



Everyday Uses for Gases

All gases are useful for something and you experience them every day; oxygen, nitrogen, carbon dioxide. Chemical engineers know why it is appropriate to use a certain gas for one thing and not for another. One example is how different gases can be used in our food packaging. But what gases do they use and why? How does a chemical engineer use a knowledge of biological systems to make the most of using gases?

An investigation:

Reading the small print on some packaged meat, such as beef mince, or salad you will read 'packaged in a protective atmosphere'. By using only a splint and some litmus paper we can identify the gases the food is packaged in. One at a time insert a glowing splint into a small hole in each package and a wet strip of litmus paper.

Hints and Tips:

<i>Packaged meat.</i>	The gas contained will relight a glowing splint as it is oxygen. Oxygenated tissue and muscle will appear red and thus fresher. Consider every diagram of the circulatory system and oxygenated blood is indicated as red and deoxygenated blood as blue.
<i>Packaged salad.</i>	This will extinguish a lit splint and turn litmus paper red as it is carbon dioxide. This atmosphere contains 4% CO ₂ , 100 times the normal amount. The leaves are still alive and require oxygen to avoid decomposing too quickly. However, most bacteria are poisoned by either the oxygen or the carbon dioxide.
<i>Packet of crisps.</i>	This will extinguish a lit splint and litmus paper remains neutral as it is nitrogen. The crisps are not alive so do not require oxygen which would only encourage aerobic bacteria and mould to grow. Because nitrogen is quite inert, the colour and flavour of the crisps is largely unaffected by long term storage in the bag.

Further thoughts:

There are many reasons why gases are used in the packaging of food above those reason given above. A positive air pressure in the bag also prevents delicate items from being crushed in transit. For instance, meat and salad are made of cells that would be destroyed if squashed, releasing hormones and chemicals that it would normally use to coordinate attacks on invaders.

Consider desiccants which control the water vapour in a closed package. This hygroscopic substance is often placed in a small cloth-like bag in electrical equipment packaging.

Further developments are used in active packaging for food and pharmaceuticals that can monitor or further modify the atmosphere and product quality. Consider:

- *Oxygen scavengers* or *absorbers* are packets of powdered iron, which rusts to form iron oxide, removing any excess oxygen from the atmosphere. Even the design of the polymer that makes up the film and packaging can control the amount of oxygen in and out of the packaging.
- Temperature monitors can be incorporated into the packaging so that can tell you if the temperature has risen too high for a long enough time to damage the goods. Or the inks on printed labels can change colour to show when the bottle or can is cold. (See <http://bit.ly/18RXS1X>)