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CHEMISTS CELEBRATE EARTH DAY

AMERICAN CHEMICAL SOCIETY

What's in the Air?

By Alex Madonik

Most of us are lucky enough to have a familiar place called home. One of the most familiar things about home is the smell. It may sound silly, but our noses are amazing chemical detectors … and we remember what we smell!

So, what's in the air that we breathe? You may already know that there's oxygen (about 21%), which our bodies need to live. Most of the rest is nitrogen (78%), which is an inert gas under certain conditions, meaning that it doesn't tend to change much or form other compounds. There's also argon (less than 1%), a gas that is even more inert, as well as small amounts of other gases. None of these gases has any odor of its own.

The things we can smell in the air inside our homes come from other sources, such as cooking, plants, cleaning products, or the materials that make up our home and its furniture. If any of these materials produces vapors, they can travel through the air to our noses, and then we may be able to smell them.

A smell you are probably familiar with is fresh paint. While modern latex paint is water-based, it also contains other chemical solvents called **volatile organic compounds (VOCs)** that we can smell as the paint dries and the VOCs evaporate. In this case, the word volatile simply means it evaporates easily. Most states have rules that limit the amount of these VOCs. Plastics, foam cushions, and carpeting contain less-volatile **semi-volatile organic compounds (SVOCs)**. These are called "plasticizers," and their job is to make materials that are strong yet flexible. These plasticizers often add to the odors we think of with new items or materials.

You probably know how strong cooking smells can be, with some seeming to "cling" for days. Frying makes food very hot, and causes lots of vapor to escape into the air. This vapor includes water (in the form of water vapor, or steam), tiny drops of oil, and many chemical compounds from the food that is cooking. This vapor travels through the air to our noses, and it also sticks to dust, walls, and counters. The oil and other smelly compounds from food are semi-volatile, which means they evaporate very slowly at room temperature, which is why we can sometimes still smell them long after they were cooked.

Another common part of indoor air is dust. If you shine a light through the air in a dark room, you'll see thousands of tiny floating particles — and there are millions more that are too small to see. Many are dust particles, tiny bits of sand, or dirt. Other particles come from plants, insects, and from our own skin. When you clean your house with a vacuum cleaner, it collects these particles. The best vacuum cleaners and home air cleaners use HEPA (High-Efficiency Particulate Air) filters. These are special filters that collect even the particles that are too small to see, and they are helpful to anyone with allergies to dust and mold.

***Alex Madonik** is the National Chemistry Week Coordinator for the California Section.*

How Plants Clean the Air Inside Our Homes

By Sanda Sun

PHOTOS BY SANDA SUN

Snake Plant

Spider Plant

Chinese Evergreen

Dracaena Warneckii

Golden Pothos

Many household products give off invisible gases that chemists call VOCs. These compounds evaporate easily into the surrounding air. They are used in chemical-based cleaners, paints, and even air fresheners. One of the common VOCs, formaldehyde, is a gas at room temperature. It is used to make various plastics and glues, and is also added as a preservative to some cosmetics.

They do dissipate (or fade away) over time, but are not entirely removed. Any materials that produce VOCs should be used or placed in areas where there is good ventilation.

VOCs can be harmful. This is especially true indoors, because there is less air circulation. Most VOCs are not very toxic unless the concentration is very high, but some do cause health problems. Some of these problems can be short-term (usually due to high concentrations) and others long-term (usually due to persistent low concentrations). Short-term exposure may cause allergy symptoms such as eye, nose, and throat irritation, or even difficulty breathing. Long-term exposure may increase the risk of cancer and organ damage. Some harmful VOCs are listed in the table below.

If the flames in a gas range, oven, or furnace are properly adjusted and maintained, there is minimal carbon monoxide produced. Good ventilation is necessary to dissipate small amounts of carbon monoxide (CO) in a house.

Several common indoor plants can clean the air we breathe by absorbing VOCs. Aloe veras, bamboo palms, Chinese evergreens, golden pothos, snake plants and spider plants filter out petroleum-based solvents. Dracaena warneckii absorbs toxins from varnishes and oils. Chinese evergreens can help filter out a variety of air pollutants.

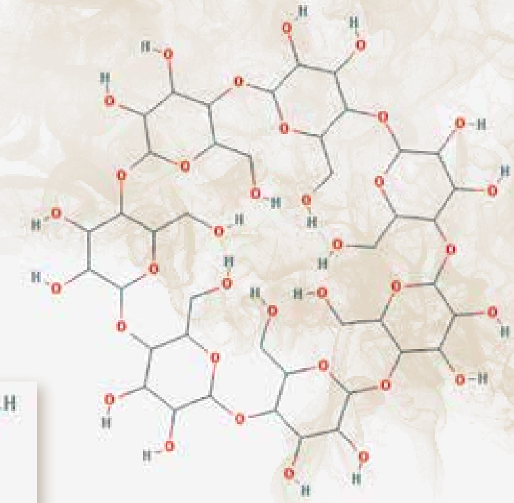
All plants require carbon dioxide (CO_2) to grow, but most cannot absorb CO. Interestingly, spider plants do absorb low levels of CO.

All the indoor plants mentioned are easy to grow and can be found in most nurseries and the gardening sections of warehouse stores.

Sanda Sun *is CCED Coordinator for the Orange County Section.*

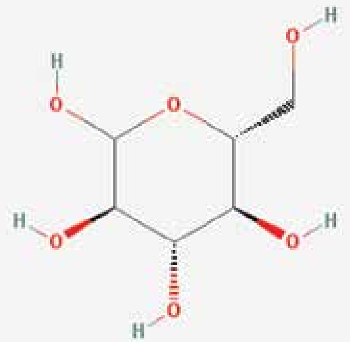
Harmful VOCs	**Sources**
Water-compatible solvents – alcohols and glycol ethers	Latex (water-based) wall-paint, home cleaning products, nail polish remover
Oil-compatible solvents – hydrocarbons / petroleum	Varnish on floors, furniture, paint thinner, turpentine
Formaldehyde	Carpets, plywood, treated papers and fabrics, preservative in cosmetics

Odor Eliminators



Cyclodextrin

By Janet A. Apser



Glucose

Ewww! What is that awful smell? Whether it is the dog that needs a bath, stinky socks, or the fish that was fried for dinner, sometimes things in our home ecosystem just don't smell good.

Chemistry has a solution to that problem. Many people use "air freshening" sprays. These sprays contain molecules that smell good, and put a lot of those molecules in the air so your nose detects more of the good smell than the bad. Some of these good-smelling molecules are limonene (which smells like oranges or lemons), while others are pinene (which smells like pine trees). When the good-smelling molecules fade away, so does their pleasant smell.

Another product that people use is called an "odor eliminator." How does an odor get eliminated? Again, it is chemistry! The main ingredients of odor eliminators are molecules called **cyclodextrins**, ring-shaped molecules made up of the sugar molecule called glucose.

When you spray an odor eliminator on a stinky fabric, the odor molecules fit inside the cyclodextrin rings. Just as you wear different-sized rings on different fingers, cyclodextrins come in different sizes to hold different-sized odor molecules.

Once an odor molecule is trapped in a cyclodextrin ring, it is stuck there, so it cannot go into the air and travel to your nose. If the molecule can't get into your nose, you can't smell it.

Cyclodextrins are very safe and non-toxic; in fact, they are used in personal products such as medicine.

Did you know that the original odor eliminators didn't have a smell at all? It was just a water solution of cyclodextrin with a preservative in it. You would spray it on a fabric and the smell would just go away. Since people were used to the smells in their houses, they didn't really think that there were odors to be eliminated, and people stopped buying it. Chemists began to add a perfume to it, so that you not only got rid of the bad odor, but you also smelled a different, nicer smell, which showed customers that the odor was gone. With that pleasant smell, sales went through the roof!

Now that people are becoming more concerned about putting extra chemicals into their homes, and some people are sensitive to perfumes, the unscented odor eliminator is back on the market.

The best way to deal with a stinky odor in your home ecosystem is to remove the source of the smell. Empty the trash cans, clean up after your pets, wash dirty clothing, and open the windows to remove cooking smells. Cooking smells linger due to deposits of oils, food residues, etc., on walls, cooking areas, tabletops, etc. A forensic scientist who works with microscopic residues can detect these food residues in homes and offices. To remove cooking smells, the areas must be cleaned or washed. For big things that are hard to wash, like couches and carpeting, odor eliminators may be a good idea.

***Janet A. Apser** is Associate Professor of Chemistry at the University of Mary Washington in Fredericksburg, VA.*

Milli's Safety Tips Safety First!

ALWAYS:

- Work with an adult.
- Read and follow all directions for the activity.
- Read all warning labels on all materials being used.
- Use all materials carefully, following the directions given.
- Follow safety warnings or precautions, such as wearing gloves or tying back long hair.
- Be sure to clean up and dispose of materials properly when you are finished with an activity.
- Wash your hands well after every activity.

NEVER eat or drink while conducting an experiment, and be careful to keep all of the materials away from your mouth, nose, and eyes!

NEVER experiment on your own!

Perfume Diffusion

By Alex Madonik

Introduction

What's your favorite flavor or perfume? Did you ever wonder how their scents travel to our noses? The air around us is made up of molecules in motion. We can't see them, but we feel them if they move toward us, causing the sensation we know as wind. In our home, we can see water vapor (gas) turn into drops of water when it meets a cold surface, such as a window on a cold day, or the outside of a glass containing a cold drink. And our noses can detect many kinds of molecules that float in the air. In this activity, you will learn more about how air molecules move.

Materials

- Two or more bottles of different flavor extracts or perfumes. Substances should be non-toxic, preferably with strong, distinctive odors.
- Flashlight (a bright flashlight is recommended, such as a small LED light)
- Measuring stick or tape measure
- Notepad
- Clock or timer

Procedures

It's best to do this activity with two or more partners. Your partners can be your parents or your friends.

1. Measure the size of the room where you will be conducting this activity–including its length, width, and height. (Also note whether there are any open doors, windows, or air vents that could let in a breeze. Is there a fan or heater in the room? If possible, try this activity in a room where the air is still.)
2. Decide where you (holding the perfume or extract) and your partners will sit, and measure the distance (5 feet, or about 1.5 meters) between you and each partner.
3. When everyone is ready, start the timer and open the bottle of perfume or flavor extract.
4. Have each partner say 'now' when they first notice the odor.
5. Sit quietly and record the time when the scent first reaches each partner.
6. Compare the times with the distances between you and your partners.
7. You can make a graph with distance along the X-axis and time on the Y-axis.

What did you see?

	FLAVOR/PERFUME 1:		FLAVOR/PERFUME 2:	
Observer	Distance from scent source	Length of time until they first smelled the scent	Distance from scent source	Length of time until they first smelled the scent
1				
2				
3				

Now make some predictions: if you increase the distance by 5 feet, will the time be longer or shorter?

Describe the motion of dust particles in the room:

- Are they all moving the same direction?
- Do they change direction?
- Do they change speed?

You will need to air out the room before you try the experiment again. Or, you could start the experiment in a different room with a different scent. Why? Our noses are more sensitive to some scents than others. Some scents evaporate more easily than others. Evaporation depends on temperature, so warming or cooling the bottle of scent could change the result as well.

If there are air currents in the room, they can carry the scent quickly from place to place. Even if you can't feel these currents, you can sometimes see them, because they also carry dust. Turn off the lights, close any blinds and/or curtains, and shine a flashlight upwards. Look at the light from different angles to see the dust particles in the air. How are they moving? Up and down? Back and forth? Are there air currents carrying them around the room? Try blowing toward the light to see how that affects the dust particles.

How does it work? Where's the chemistry?

Most familiar scent molecules are made of mainly carbon, hydrogen, and sometimes oxygen. Some are more complex. They evaporate easily, and it's the vapor in the air that we can smell. There are two ways a perfume's scent can spread. First, it can travel in the air by **diffusion**. The scent molecules move rapidly in the air, but then they hit other air molecules and change direction. After a while, they spread out across the room. We can't see them, but we can smell them! The second way odors can move is when air currents carry them more quickly across the room.

Dust particles are much bigger than molecules, but they can still float in the air, moving by diffusion or in air currents. Light reflects off the particles, so we can see them if we turn off the room lights and shine a flashlight through the air. The dust particles are easy to see if the background behind them is dark.

“The Great Indoors-Your Home’s

Everyone loves to go on a scavenger hunt! Go around your own house and see how many of the 10 things listed below you can find. When you find an item on the list, put a check mark by it … and let your parents or guardians know if there are any follow-up suggestions. Have fun!

1. **Fan** – cools your house in summer.
2. **Heater/Fireplace** – heats your house in winter.
3. **Air Filters** – remove particles from the air such as dust, pollen, and allergens. Make sure that the filter is cleaned and/or changed regularly.
4. **Smoke/Carbon Monoxide Detectors** – Alert you when there is a fire or a dangerous amount of carbon monoxide in your home. Make sure to change the batteries twice a year, and be sure these devices are functioning properly.
5. **Dehumidifier** – removes excess moisture from inside your house. When water collects inside the dehumidifier, the water needs to be drained out regularly.
6. **Fire Extinguisher** – every house should have a fire extinguisher in case a small fire occurs somewhere inside the house (for example, cooking).
7. **Humidifier** – adds moisture to the air, especially in the winter when the house is dry.
8. **Indoor Plants** – freshen the air and actually remove harmful vapors.
9. **Mold and Mildew** – can appear in various places in your house where there might be excess moisture, particularly around windows, doors, refrigerators, and the kitchen. If you find mold and mildew, ask your parents to clean it up and to take proper measures prevent further buildup of mold and mildew.
10. **Water Softener** – removes calcium and magnesium ions from the water so that when you take a bath or shower the soap is more “soapy.” Have your parent make sure the water softener has the right level of chemicals.

The Adventures of Meg A. Mole, Future Chemist

Dr. Erica Hartmann, Postdoctoral Fellow

This year I had the honor of visiting the University of Oregon! This is where I met Dr. Erica Hartmann, a Postdoctoral Fellow at the university's Biology and the Built Environment Center. Dr. Hartmann collects dust and studies it to find out what types of chemicals and microbes are in it. Microbes, she explained, are single-celled life forms that are so small, millions could fit on the head of a pin!

When I arrived, Dr. Hartmann took me on a "dust collection" field trip! She showed me how she collects her samples. She crawled across floors, climbed over furniture, and even crawled across rafters in the ceiling! Her newest dust collector is a cool backpack vacuum cleaner that she carries on her back, just like in the movie, *Ghostbusters*! Her job allows her to get dirty, and she told me she really enjoys not having to wear a suit every day. She does have her favorite lab accessory that she wears every day – purple nitrile gloves!

I asked Dr. Hartmann if she enjoyed the sciences when she was growing up. She exclaimed, "Yes! I always really liked biology. It wasn't until much later, when I had an amazing chemistry professor in college, that I started to be interested in chemistry." Her parents and teachers inspired her to be a scientist. "My father worked at

NASA, and they used to have an event called Take Your Daughter to Work Day (now I think it's open to all children of NASA employees, both girls and boys). My father took me every year, and I did all kinds of activities. I especially remember eating astronaut ice cream. Also, in 7th grade, my science teacher was a beekeeper at a local nature center, and I volunteered to help with the hives." She told me she really made her decision to be a scientist in college, where she had some "truly excellent mentors."

Dr. Hartmann told me her favorite part of her job is changing the world! "In science," she said, "we can make important discoveries that keep people healthy and make the world a better place." She also likes that she has been able to explore the world. "I've traveled for work all across the US, and also to Italy, Japan, France, Germany, and most recently, Finland."

So, where would we all come in contact with her work? She explained, "Everywhere! There are chemicals and microbes all around you, and even inside of you. My job is just trying to figure out what these microbes are, and what they're doing."

Personal Profile

FAVORITE PASTIME/HOBBY? Fencing and skiing

ACCOMPLISHMENT YOU ARE PROUD OF? When I got my driver's license (at 16), my parents wouldn't buy me a car, so I got an after-school job and worked really hard to save up enough money to buy one for myself. I loved that car and drove it for 7 years!

Word Search

Try to find the words listed below – they can be horizontal, vertical or diagonal, and read forward or backward!

C	Y	C	L	O	D	E	X	T	R	I	N	S
T	V	O	A	F	U	N	G	I	E	E	C	V
D	E	N	A	D	T	C	P	R	T	T	C	X
I	N	X	P	D	N	R	M	F	A	A	T	Z
F	T	E	M	I	I	R	E	A	W	P	S	J
F	I	E	U	U	N	C	B	T	D	I	Y	Q
U	L	I	C	O	P	I	O	T	R	S	B	E
S	A	U	S	O	S	I	R	Y	A	S	O	E
I	T	E	R	T	U	E	C	A	H	I	T	E
O	I	M	R	E	S	U	I	C	B	D	S	E
N	O	O	O	T	L	F	M	I	T	T	W	A
D	N	I	I	L	L	O	H	D	E	F	U	A
E	U	A	R	C	D	D	F	G	R	H	K	A

CYCLODEXTRINS
DIFFUSION
DISSIPATE
FATTY ACID
FUNGI
HARD WATER
MICROBE
MOLD
SCUM
VENTILATION

For answers to the Word Search, please visit the Educational Resources page at www.acs.org/earthday.

Water You Thinking?

By Richard Rogers

We all know that our drinking water is safe. It is tested many times before it reaches our faucet. However, what is in our water besides H_2O?

According to the United States Geological Survey (USGS), most areas of the continental U.S. have **hard water**. What makes water hard? Hard water contains minerals, primarily calcium (Ca) and magnesium (Mg) salts, although the water can also contain iron (Fe), aluminum (Al), or manganese (Mn) salts.

Water that does not have these minerals is called **soft water**. The type and amount of minerals in water depend on the water source and the area of the country. Hardness is normally tested and reported as parts per million (ppm) of Ca, though the test usually also includes Mg. There are additional tests that can detect levels of other elements, but they are rarely performed, since the levels are usually low.

Note: Well water can range from soft to hard. It can contain other minerals in addition to Ca, Mg, and Fe salts. In some areas, low levels of arsenic (As) are found.

So how hard is hard? The most commonly accepted values are shown in the table below.

Hardness	ppm Ca
Soft	< 60
Medium hard	60 – 120
Hard	120 – 180
Very hard	>180

Why do we care about the hardness of our water? It is not dangerous to drink; however, it can hurt your plumbing, tubs, sinks, pools, and certain other surfaces. The minerals produce "scale" and sediments that can clog up pipes and reduce the amount of water flow, making it necessary to replace them. They can also react with soap and shampoo to create hard-to-remove water spots, soap scum, and bathtub rings — problems that you may hear about in cleaning product commercials. Soap scum can make your skin feel dry, and can also make you need to use more soap and shampoo to get clean. In some cases, the water can also have a bad taste. If you have a swimming pool, hard water can cause haziness in the water.

The easiest way to learn about the water in your house is to ask the local water supplier. They test the water often and should be able to tell you the hardness and the common minerals in the water. Test kits are also available at most hardware and home improvement stores. (Some water suppliers do limited water softening when they treat drinking water.)

If you have hard water, what can be done about it? If the water is hard enough to cause problems, a water softener can be installed. The most common type of water softener works by removing the calcium and other ions (the charged forms of elements that make up salts) and replacing them with sodium ions. Now and then, the water softener needs a recharge with sodium ions. Common salt is used to wash out the other minerals. There are other types of water softeners available as well.

So check out what kind of water you have and whether you have a softener. If you have hard water, a water softener might be a good idea!

***Richard Rogers** is a Senior Research Chemist at Grain Processing Corporation.*

Your Suds Are Duds!

By Rick Rogers, Alex Madonik, and **Sumera Razaq**

Introduction

When you wash your hands, what do you need, besides water? Soap, of course! Soap is one of the oldest chemical products. Soap works because it dissolves greasy dirt, and it also dissolves in water. But, what if your water doesn't dissolve the soap? Hard water contains minerals that prevent the soap from dissolving. Chemistry has an answer for this problem!

Materials

- 4 empty 20 oz. (about .6 L) soda bottles with caps
- Epsom salts (a substance called magnesium sulfate that has the chemical formula $MgSO_4 \bullet 7H_2O$)
- Borax — an important boron compound, a mineral, and a salt of boric acid with the chemical formula $Na_2[B_4O_5(OH)4] \bullet 8H_2O$). It can be found in the laundry aisle of the supermarket.
- Liquid dishwashing soap
- Distilled water (can use "filtered" water from a refrigerator dispenser or a "filter" pitcher)
- Tap water (from the kitchen sink)
- Marker

Procedures

1. Remove labels from the bottles and use the marker to write DO NOT DRINK warnings on each.
2. Number the bottles 1, 2, 3, and 4.
3. Add 2 cups (about .5 L) of distilled water to bottles 1, 2, and 3.
4. Add 2 cups of tap water to bottle 4.
5. Add 2 tsp. (10 ml) of epsom salt to bottles 2 and 3.
6. Add 2 tsp. of borax to bottle 3.
7. Place cap on the bottle with epsom salt, shake well, and remove cap.
8. Add a few drops of dishwashing detergent to each bottle.
9. Place cap on each bottle and shake well.

Safety Suggestions

- ✓ Safety goggles required
- ✓ Do not eat or drink any of the materials used in this activity
- ✓ Thoroughly wash hands after this activity
- ✓ Protective clothing suggested
- ✓ Caution hot liquids
- ✓ The materials used in this activity can be disposed of down the drain with running water

What did you see?

For each bottle, record the height of the foam layer above the water:

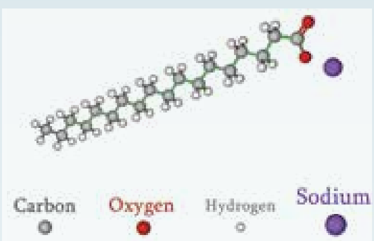
1. Distilled water (soft water) ____________
2. Distilled water + epsom salt (hard water) ____________
3. Distilled water + epsom salt + borax (softened hard water) ____________
4. Your tap water ____________
5. How do the four bottles compare? ____

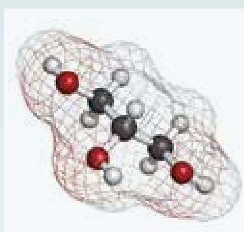
Which has the most foam? ____________

Which has the least? ____________

How does it work? Where's the chemistry?

Soap is made up of chemicals called **fatty acids**. They have an acid head and greasy tails. The greasy tails are like a fat, so they stick to greasy dirt. In soap, the acid end of the fatty acid is converted to a salt, so they can also dissolve in water. In water, the greasy tails of the fatty acids like to stick together. As they stick together, the soap molecules (fatty acids) can form films that turn into bubbles.





The minerals in hard water contain salts of calcium, magnesium, and sometimes iron. These salts can react with the acid ends of fatty acids to make an insoluble substance that we call scum. This scum does not dissolve in water. If there is too much magnesium and calcium in the water, there's no soap left to make bubbles! Borax reacts with calcium and magnesium salts so that they basically leave the soap alone.

The bottle with epsom salt (#2) should have fewer bubbles than the bottle without epsom salt (#1). The bottle with epsom salt is hard water, because it contains a magnesium salt. How does tap water from your sink (bottle #4) compare to bottles #1 and #2? Is your water hard or soft? How do bottles #2 and #3 compare? Do you think borax changes the way the epsom salts affect the hardness of the water? If so, how?

Note: If you want to test your tap water, buy a test kit! You can find test kits online or at your local hardware store.

Mold, mildew and Dampness in Your Home

By George H. Fisher, Ph.D.

Have you ever seen mold growing on bread? Did you know it could grow on walls and carpet too? Mold and mildew grow in places where there is a lot of moisture, such as around leaky roofs, windows and pipes, or anywhere after a flood. They grow well on walls, ceilings, carpet, wood, and paper. Mold and mildew are types of **fungi**, in the form of spores or hair-like bodies too small to see without a microscope.

Exposure to damp and moldy environments may cause a variety of health problems. Mold and mildew may cause allergies including nasal stuffiness, difficult breathing, throat irritation, and coughing or wheezing. People sensitive to mold and mildew should stay away from areas that are damp and moldy. Residues from mold and mildew will persist even after an exposed area has dried out.

Since mold and mildew need moisture to grow, you can control and prevent them in your home by controlling moisture. Keeping humidity levels below 50% to 60% all day long can help keep houses or buildings dry. An air conditioner or a dehumidifier will help you keep the humidity level low.

If mold or mildew is growing in your house, you need to clean it up and fix the moisture problem. Firstly, **ventilate**, especially the areas that create moisture, like the kitchen and bathroom. When vent fans are present, make sure to turn them on and/or leave them on longer. Next, mold and mildew growth can be removed from hard surfaces with soap and water or a bleach solution. Sometimes it is too difficult to clean it yourself. When that happens, there are professionals who can remove mold and mildew by a process known as **remediation**, using special chemicals and cleaners to prevent future growth.

To learn more, see the Environmental Protection Agency's publication, "*A Brief Guide to Mold, Moisture, and Your Home*" at http://www.epa.gov/mold/moldguide.html.

***George H. Fisher** is Professor of Chemistry at Barry University, Miami, FL.*

Words to Know

Cyclodextrins: A family of chemicals made up of sugar molecules bound together in a ring.

Diffusion: The random mixing of particles of liquids or gases by their spontaneous natural motion so that they move from a region of high concentration to one of lower concentration.

Fatty Acid: Chemical building blocks of the fat in the body and in food.

Fungi: Plantlike organisms lacking the green pigment chlorophyll (for example: mushrooms, molds, yeasts, and mildews).

Hard Water: Water that contains lots of dissolved minerals that while not unhealthy, but can cause problems when using soap to wash and can leave bad deposits in pipes, sinks and toilets.

Microbe: Living things, like bacteria and viruses, that are too small to see without a microscope. Examples include bacteria, viruses, protozoa, yeast, and some algae.

Mold Remediation: The removal, cleaning, sanitizing, or destruction of unwanted mold. It can also include activities that prevent it from coming back.

Scum: A layer of unpleasant or unwanted material that has formed on the top of a liquid.

Semi-Volatile Organic Compounds (SVOCS): A group of carbon-based chemicals that do not evaporate as easily at room temperatures as other VOCs.

Soft Water: Surface water that contains low amounts of dissolved minerals, especially ions of calcium and magnesium.

Ventilation: The process of "changing" or replacing air in any space to provide higher indoor air quality.

Volatile Organic Compounds (VOCs): A large group of carbon-based chemicals that easily evaporate at room temperature.

Celebrating Chemistry

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What is the American Chemical Society?

The American Chemical Society (ACS) is the largest scientific organization in the world. ACS members are mostly chemists, chemical engineers, and other professionals who work in chemistry or chemistry-related jobs. The ACS has more than 158,000 members. ACS members live in the United States and different countries around the world. Members of the ACS share ideas with each other and learn about important discoveries in chemistry during scientific meetings held around the United States several times a year, through the use of the ACS website, and through the many peer-reviewed scientific journals the ACS publishes. The members of the ACS carry out many programs that help the public learn about chemistry. One of these programs is Chemists Celebrate Earth Day, held annually on April 22. Another of these programs is National Chemistry Week, held annually the fourth week of October. ACS members celebrate by holding events in schools, shopping malls, science museums, libraries, and even train stations! Activities at these events include carrying out chemistry investigations and participating in contests and games. If you'd like more information about these programs, please contact us at **outreach@acs.org**.

PRODUCTION TEAM

Alvin Collins III, Editor
Rhonda Saunders, RS Graphx, Inc., Layout and Design
Jim Starr, Illustration
Eric Stewart, Copyediting
Sumera Razaq, Puzzle Design

TECHNICAL AND SAFETY REVIEW TEAM

Michael Tinnesand, Scientific Adviser
Lynn Hogue, Consultant, Committee on Community Activities
Michael McGinnis, Chair, Committee on Community Activities

CHEMISTS CELEBRATE EARTH DAY THEME TEAM

Alex Madonik, Chair
Janet Asper
George Fisher
Ressano Machado
Rick Rogers
Sanda Sun

DIVISION OF MEMBERSHIP AND SCIENTIFIC ADVANCEMENT

Denise Creech, Director
John Katz, Director, Member Communities
Alvin Collins III, Manager, Volunteer Support

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The activities described in this publication are intended for elementary school children under the direct supervision of adults. The American Chemical Society cannot be responsible for any accidents or injuries that may result from conducting the activities without proper supervision, from not specifically following directions, or from ignoring the cautions contained in the text.

REFERENCES

http://grist.org/living/will-my-houseplant-clean-the-air/

http://www.mnn.com/health/healthy-spaces

http://water.usgs.gov/owq/hardness-alkalinity.html

http://www3.epa.gov/climatechange/science/overview.html