How I Grew These Gorgeous Iron Sulfate Crystals at Home

IRON SALTS/ JULY 20, 2020 *by* CHASE / 19 COMMENTS

Iron (II) sulfate can be tricky to work with, but it forms unique blue-green crystals.

I love growing crystals. Actual crystals. It's been 2 years since I fell in love with this hobby in chemistry class, and I'm still making discoveries every day.

Even so, it starts getting dull when you work with the same compounds for ages. That's why, 2 months ago, I decided to try something new. I decided to grow something more unique. I decided to grow green crystals.

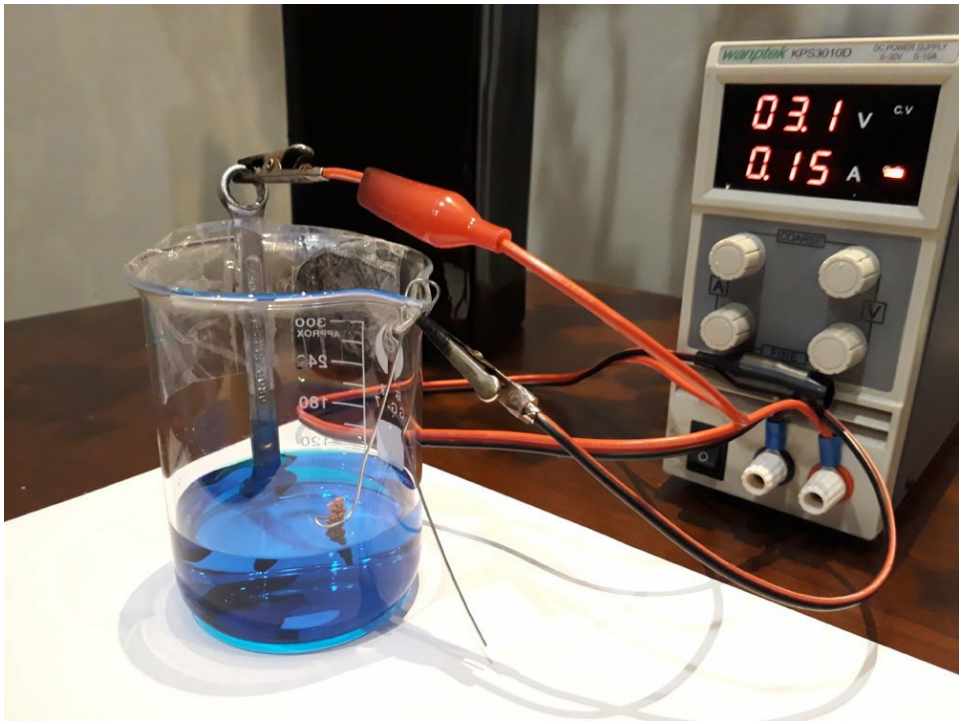
Synthesis

As I don't have access to a lot of chemicals, I chose a compound that I could make myself. It's called iron (II) sulfate – which is basically the product of a reaction between iron nails and battery acid. Now, I couldn't just rip open Dad's car and steal the battery, so I used another method to obtain the iron (II) sulfate – electrolysis.

I started off with a saturated solution of blue copper sulfate (a type of rootkiller) which had taken me two weeks to purify. For my source of iron, I went to a hardware store and bought a steel wrench. The idea was to force the copper out of solution and replace it with iron.

This is the chemical equation: $CuSO_4 + Fe \rightarrow Cu + FeSO_4$

To make things happen, I took out my trusty power supply and connected the wrench to the positive terminal and a piece of copper as the negative terminal.



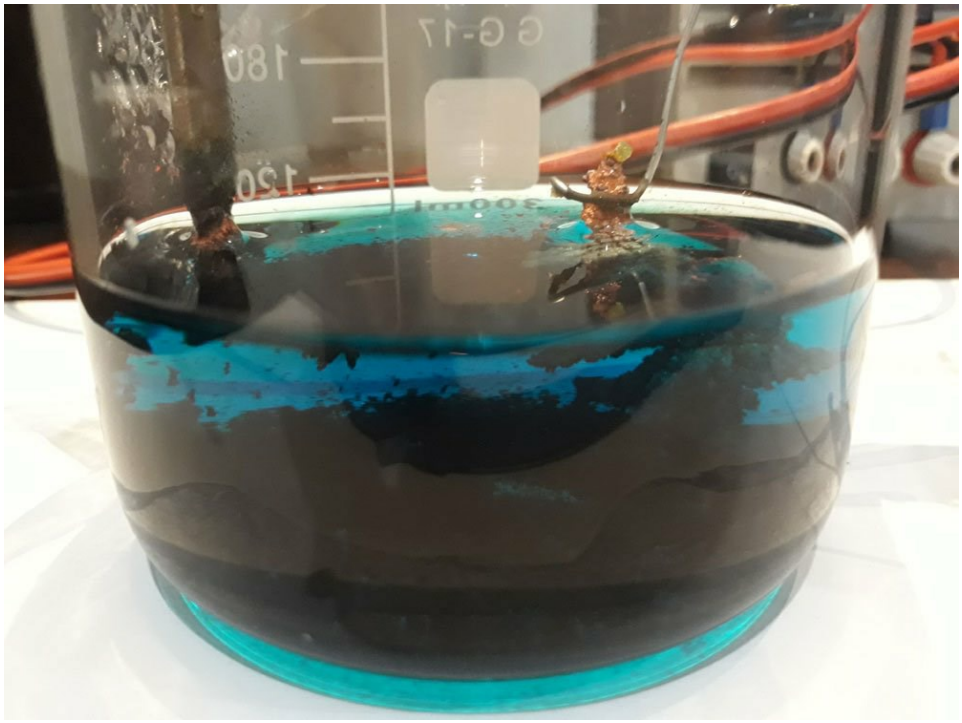
After pouring the blue solution into a beaker and putting the electrodes into place, I flipped on the switch.

Absolutely nothing happened, and all I could hear was a faint buzzing sound. But after 2 hours, bits of the carbon in the wrench started to flake off.

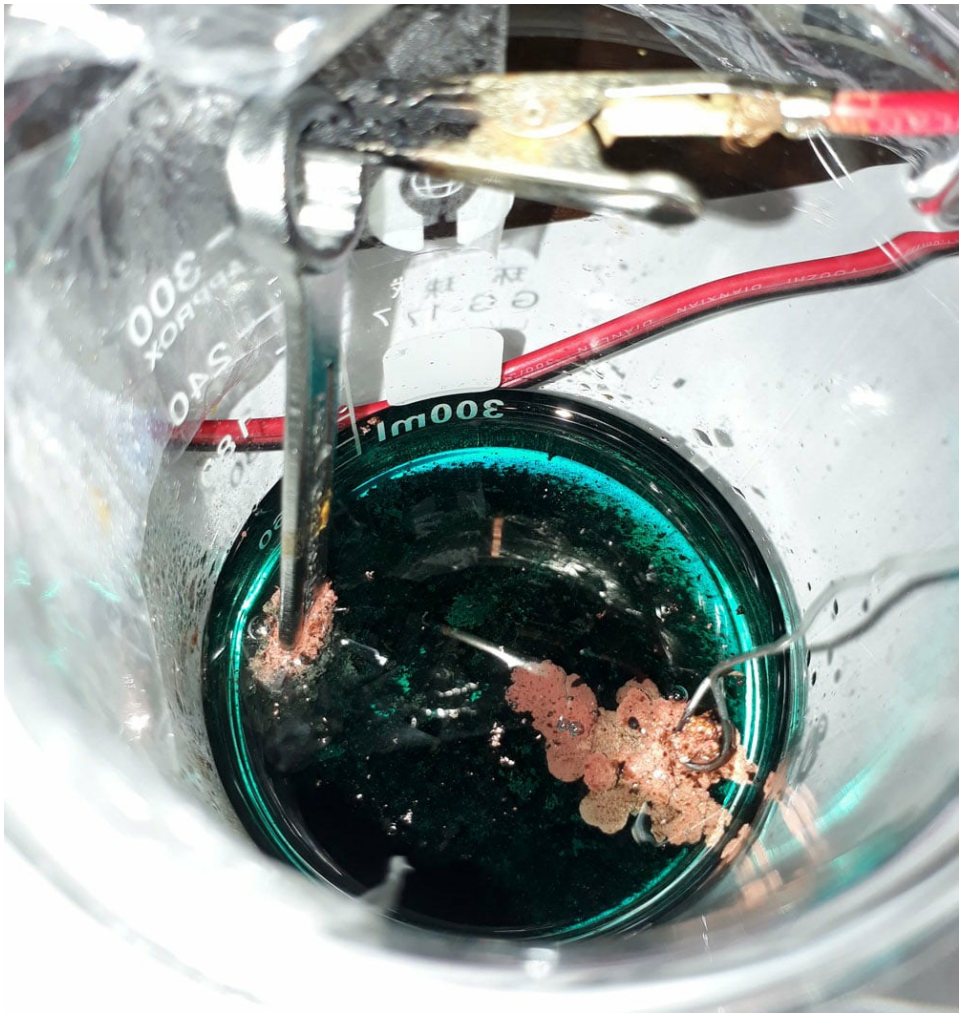
After 4 hours, the part of the wrench sitting inside the solution started to get eaten away.

The next morning, the bottom part of the wrench had completely dissolved. The beaker was filled with carbon, dirt and impurities, while a large clump of copper had formed on the negative terminal.

This was good news, as it meant that the blue copper ions were getting discharged, forming copper metal. Meanwhile, green iron (II) ions took their place. Sure enough, the color of the solution changed from an intense blue to a lighter turquoise.



Over the course of the day, the solution turned steadily greener. By the time I went to bed, it looked like this:

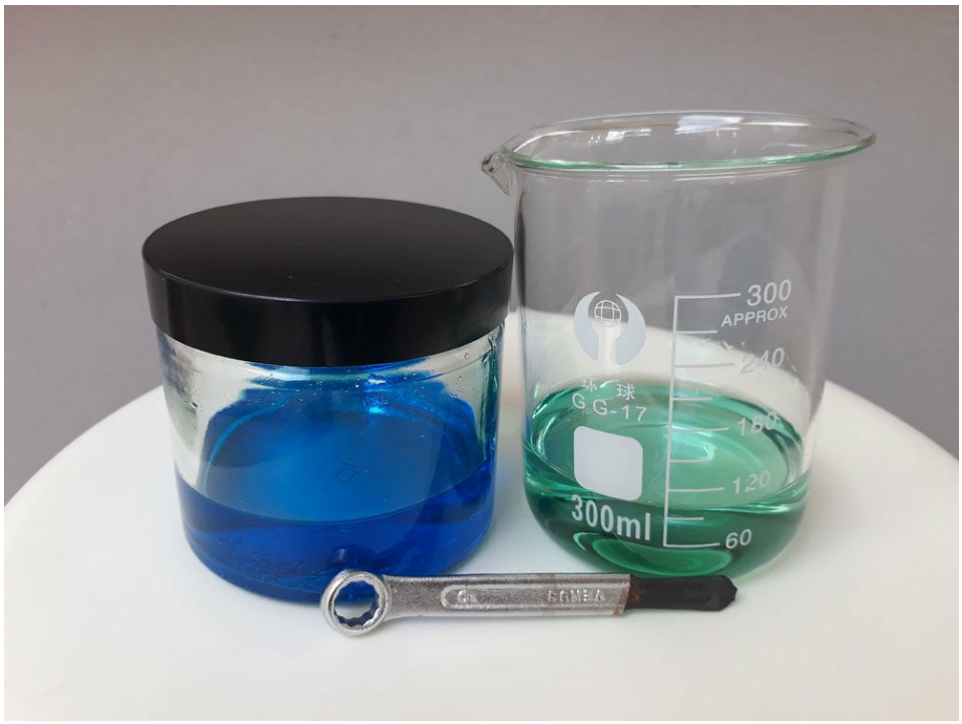


If you're wondering, the shiny orange lump is copper metal deposited on the cathode.

When I woke up, I had a nasty surprise. The solution had turned brown, and what looked like bits of mud were floating around.

The thing about chemistry is that reality is always far more complicated than the theory inside a textbook. Although the product I wanted was green iron (II) sulfate, brown iron (III) hydroxide had formed overnight. This was likely because the solution wasn't acidic enough.

Luckily, I managed to fix this by adding a few drops of sulfuric acid I had made previously. After some swirling, the brown goo vanished. I filtered everything, and ended up with 120 ml of a nice green solution of iron (II) sulfate.

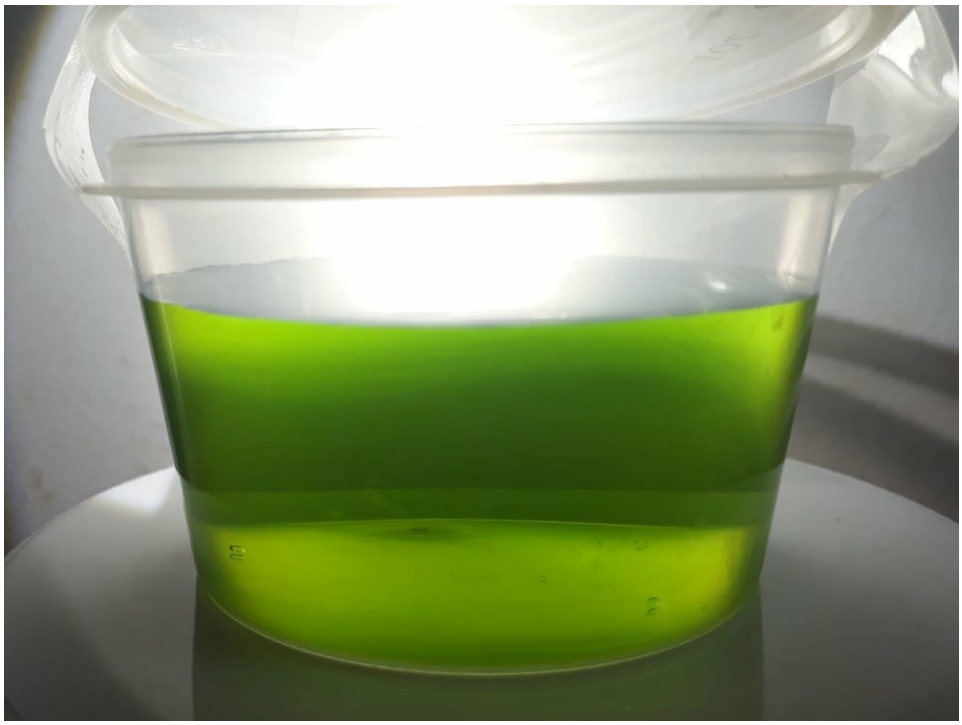


Although the solution was quite concentrated, it still wasn't good enough to grow crystals with. I had to further evaporate the water until it reached the saturation point. So I let it sit quietly in the storeroom.

Growing the Crystals

After 5 days, I was pleasantly surprised to see tiny crystals at the bottom of the beaker.

Using tweezers, I gently picked out 3 nicer crystals and transferred them, along with the solution into a smaller container. I then closed the lid halfway to slow down evaporation to get higher quality crystals – because the slower you grow them, the nicer they'll be.

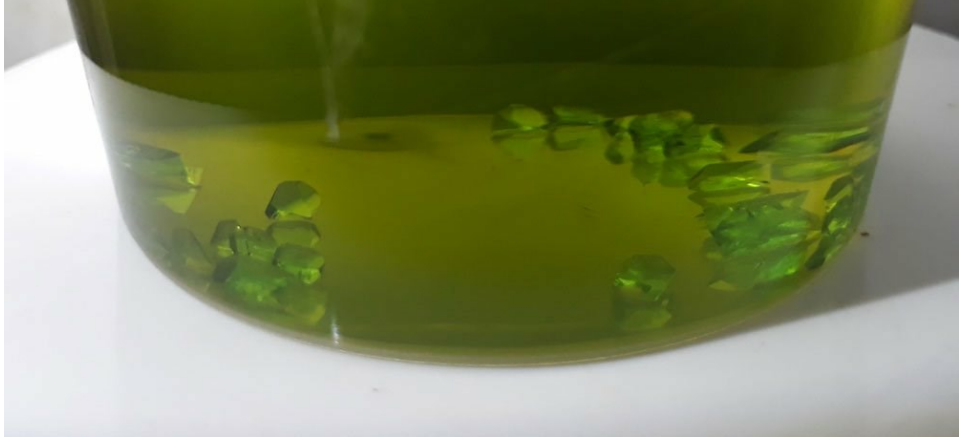


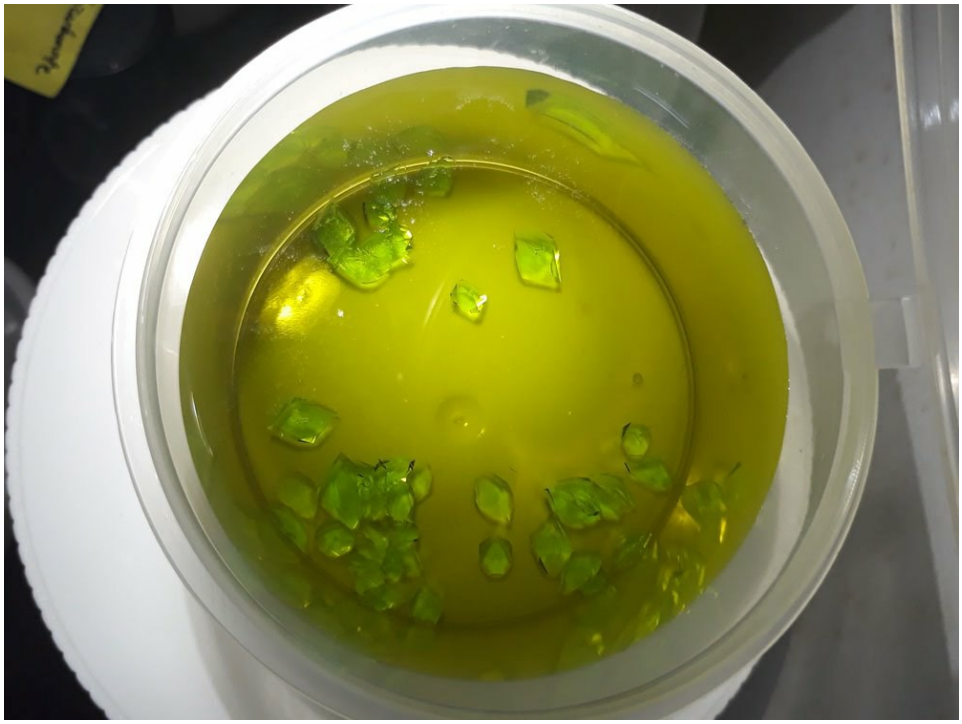
Day by day, the crystals got bigger.

Unfortunately, the solution also steadily became more yellow, because green iron (II) sulfate is easily oxidised in air to form brown iron (III) sulfate.

Wait too long, and insoluble hydroxides will form, messing up the crystals and forming gooey muck. Adding sulfuric acid can slow down the process, but I could only add a few drops because I was rather short on it.

Still, it was an eventful week.



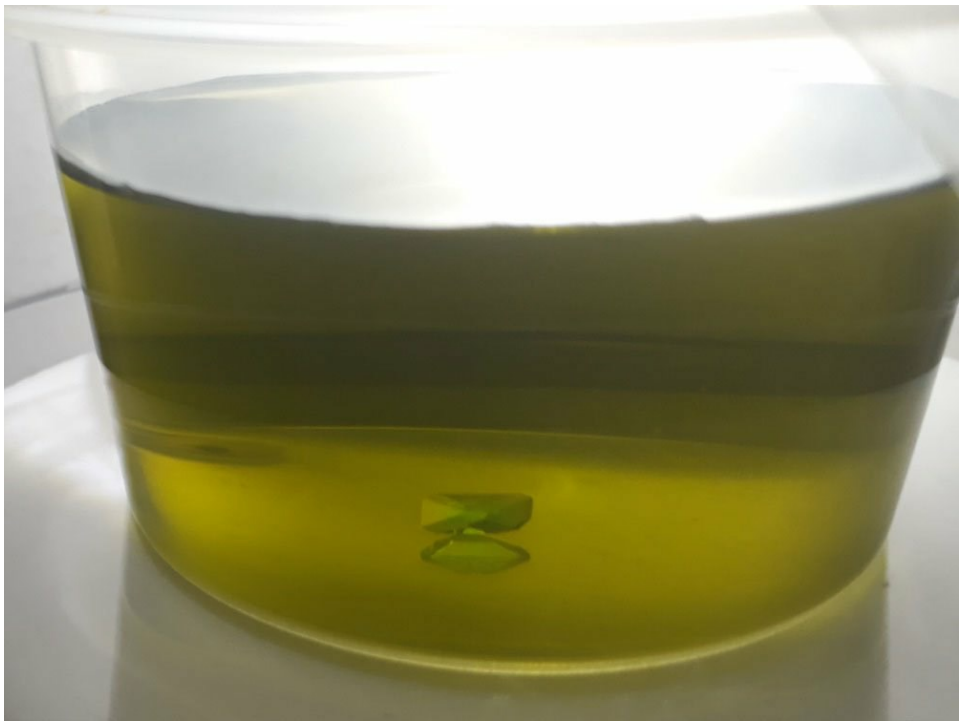


A few days in, the crystals started to clump together. My initial plan was to grow just a few amazing specimens, so I removed most of the crystals, leaving one to continue growing.

I was awestruck when I pulled out these gorgeous specimens!

They looked like little bits of glass, and the way they sparkled was something I had never seen before in all my years of crystal growing.

Of course, the most exciting part was yet to come. I wanted even bigger ones.



After 4 more days:

Two and a half weeks after making the green iron sulfate solution, my dreams came true. I fished eleven crystals out of the now brown liquid, and dried them with a piece of filter paper.

And they were absolutely amazing.

They looked like brilliantly cut gems that had been polished to perfection. When I put them under the light, those green crystals gave off a soft bluish glow that's difficult to describe. One crystal was utterly flawless – its edges as sharp as diamond and as clear as glass.

I'll let you see them for yourself.

Beautiful, aren't they?

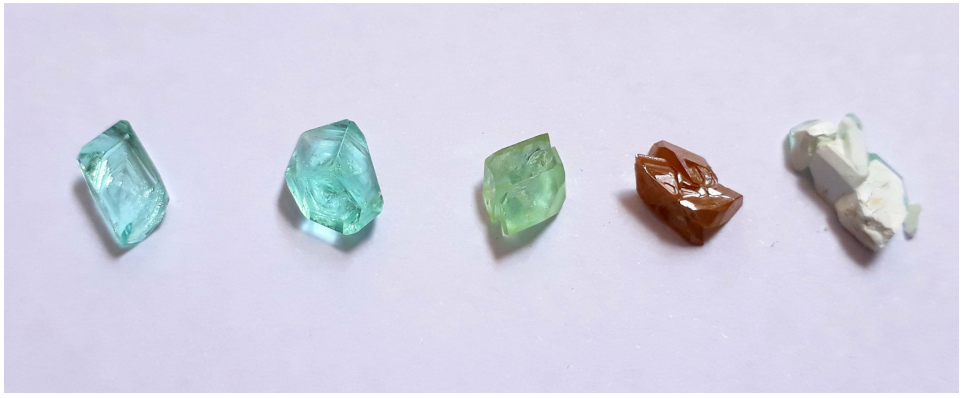
Unfortunately, I couldn't just put them on display – because of two problems.

Storage

First, when exposed to the oxygen in the air, iron (II) sulfate heptahydrate oxidizes to form brown iron (III) sulfate. It loses its sparkling blue-green hue and takes on the color of rust.

Alternatively, if it is placed in a dry environment, the crystal will dehydrate. This means it loses the water trapped inside its crystal

structure and turns into white powder.



From left to right: 1. Freshly grown crystal; After a month: 2. Sealed in airtight container; 3. Stored in normal container; 4. Left in the open; 5. Stored with a desiccant.

However, there is hope. I decided to try storing them in an airtight glass bottle, and it worked pretty well. As you can see, the second crystal looks almost brand new, even though it has been kept for a month.

Neat.

It's been great fun growing iron sulfate crystals. As I've mostly used up the solution, I decided to stop my experiments for now, and move on to a new compound.

It's a close cousin of this one – double salt ammonium iron (II) sulfate – also known as Mohr's salt. Plus, it's much more stable in air. Check out my first attempt **here**!

About Chase

Science nerd. Proud owner of pet rocks. I first started this website 5 years ago to share my love of growing crystals with others. Currently studying Machine Learning at the University of Tübingen.

Comments

Mike Quincy
MAY 3, 2025 AT 3:24 AM

This is remarkable and well done. But may I ask why you didn't start with Ferrous (II) Sulphate Heptahydrate instead of the root killer? It's basically just a fertilizer sold for cheap at Lowes or Walmart. I have a four pound bag of it but when dissolved it turns a nasty yellow color. What I need is pure Fe(II)SO4. Wouldn't I just add some sulphuric acid (concentrated drain cleaner) and wait for the crystals to grow like you did?

REPLY

CHASE
MAY 14, 2025 AT 9:58 AM

That's a perfectly valid (and faster) way to do it! I just thought it would be more interesting to do it this way.

And yes, regular store ferrous sulfate is a nasty yellow color due to the oxidation. Some dilute sulfuric acid will clear it up, turn it green, and slow down oxidation.

REPLY

Bashe
FEBRUARY 6, 2025 AT 5:18 AM

Your so cool. I came across your page when trying to find a solution to alkalize bath water. Would it be ok to add in bath bombs. I know it oxidizes but do you have any other suggestions?

REPLY

CHASE
FEBRUARY 10, 2025 AT 6:36 PM

Bad idea. If you do that, you'll smell like rust afterwards. Instead, use baking soda.

REPLY

Max D.
MARCH 17, 2024 AT 11:09 PM

Hi! Amazing results! I'm trying to do this at home, and I started electrolyzing some mild steel rods in a solution of magnesium sulfate (the cathode is in a terracotta pot to prevent magnesium hydroxide from mixing with the iron sulfate), however instead of turning any shade of green, it was completely brown. Do you know why this happened? I added some dilute sulfuric acid to it to see if it there would be a reaction, but nothing happened. I noticed you used 3 volts, I used 15 – does this make a difference? Any help is appreciated, thanks!

REPLY

Caitlin
DECEMBER 19, 2022 AT 5:23 AM

is it possible to grow crystals with a store bought iron supplement (contains Ferrous Sulfate, Microcystalline Cellulose, Povidone, Crospovidone, Ethanol. 2% or less of FD&C Blue No. 1 Lake, Hydroxypropyl Methylcellulose, Magnesium Stearate, Medium Chain Triglycerides, Polyvinyl Alcohol, Titanium Dioxide)?

REPLY

CHASE
DECEMBER 20, 2022 AT 12:07 AM

It depends how much of it consists of iron sulfate. You could probably dissolve everything in water to separate out the iron sulfate, since most of the other stuff is less soluble in water. Then do a few recrystallizations to purify it.

REPLY

HAZEL JONES
OCTOBER 21, 2022 AT 4:29 PM

I have a question. Can I make iron sulphate using red iron oxide and sulphuric acid?

REPLY

CHASE
OCTOBER 21, 2022 AT 11:30 PM

Yup, sure you can. Be careful with the sulfuric acid.

REPLY

Lee
MAY 10, 2022 AT 5:46 AM

This. Is. AWESOME! And breathtakingly beautiful. Thanks so much for your experience and expertise.

REPLY

Connor
MAY 9, 2022 AT 4:34 PM

Hello! I was thinking of doing this process and thought maybe dipping the crystals in resin tho fix them away from oxygen might preserve their colour?

REPLY

CHASE
MAY 10, 2022 AT 5:22 AM

Yes, that might work. But don't use a water based resin, since the crystals are soluble in water.

REPLY

Wouter
APRIL 2, 2022 AT 3:42 PM

Hi Chase. First of all thanks for your great tutorials and showing off your nice crystals! I

have acquired some iron(II)sulfate and I am planning to grow crystals on a fishing line. I have acetic acid available to prevent formation of Fe(III)hydroxide, would that work too instead of sulfuric acid? Or will I obtain iron acetate impurities?

REPLY

CHASE
APRIL 3, 2022 AT 1:26 AM

Hey there! Does your acetic acid consist of vinegar, or something more concentrated? If it is vinegar, it is too weak to help much. I have tried using vinegar to acidify copper acetate solutions (copper (II) hydroxide also likes to form in them) with little success. Glacial acetic acid, on the other hand, is much stronger.

Honestly, I've never tried it before. Adding the acetic acid to iron sulfate solution would definitely introduce impurities, but they might not negatively affect crystallization. I recommend you prepare two very small batches (~50 mL) of iron sulfate solution. Add acetic acid to one batch. Leave the two solutions exposed to air for a few days until crystals form. Both solutions will turn brown (even sulfuric acid cannot prevent that), but the acetic acid one should hopefully be greener and contain no precipitate. If the crystals in both batches look the same, then you're good to go.

Good luck!

REPLY

nguyễn
MARCH 3, 2022 AT 1:17 PM

I'm not sure. I put fes04 in a glass and mixed them with hot water. And it started to form brown clouds under the water. The water color also changes from transparent to yellow brown. so I think yellow water is acid. :)))

REPLY

CHASE
MARCH 3, 2022 AT 2:42 PM

Oh. That's actually very normal. The brown stuff is actually iron(III) hydroxide and happens when your solution is not acidic enough. The problem is not because of acid. Instead, you should ADD a little sulfuric acid to make everything clear again. Also, drop a piece of steel wool inside. The steel wool will help you turn the brown stuff back to green.

REPLY

nguyễn
MARCH 3, 2022 AT 11:24 PM

Thank you so much!

REPLY

nguyễn
MARCH 2, 2022 AT 1:03 PM

Hi Chase. I have 1 problem. I mixed water in feso4.7h2o powder and it made acid. Can you help me Convert from powdered feso4 to liquid feso4.please!!!!

REPLY

CHASE
MARCH 3, 2022 AT 4:44 AM

What do you mean it made acid? It's straightforward to dissolve the powder in water. After that, the solution should have turned green as the FeSO4 dissolved into the water. May I know what problem you are facing?

REPLY

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