**COPPER NANOPARTICLE SYNTHESIS**

***Version 1.0***

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# OBJECTIVE

To prepare copper nanoparticles from copper sulfate and ascorbic acid.

# REQUIREMENTS

To follow this tutorial, it is necessary to have training in: weighing on a precision balance.

# SOFTWARE REQUIREMENTS

None.

# STEP BY STEP

## **PREPARATION OF SOLUTIONS**

To prepare the copper nanoparticles, it is necessary to prepare two base solutions. To generate them, you will need 5g of copper sulfate and 7.5g of ascorbic acid. Make sure you have these materials before following the procedure. For your safety, wear gloves and do not ingest any of the resulting elements or solutions.

1. Obtain two glass beakers of at least 200 mL each.
2. Add 750mL of water to each of them. Make sure that all the water is at the bottom of the container and not adhered to the walls.
3. In a ceramic container, weigh 7.5g of ascorbic acid.
4. Add the ascorbic acid to one of the beakers with water.
5. Stir until a homogeneous and translucent solution like the one shown in Figure 1 is obtained. Properly label the beaker with a tag*.*



Figure 1: Ascorbic acid solution in water.

1. In a ceramic container, weigh 5g of copper sulfate.
2. Add the copper sulfate to the remaining water in the other beaker. Properly label the beaker with a tag.
3. Stir until a homogeneous and blue solution is obtained, as shown in Figure 2. Keep in mind that the container in which this solution is made will be the same container where you will obtain and store the copper nanoparticles to avoid losses when transferring them to another container.



Figure 2: Copper sulfate solution in water.

## ELABORATION OF COPPER NANOPARTICLES

1. Stir the copper sulfate solution vigorously while slowly adding the ascorbic acid solution. You will notice that the solution changes from blue to green. This is due to the displacement of copper ions caused by iron ions. The solution should look like the one shown in Figure 3.



Figure 3: Resulting solution when mixing ascorbic acid with copper sulfate.

1. Stir vigorously for approximately 1 minute.
2. Cover the container to prevent contamination.
3. Leave the solution at rest for at least one hour. You will notice a pink layer at the bottom of the container, as shown in Figure 4*.*



Figure 4: Separation of copper nanoparticles (pink bottom layer) from ascorbic acid solution (green).

1. The bottom layer contains the copper nanoparticles.
2. Remove the green ascorbic acid solution to access the particles. Keep in mind that the copper nanoparticles will begin to oxidize immediately after removing the ascorbic acid solution that covers them*.*

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