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MAKE A CABBAGE CHANGE COLOUR!

Scientists often need to know if a substance is an acid or if it is a base. They use indicators to find out. An indicator will change to one colour when it is mixed with an acid and another colour when mixed with a base.

Chemicals from different plants can make indicators. With a head of red cabbage, you can test for acids and bases and learn a lot about pH factors and chemical reactors.

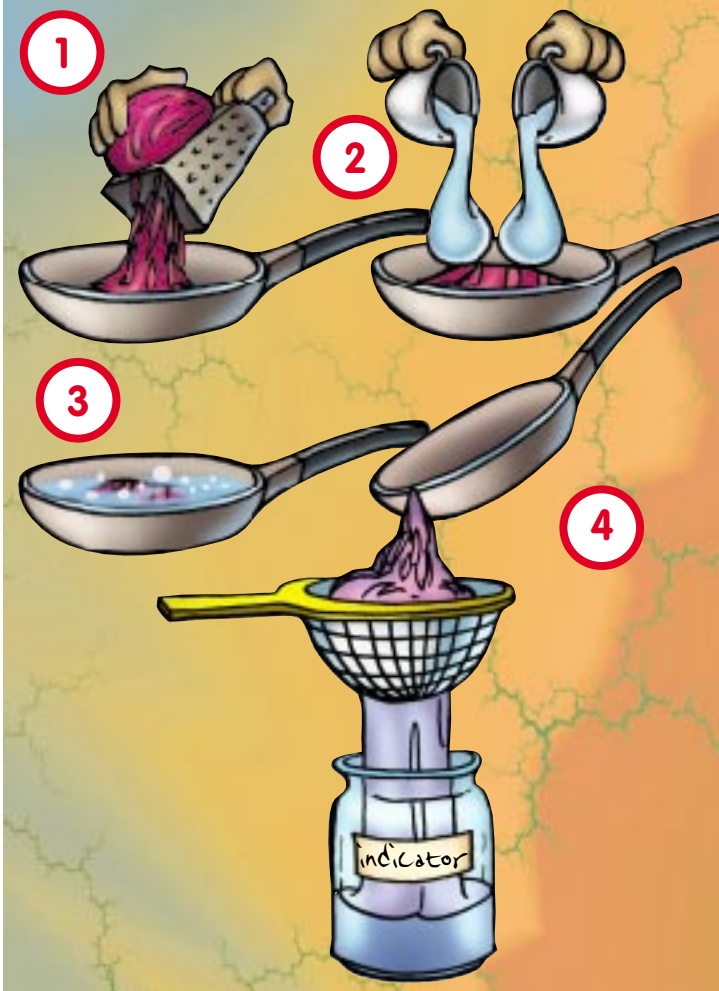
Here is how to make your own indicator from red cabbage.

You will need:

- A red cabbage
- A grater
- A stainless steel pan
- Water
- A strainer
- A glass jar
- A label

Grate about one cup-full of cabbage into the stainless steel not aluminium) pan. Pour two cups of water over the cabbage. Boil the cabbage until it is tender (about 15 minutes). Before the cabbage is done, it will have lost some of its red colour and will look a little bluish. The water will have a colour between blue and red. Take the pan off the heat and leave it to stand until it has completely cooled off.

Carefully strain the water into the glass jar. Label the jar: INDICATOR. You can use your indicator now to test for acids and bases, or refrigerate it for later. If you do not refrigerate it, bacteria will break down the cabbage and your indicator will not work properly.



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SAASTA

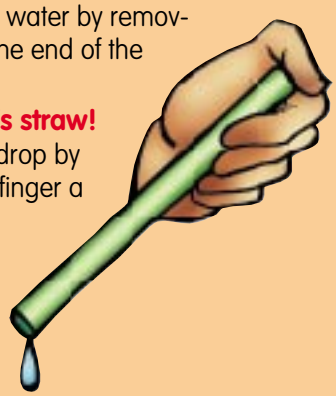
Don't throw away the cabbage. You can dish it up to your family. First, add a little vinegar or lemon juice to turn the cabbage back to a more appetising red colour. Then add some butter, salt and sugar. If you wish, stir in chopped apple and a few raisins.

How to use a straw as dropper

If you use the straw instead of a medicine dropper, put one end of it in the cabbage water. Put your finger over the other end, and lift the straw. Release the cabbage water by removing your finger from the end of the straw.

Don't drink from this straw!

To release the water drop by drop, just move your finger a little bit. When you do that, you allow air to enter the straw. The bit of air pushes out a drop of the cabbage water.



Remember...

How can you remember which turns what colour when you are using the cabbage juice test? Just match the letters:

aciD = reD Base = Blue

Brain teaser

Clever people have for many years been making up problems about measuring liquids. Try working this one out:

You have a five-litre jug and a three-litre jug and a supply of water. How can you measure exactly four litres? (Water a plant with any water you have to throw out.)

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Answer:

Fill up the five-litre jug. Fill up the three-litre jug from the five-litre one. Empty the three-litre jug. Now you have two litres in the five-litre jug. Pour the two litres into the three-litre jug. Fill up your five-litre jug again, and use the water in this jug to fill up the three-litre jug. You now have four litres in the bigger jug.

How to use your indicator

You are now ready to use your cabbage water to test for acids and bases.

You will need:

- Small glass jars or plastic containers. Clear plastic film containers are perfect.
- A piece of paper or paper towel for each container.
- A medicine dropper or drinking straw.
- Your science notebook and pen.

Put a little of each substance you want to test into a small jar or container. You can test as many substances as you like. Set each container on a piece of paper, or something you can write on. Write the name of the substance right on the paper.

Transfer a little of the cabbage water indicator to the substance. Use the medicine dropper or drinking straw. You'll see the colour of the cabbage water change. Acid turns the cabbage water indicator red. The redder it goes, the stronger the acid. Try the test with lemon juice, vinegar, cream of tartar dissolved in water, and sour milk.

Try the test with distilled water. Does it have any effect on the indicator?

Bases turn the indicator blue. Do the test with tap water and baking soda. Very strong bases will turn the indicator green. Do the test with ammonia bathroom cleaner, washing soda or garden lime.

Write **ACID** or **BASE** on the paper in front of each sample. Then write all about it in your science notebook.

Are these acids or bases?

Apple juice
Vitamin C tablets, crushed and dissolved in water (ascorbic acid)
Banana (mashed)
Coffee
Cola drinks
Eggshell (crushed and wet)
Egg white
Saliva
Seawater
Rainwater
Sugar
Toothpaste
Water from cooking carrots or peas

Indicator art

Paint a picture using different indicator fruit juices (concentrates), such as grape, blackberry, cherry, raspberry, or blueberry in different parts of the picture. Tell a friend that you can completely change the colours in the picture just by painting over it with a clear solution.

Paint over the picture with a solution of 1 teaspoon baking soda stirred into 1/2 cup of water. Try changing the picture into its original colours by painting over the picture with vinegar or lemon juice.

Play a trick on your friends with red cabbage

You can make something that looks like light blue water turn a mysterious ruby red, and then you can make it turn blue again. You will really just be showing off how acids and bases change colour when you test them with red cabbage water, but your friends might not know that.

You will need:

- Two clear glasses
- Red cabbage indicator
- White vinegar
- Baking soda
- Water

Before you invite your friends to show off the trick, pour some of the cabbage water into one glass. The colour looks almost blue. Now pour in a little white vinegar, just until you see a change in colour. The water will suddenly turn bright red. (You have just proven that white vinegar is an acid.)

In the second glass, mix some water with one or two teaspoons of baking soda. The glass should look as if it contains ordinary water. If the water is cloudy, you have added more baking soda than necessary. Add more water.

Now gather a few friends around you. Pour the water containing the baking soda into the bright red water of the first glass. The water will foam and then the colour will turn blue. Your friends will be amazed!

THE TURMERIC TEST

Here is another good way to test for acids and bases. This test gives you especially interesting colour changes for bases.

You will need:

- A glass jar with a lid
- Turmeric
- Rubbing alcohol (from the chemist)
- Labels
- A medicine dropper or drinking straw
- Paper towels or coffee filters

In the glass jar, mix one teaspoon of turmeric in 1/4 cup (60 ml) of rubbing alcohol. Allow the mixture to set until the alcohol turns bright yellow.

LABEL THE JAR:
WARNING: POISON TURMERIC INDICATOR

Keep the lid on when you are not using the indicator. Keep it away from small children.

Dot the paper towels or filters with a sample of each substance you plan to test. Label each substance directly on the paper. Transfer a little of the turmeric indicator to the substance, using the dropper or straw. Don't drink from this straw!

Look for colour changes. You can expect a reddish change with bases and a less obvious yellow with acids. Write on the paper whether each substance is an acid or base.

Turmeric trick

Save a bit of your turmeric indicator to play a blood-red trick.

Mix one to two teaspoons (5 - 10 ml) of baking soda with water in a glass. Then slowly, carefully pour a little of the turmeric indicator down the side of the glass.

Baking soda is a base, so you expect a reddish colour change.

The yellow alcohol-turmeric solution will float on top of the baking soda solution because it is lighter than the baking soda solution.

Right at the line where the two solutions meet, you will see a blood-red line appear.

Now add an acid like vinegar, stand back, and see what happens!

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FACTS ABOUT ACIDS AND BASES

- Acids and bases are not only important in chemistry, they are also necessary for cooking. The right sort of acid adds flavour to food. It gives food a sour, or "tangy", taste. Acids can also help preserve food.
- Bases can combine with acids to help with the baking process. The chemical reaction between acids and bases produces tiny air bubbles that make bread, biscuits and cakes rise.
- The strongest acids and bases are not found in food. Just touching a really strong acid, like pool acid, or a strong base can cause a bad burn.
- Another word for base is alkali.
- The pH scale is used to show how acidic something is. A scale of 0 to 14 is used, with 7 the pH value of pure water. The more acidic a substance is, the closer its pH will be to 0, and the more alkaline, the closer it will be to 14.
- Litmus is one of the best known indicators. It is made of lichen and algae. An acid solution will turn blue litmus red, but will not change the colour of red litmus. A solution containing a base, or alkali, will turn red litmus blue.
- You can make other indicators, using radishes, cherries, or concentrated grape juice as indicators.

What does a water analyst do?

A water analyst is a chemist who uses different indicators to test water samples.

Indicators are used to test the water for too much base and for calcium. When calcium and base are together in a water sample, a hard deposit is formed that can coat the inside of water pipes. The deposit makes the room inside the pipes smaller, and the water has less space to flow through. More energy is then needed to pump the water to wherever it is required.

This means the water analyst uses indicators to keep water quality high.

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