

Note to teacher regarding Photosynthesis lab:

Salt and sugar and carbonated water made the negative control float. I think acid makes bubbles with the carbonate. I suspect that all things that dissolve in water change the buoyancy and therefore make them float faster. Sodium bicarbonate may function in the same way.

You can get them to sink. Use a perfectly air-tight small syringe. Use new ones from the back if necessary. Positive pressure and flick. Negative pressure and flick. With the negative pressure you can see the air coming out of the chads. Then apply positive pressure again and they should all sink. Repeating twice with baby spinach was all that was necessary. All 80 chads go into the liquid at once. Practice first. It takes a full period. They never put the chads into the liquid no matter how many times I tell them. They never do all experiments at the same time. They don't put the chads close enough to the light source. They choose tiny test tubes with 10 chads, so the bottom chads are shaded and won't float. They choose test tube racks and large test tubes that keep the chads too far from the light source or shade the chads.

Exp conditions ideas

Leaves from outside

Dying leaves

Heat

Cold

More or less sodium bicarbonate.

2 day old spinach vs fresh spinach (if they don't get through the experiment)

Add acid (but makes everything float due to sodium bicarbonate)

Add base

Flick leaves when pressure is on. Flick leaves when pressure is negative and bubbles from leaves form.

Don't use spring water from a bottle - they didn't float. They did float once sodium bicarbonate was added, and they did float when the water was changed to tap water

0.3% sodium bicarbonate (from Chem) or 1 g/ 100 mL. Not even necessary - did the whole experiment in Tap water and without soap and it was fine. But do it anyway with the additives. Distilled water will lyse cells.

Don't have all your chads sitting out on your desk until you need them or that is a treatment - drying out from cut edges. Many students had 3rd rep take the longest.

Do in triplicate all at once (but syringe separately)

Get the light VERY close. Even after this warning many students have the light too far away.

Strongly suggest that everyone do the positive control first, and do it under Mr. L's grow lights so we know it will work.

Keep the distance to the bottom of the glass constant.

Spinach

Lamps - grade 10 light activity, or environmental biology grow lamps

Many small tiny Beakers or white plastic ones. Could buy small disposable plastic cups like medicine cups.

Triplicate is possible if we can make chads and make them sink fast enough, and if we can get multiple beakers under the light at once

Drop of soap. Not quantified. Too much if it bubbles. Coats the leaf and lets water into the hydrophobic leaf.

Ice option?

Tips for students:

Cut all chads at once right into a beaker of bicarbonate. Just let them float there and pour them into the syringe as needed.

Get lights as close as possible to experiment

Only negative control would really be in total darkness

Technique must be shown to students for getting them to sink. It does always work. Practice it.

1. Test empty syringe for seal by pulling to create a vacuum.
2. Dump in chads in bicarbonate - more than 10
3. Remove air
4. Negative pressure first, with shaking
5. Even more negative pressure, with shaking
6. Remove air if needed, then even more negative pressure, with shaking
7. Some strong positive pressure. See if they sink. If not, repeat.
8. If leafs don't sink after 3-4 evacuations, maybe not enough soap

Use 10-15 chads. Remove the ones that don't sink. Record the number of sunk ones at start, so we can use % floats.

Student results and my verification indicate that 0% bicarbonate - just water, works ok. So bicarbonate may not be necessary but does speed it up slightly. Distilled water does not work - all negative results. Probably because lyses cells and water has access to the cells because of the cut edges of chad.

Make 2% bicarbonate w/v = 10g in 500 mL

Make 0.3% by 150 mL of above per litre.

Add drop of dish soap to coat the leaf so water can enter

Some student results showed no floating just off of ambient room light, so total darkness was not required.