40 g ➤ 4.5 cm <p>Dark</p> <ul style="list-style-type: none"> ➤ 2 uneven sides ➤ 1 pointy point ➤ 3 uneven edges ➤ 39 g ➤ 4.4 cm |  <p>Light crystal</p>  <p>Dark crystal</p> |
| 13 July 2023 12:40 | <p>➤ There were no seed crystals at the bottom of the jars.</p> <p>➤ Same procedure as last time except one change.</p> <p>➤ I added 21 g of alum</p> | <p>Light</p> <ul style="list-style-type: none"> ➤ 51g ➤ 4.8 cm ➤ 5 uneven sides with steps in them ➤ 2 uneven edges that have disappeared ➤ 2 uneven points which are flat. |  <p>Dark crystal</p> |

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| | | <p>Dark</p> <ul style="list-style-type: none"> ➤ 49g ➤ 4.9 cm ➤ 5 uneven sides with steps in them ➤ 1 uneven edge that is very bumpy <p>3 uneven points which are gone</p> |  <p>Light crystal</p> |
| 20 July 2023 12:00 | <ul style="list-style-type: none"> ➤ There were powder seeds at the bottom of both the jars. ➤ The exact same procedure except for one change <ul style="list-style-type: none"> ○ I added 8g of alum | <p>Light</p> <ul style="list-style-type: none"> ➤ 55g ➤ 6 cm ➤ 6 uneven sides ➤ 3 uneven points <p>Dark</p> <ul style="list-style-type: none"> ➤ 54g ➤ 5.9 cm ➤ 5 uneven sides ➤ 3 uneven points |  <p>Light crystal</p>  <p>Dark crystal</p> |
| 24 July 2023 | <ul style="list-style-type: none"> ➤ There were clear seeds at the bottom of the jars. ➤ There were a few changes to the procedure <ul style="list-style-type: none"> ○ I weighed and measured the crystals for the last time. ○ I cut them off the fish gut. | <p>Light</p> <ul style="list-style-type: none"> ➤ 63 g ➤ 5.2 ➤ There are two smooth sides. ➤ The six uneven sides look like they have steps in them. ➤ There are four flat points. ➤ There are two curved edges. ➤ It is an octahedral. |  <p>light crystal</p> |

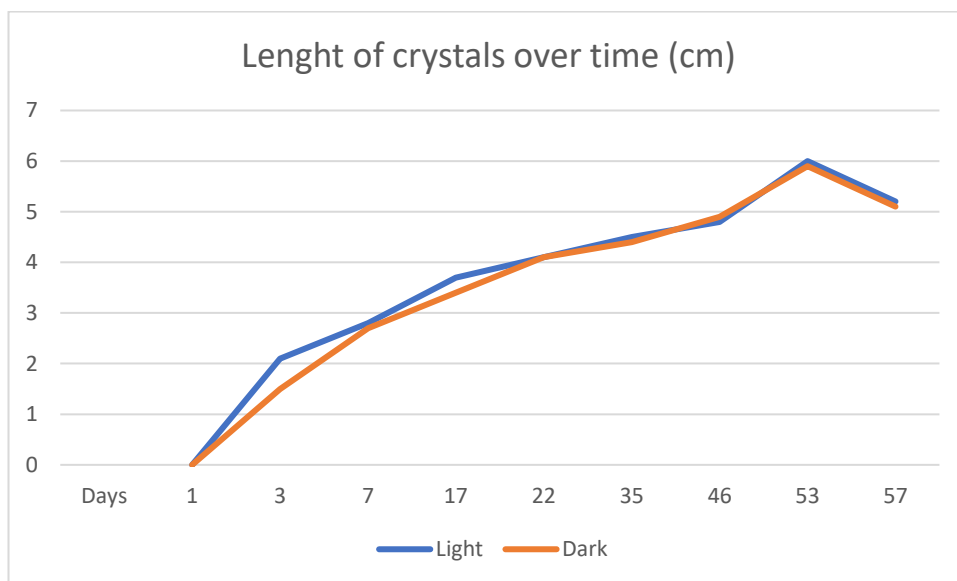
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| | | <ul style="list-style-type: none"> ➤ It is very cloudy. <p>Dark</p> <ul style="list-style-type: none"> ➤ 63 g ➤ 5.1 ➤ There are three curved edges. ➤ There is one sharp point. ➤ All the sides have steps in them. ➤ It is very cloudy. ➤ It has sharper edges than the light crystal. |  <p>Light crystal</p>  <p>Dark crystal</p>  <p>Dark crystal</p> |
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Results

Over 57 days my crystals both grew to 63 g. My light crystal grew to 5.2cm and my dark crystal grew to 5.1cm. In the end they were both cloudy.



The above graph shows the crystal growth in weight over 57 days. Apart from the spike in growth from the dark crystal I think they grew at a very similar speed.



The above graph shows the length of the crystals over 57 days. They grew at a very similar speed.

Conclusions

I learnt that it is important to work with a good quality alum, because some products are not good quality which is why I was struggling to grow my crystals. My results showed that light and darkness does not affect the growth and the clarity of the crystals.

Ideas for further research

I noticed that the day after I changed the alum there was a spike in growth but then after that it slowed down. I would like to know if I change the alum solution every day, can I get the crystals to grow bigger and clearer?

Acknowledgements

My mom helped me with the following:

- Holding the callipers so I could take photos.
- Tying the seed crystals to the string.
- Pouring hot water into the funnel so it could filter into the jars.
- Giving me advice on how to do the write up since it was my first time.

References

https://en.wikipedia.org/wiki/Potassium_alum#:~:text=Potassium%20alum%20is%20commonly%20used,for%20minor%20bleeding%20from%20shaving.

<https://raci.org.au/common/Uploaded%20files/Website%20files/School/crystal/SA%20Crystal%20Growing%20comp/Crystal%20Growing%20-%20Advice%20to%20students.pdf>