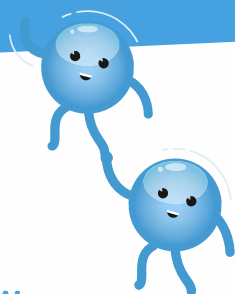


## 6. Keeping food fresh

Nitrogen packaging prevents the browning of fruit



### Overview

A show-long experiment highlighting gases that have an important but hidden role to play in keeping the food we eat fresh, and looking appetizing.

### What's happening?

When the fruit is cut, bruised or bitten, the cells and tissue inside are damaged and exposed to the air. The presence of oxygen triggers a chemical reaction between enzymes inside the apple (polyphenol oxidase enzymes and polyphenol molecules). Both the enzymes and these polyphenol molecules exist together in the apple, but it is only when the fruit is damaged that they can react together. The polyphenol molecules are oxidised, forming a colourless precursor to the browning which can then react further with amino acids, proteins and even form polymers to cause the brown colour on the cut surface. The brown colouration could be considered as apple rust forming on the cut surface.

To stop this happening fruit is often packaged in an atmosphere of 5% oxygen, 5% carbon dioxide and 90% nitrogen. The difference this makes can

be demonstrated by cutting an apple in front of the audience and comparing the two halves under two different atmospheres, one air and one that is flushed with nitrogen.

### Why is this important?

This highlights just how significant the secret world of gases is in the everyday. One of the most visual examples of the impact of gases is the browning of cut fruit and vegetables, but gases play a huge role in the food we eat, from the carbon dioxide bubbles in our drinks through to raising the perfect Victoria sponge. Without the release of carbon dioxide from sodium bicarbonate our cakes would not rise and without modified atmosphere packaging (MAP) our food would be discoloured, rapidly lose freshness and be unpalatable.

### More stories to tell

#### Does this happen with all fruits or vegetables?

Any foods that produce polyphenol oxidase (PPO), e.g. apples, pears, bananas, peaches or potatoes should work in this experiment. Encourage audience members to try this at home by submerging cut fruit into water and comparing it with fruit left exposed to the air.



## Is it bad for you to eat brown apples?

Even though the colour and scent of the apple may change it is not harmful to eat browned apples. However some people find it so unappetising that genetically modified varieties of apples now exist that never turn brown when cut!

## The Activity

### Before the show:

1. Pre-flush a semi-airtight container with nitrogen gas. Siphoning nitrogen from liquid nitrogen is a particularly effective method of doing this and ensures that there is a second container filled with air.

### During the show:

1. Flush the container again with nitrogen produced in the show.
2. Invite two volunteers up to the stage (ensure you explain what they are about to do).
3. Get each volunteer to take a bite out of an apple, immediately put one apple into the nitrogen container then the other apple into the air-filled container.
4. Leave for at least 15 minutes and then re-visit at the end of the show, use a web cam to compare the differences.

## SECRET GAS FACT

The composition of gas in modified atmosphere packaging has to be just right. Too little oxygen and anaerobic respiration starts and the food develops unwanted tastes and smells.

## Troubleshooting

1. The reaction can be sped up in the presence of iron. If using volunteers is not possible try using a slightly rusted knife to cut the apple.
2. The reaction can be slowed down by heating the apples, reducing the pH of the apple's surface or adding antioxidants such as ascorbic acid

## Health and Safety



Every delivery centre must undertake their own risk assessments for the specific audiences, locations and conditions they are presenting in. Sample assessments are available on The Secret World of Gases website. Below is a guide to the key risks and hazards:

1. Please see risks associated with handling liquid nitrogen in 'Additional Resources'.
2. Risk of allergies. Make sure you have warned the audience exactly what will be expected of volunteers before inviting any down to take bites out of the apples.

