



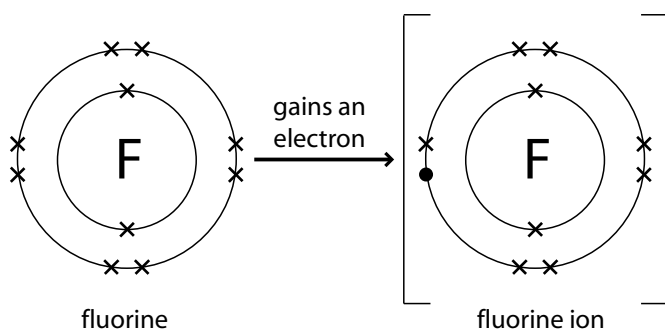
# Fluoride in water supplies

Julia Sape/Bigstockphoto

*The UK health secretary recently announced that more water companies would be encouraged to add fluoride to the water supplies. Why is fluoride added? What are the advantages and what are the risks? Should it be put in our water? What do you think?*

## Fluorine or fluoride?

Fluorine is one of the most dangerous and toxic elements in the periodic table. In spite of this, the fluoride ion is used safely in toothpastes and drunk by most people in their water. Why?



When it is an element, fluorine has 7 electrons in its outer shell, which could potentially hold 8. This makes the fluorine atom very reactive as it grabs an electron from almost any other material. Once it has reacted and gained an extra electron it has a full outer shell. This is a far more stable arrangement and the fluoride ion is unreactive and safe.

## Fluoride facts

- Fluoride is the naturally occurring ion of the fluorine atom and has the symbol  $F^-$ .
- It has been added to some water supplies in England since the 1960s, when statistics showed that in areas where water had naturally occurring high levels of fluoride children had fewer decayed teeth than in areas where the natural concentrations were low.
- The first places in the UK to have fluoride added to tap water were Birmingham and Solihull.
- Fluoride is also added to water in other countries. About 70% of tap water in both the USA and Australia has fluoride added to it.

## How it works

Fluoride works to prevent cavities in teeth in two ways:

- When fluoride touches the enamel (the hard, white outer layer of the teeth) it becomes embedded in the mineral which makes up the main part of the teeth and bones (called hydroxylapatite). The  $F^-$  ions replace some of the  $OH^-$  ions which are naturally present in the enamel. This strengthens the tooth enamel and makes it more resistant to the acids produced by bacteria in the mouth.
- The fluoride also acts as a catalyst and helps the body to rebuild the enamel crystals if they are damaged by bacterial acids.

## Arguments in favour

The Health Secretary and others believe that adding fluoride to drinking water is necessary to prevent

tooth decay among children who do not brush their teeth regularly. There is less decay in the teeth of children in more affluent families who tend to supervise the brushing of their children's teeth than households where children may not even have their own toothbrush. This is a chance to give children from poorer backgrounds a chance to have reduced tooth decay and cut down the amount of dental work which they may need in the future.

Children in Manchester, where water is not fluoridated, have twice the levels of tooth decay of those in Birmingham, where it is.

### Arguments against

While a small amount of fluoride can help to prevent tooth decay, it is known to cause problems if too much is consumed. In drinking water with a fluoride content of greater than 4 mg/litre it can lead to a condition called fluorosis, the first sign of which is permanently discoloured teeth. Children are particularly susceptible to this. In more extreme cases fluorosis can cause a hardening of the bones which can lead to a deformed skeleton. In some parts of India and Ethiopia where the levels of fluoride in water can be naturally very high the condition is common.



Brown staining on the teeth of a child with fluorosis

There is also some research suggesting that too much fluoride could be a risk factor for certain types of bone cancer and possibly bladder cancer.

Part of the problem with adding fluoride to drinking water is that there is no completely accepted optimal (best) level for daily intake of fluoride. This means the amount that would maximise protection against tooth decay while minimising other risks. The range most often given by researchers is 0.05-0.07 mg of fluoride per kg of body weight per day. The trouble is that people do not just ingest fluoride from tap water – it is also found in toothpaste and numerous foods (see the table below). Exactly how much is consumed will vary from person to person depending on their diet, whether they swallow or spit their toothpaste and how much water they drink. This makes it very hard to determine how much is consumed by the population.

Tooth decay has been decreasing throughout the last 50 years even in areas where fluoride is not added to drinking water. This could be due to increased use of fluoride toothpaste or better diet. The reasons are not entirely clear.

Vicky Wong is Chemistry editor of CATALYST

1 mg is a thousandth of a gram

Food	Fluoride content in parts per million (ppm)
Strong tea	3.73
Raisins	2.34
Fresh coffee	0.91
Diet coke	0.60 (average)
Mackerel and sardines	27 (fresh weight)
Vegetables	3-20 (dry weight)
Cheddar cheese	0.35

### The debate - what do you think?

Fluoride is naturally present in many water supplies and artificially added to others. If children from these areas have better teeth then this benefit should be available to all children.

We should do anything we can to help poorer children have good teeth. It's not fair that they should be at greater risk of dental health problems.

Fluoride is only being added to prevent tooth decay among a relatively small proportion of the population, mostly children in deprived areas who do not brush their teeth. These children are already being identified and treated in more effective ways.

Adding fluoride is effectively adding medicine to the water supply. People are being medicated without giving their consent.

Not all doctors agree that it should be added. "Evidence on the potential benefits and harms of adding fluoride to water is relatively poor," according to The British Medical Journal.

We do not know enough about the potential problems of consuming too much fluoride. We should leave it to parents to decide whether to give their children extra in their diet.

We should concentrate on getting toothbrushes and toothpaste to children who are likely to have poor teeth, as well as access to a dentist, instead of adding fluoride to drinking water.