Flowers.
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Experiment #1 - What helps a flower last longer?

For all you budding scientists wanting to experiment with different types of floral preservatives, here is some help with setting up your experiment.

Flowers have a pre-set or pre-determined life that is established by the plant (or its genetics). Some flowers last a day while others may last up to several months (on the plant). Scientists have unlocked a few secrets in the life of a flower. One thing you may want to experiment with is how long humans can keep flowers alive once they are removed from the plant. It is interesting that even our best efforts don't often exceed the life nature has "programmed" the flowers to have. With proper care, however, some flowers will last up to a few weeks.

One miracle that makes plants different from animals is their ability to make food. Using water and carbon dioxide (what humans and animals exhale) in the presence of sunlight and within the chlorophyll (green pigment), plants make their own food. It is a simple sugar that provides energy for all the growth and development of a plant – including making and developing a flower. However, once cut from the plant, the fresh flower no longer is connected to its food source. There are not enough leaves on fresh flowers to produce the amount of food needed to keep them alive.

That's what we humans try to substitute in the vase: providing food and water for the fresh flowers they would have normally taken from the plant. Many students study which substances have positive effects and notice which ones have negative effects. Remember that the flower needs to take up water and in that water should be a source of energy the flower can use. If water can't go up the xylem tissue (the water conducting vessels that work like straws to take water up to the tip of the flower petals) or if there isn't enough food, the flower will die.

Substances you might add to 8 oz. of warm water in a glass or plastic vase:

Substance	Amount to add to 8 oz. of warm water	What it provides	The likely effects
Water: plain water, tap water, distilled water, deionized water, boiled water, rain water, spring water, bottled water		water	Prolongs flower life but not for long since there is no source of food or energy

table sugar or granulated sugar	1 Tablespoon	(sucrose, a simple sugar) food or energy source	encourages growth of stem-clogging bacteria and fungi so water can no longer be taken up
soda pop (clear, not diet)	4 oz.	variety of sugar sources	
orange juice, lemon juice	1 Tablespoon	fructose (a simple sugar), food or energy source and citric acid	
milk	1 Tablespoon	lactose (a simple sugar), food or energy source	
penny	1	2.5% copper in entire penny	inhibits the growth of stem-clogging bacteria and fungi but provides no food
vinegar	1 Tablespoon	acetic acid	
aspirin (crushed)	1	acetylsalicylic acid	
bleach	1 teaspoon	sodium hypochlorite & sodium hydroxide (lye)	
commercial or professional preservative	1 packet (follow directions)	food or energy source and biocide	provides food and reduces growth of stem-clogging bacteria and fungi
salt, solutions containing salt like pickle brine	1 teaspoon	toxic to flowers	speeds up flower death
vanilla extract (contains alcohol)			
flour, baking soda	1 teaspoon	particles won't dissolve completely	clogs the xylem tissue and prevents water uptake

As you can see from the table, some substances have a food source (sugar) that may help the flower live a bit longer. Water is supplied in the vase (obviously, where the substances are dissolved). However, the sugar alone in the vase will promote the growth of bacteria and fungi, clogging the xylem (part of the stem that takes up water). So, an ideal floral preservative has a balance of sugar and an acidic substance (to deter the bacteria and fungi from growing) to extend post-harvest life the most.

Experiment #1 Outline

What you need to buy or find:
Identical glass or plastic containers for vases
Small bowl filled with warm water for recutting stems under water
Identical flowers (ideally 3 stems per vase)
The components or substances you'll add to make treatments (various)

Several things to consider before you begin:

Hypothesis: A good hypothesis is based on many things that are known and one thing that you suspect or hypothesize will happen (an unknown). Hypotheses should be stated as if nothing were going to happen (called a null hypothesis) where there is no change or everything is the same. Your hypothesis might be that sugar added to water will have no effect on floral life (and you compare that to plain water). My hypothesis is that the commercial preservative will last the same as any other treatment. I can test that (and know that the commercial preservative will probably last longest) by putting the preservative packet into 8oz. of warm water and putting a second vase of just warm water along side that – then adding identical flowers to each vase.

Keeping the environment and other conditions the same to reduce the outside influences is very important. The only thing you want to be different is the contents of the vase solution. You will want to collect both flowers and vases or containers that are identical and keep your flowers in the same room, under relatively the same conditions.

Determine how many "treatments" you'll use and a find that many identical glass or plastic containers (vases or glasses will work just fine). Do not use metal containers as they will sometimes react with the things you put into solution in the vase. I highly recommend you use two comparisons: plain or tap water and another using a packet of commercial preservative.

Next, find several identical flowers. I like to use carnations for this experiment (standard white) since you can see them age easily since the petal tips will turn brown. They are readily available from a wide variety of floral outlets and they do last for several days. Chrysanthemums will work well, too, as will mini carnations. I suggest you use 3 stems per vase as you will see some variation in the flowers in one vase.

Getting started:

Into each vase or container, add the same amount (8 ounces) of warm water. Using warm water helps to dissolve the items you add and warm water is best to restart the uptake of water into the stem. You could try many things, but *DO NOT MIX chemicals and always have appropriate supervision when you are making or mixing your treatments*.

Have a small bowl filled with warm water sitting alongside the vases or glasses. Be sure that you re-cut a small amount of the stem off while holding the end under water. This will also help to restart the flow of water up the stem. Simply use sharp shears or scissors and snip off the bottom _ inch of the stem while holding about 2-3 inches of the end of the stem under water in the bowl. Then, transfer the flower to the prepared glass or vase.

Make observations daily on your observation sheet. First, look at the plain water vase, which is your comparison on control treatment. What is the color of the flower today? Is there any darkening or lightening/fading of the color? Any wrinkled petals or changes in flower shape? How fresh do the flowers look? Perhaps you could rate the freshness of

the flower on a scale from 5 (super fresh) to 1 (nearly dead). How milky or cloudy is the solution in the vase (why is it cloudy, you ask? Bacteria and fungi are growing!). You might take pH readings daily if you have that equipment (or want to buy some pH papers at the drug store). These observations are your results.

Conclusions are the next step. Why did you see what you observed? What caused the changes? Did you collect evidence to support or not-support your hypothesis?

Let me know how yours turns out. Keep enjoying science - the world needs more scientists!

For more information on
The amount of copper in a penny
(http://www.usmint.gov/about_the_mint/fun_facts/index.cfm?action=fun_facts2)

Floralife (professional floral preservative) (http://www.floralife.com/) see the information for both students and consumers.
Chrysal (http://www.pokonchrysal.nl/eng/index.html) is another professional floral preservative.

Aspirin components (http://www.tsbkm.com/cgi-bin/lessonlocator/view_activity_info/292)

General information about floral preservatives:

http://aggie-horticulture.tamu.edu/syllabi/203/lecture/chemicals.html

http://www.ipm.iastate.edu/ipm/hortnews/1993/8-11-1993/cut.html

http://www.florainternational.com.au/Caring%20for%20your%20roses.htm