

What's your favourite fungus?

The One That's Used in Fizzy Drinks

Fizzy soft drinks contain many chemicals. One of these is citric acid - a weak acid that is naturally found in citrus fruits such as oranges, lemons and limes. It is added to soft drinks to give a slightly sour taste, to stabilise the 'fizz' and also to serve as a preservative. The process of carbonation puts the 'fizz' in drinks. This is achieved by dissolving carbon dioxide in water to produce carbonic acid. The addition of citric acid creates a buffer that stabilizes the carbonic acid, so that the fizz remains in the drink after the bottle is opened.

Initially, citric acid was obtained from lemons, but since 1923 all commercial citric acid (600,000 tons every year) has been obtained from fermentation by *Aspergillus niger*, a filamentous fungus. Citric acid is the first product to be made from a cycle of conversions known as the citric acid, or Krebs cycle. This cycle occurs in the mitochondria of all living cells that use oxygen for respiration. The cycle is important, as it is part of the metabolic pathway that breaks down carbohydrates, fats and proteins into carbon dioxide and water to generate energy for the cell.

Aspergillus niger accumulates large amounts of citric acid. This is achieved by reducing the level of iron in the growth medium because the enzymes that convert citric acid into the next product of the cycle need iron. Keeping the iron content low stops the Krebs cycle before the citric acid can be converted, so the acid can be harvested and used commercially.

Large quantities of *Aspergillus niger* are grown on a medium containing sugar as its carbon source. The fungus grows at the surface of the medium and the citric acid product is released into the liquid below. The mould is then filtered out and the remaining citric acid collected. When citric acid is added to a solution it forms citrate ions. Citrates are excellent buffers for keeping the pH of acids steady. In the case of soft drinks, the citrate ions ensure that the carbonic acid remains stable, keeping the 'fizz' in your drink.

