What can get into water?

What do we put into water?

About half of the water that comes into our homes, that which we use inside the house, ends up at the sewage treatment plant.

We use water to wash our food, our dishes, our clothes and ourselves, and to flush away our personal waste. We use considerable amounts of it to carry away only a small quantity of dirt, so wastewater is mostly water — a 200-litre drum of it contains only about one tablespoon of dirt.

The dirt consists of organic molecules that contain carbon, inorganic molecules that do not contain carbon (except for carbonates), micro-organisms and fine particles that are suspended in the water rather than dissolved.

Did you know?

A 200 litre drum of wastewater contains only about one tablespoon of dirt

Most used water goes to a sewage treatment plant to reduce the amounts of pollutants. An advanced water treatment plant removes all contaminants.

Organic matter - the stuff of life

Carbon is very reactive so there are millions of organic compounds. Each atom has four bonds — it can attach itself to four other atoms at the same time. It has a particular affinity with hydrogen, oxygen, nitrogen and phosphorus and readily joins on to other carbon atoms.

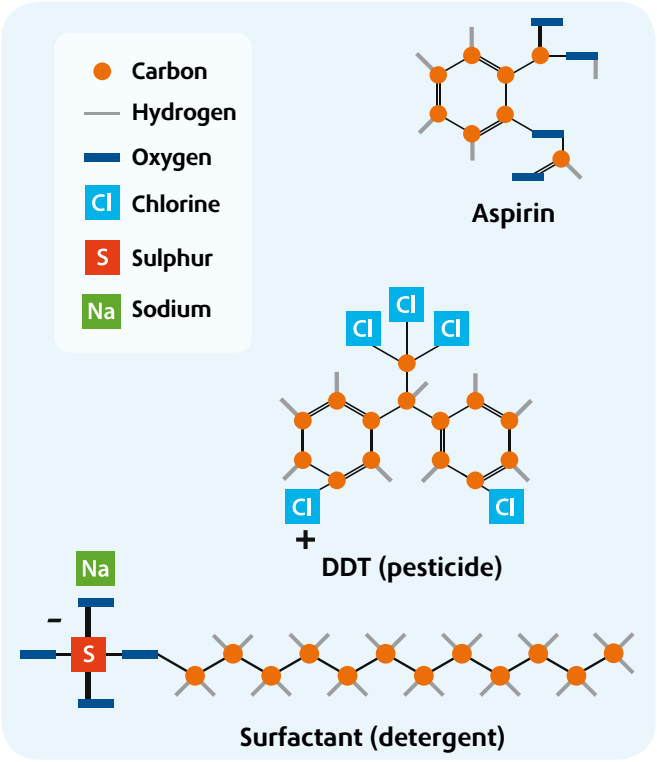
Some organic compounds are simple, such as ethanol or acetic acid (vinegar), but others are highly complex — carbon can form rings and long chains that may branch. There are natural organic chemicals that living matter is made of — we are made of them and so is our food.

They include compounds such as amino acids (the building blocks of proteins), sugars, fats, hormones and vitamins.

WaterSecure is a statutory authority that manages Australia's largest water recycling scheme. It produces purified and desalinated water for south-east Queensland.

WaterSecure
A new source of pure water

Algal blooms and eutrophication occurs with excessive nutrients.



Specialty chemicals

Synthetic, designer organic chemicals have been developed because they exhibit some quality or activity that is valuable to us.

Specialty chemicals include herbicides, insecticides, pharmaceuticals, food colouring and flavours, personal-care products, dyes and paints, adhesives, detergents, polymers and plastics — they are found just about everywhere in our modern lives.

Some organic chemicals are easy to break down (they are biodegradable) but others do not degrade so easily.

Nutrients: nitrogen and phosphorus

Nitrogen in the form of urea is a breakdown product of the proteins in plant and animal matter. We excrete urea in our urine but by the time it reaches the Sewage Treatment Plant (STP) most of it has reacted with water to form ammonia compounds.

Phosphorus also comes from plant and animal matter but at least half of the phosphorus found in sewage comes from the detergents we use.

Inorganic matter

Most minerals are not a cause for concern in water — indeed we frequently go out of our way to buy water that contains minerals. Our water contains many natural minerals from the rocks the water has come into contact with on its journey to the water treatment plant. Some of these, such as iron and manganese, can be nuisances as they stain clothes and appliances, so they are treated before the water is supplied to us. Inorganic compounds that need attention include heavy metals and nutrients.

Heavy metals

These can accumulate in our bodies and be detrimental to our health. They are usually found in trade waste and are effectively limited by efficient trade waste controls. They are easily removed by wastewater treatment and are not found (at high levels) in the effluent leaving the plant, but are accumulated in the biosolids.

What can get into water?

Micro-organisms

Micro-organisms include bacteria, viruses and single celled organisms — protozoa. Those that can cause infectious diseases are called pathogens. Person to person is the most usual way a disease is transmitted. We can catch infections from coughs and sneezes, sexual activity, swimming pools, food, cuts and skin lesions, and mosquitoes.

Bacteria

Bacteria are everywhere. They are relatively simple and the most abundant of all organisms. There are many thousands of different species and they are always around us — they are our constant companions. It is true to say that their presence in the right place and in the right quantity is essential to life. It is only when bacteria get into the wrong place, from a human point of view, that problems arise. Bacteria can perform a large number of chemical transformations. For example, they are responsible for:

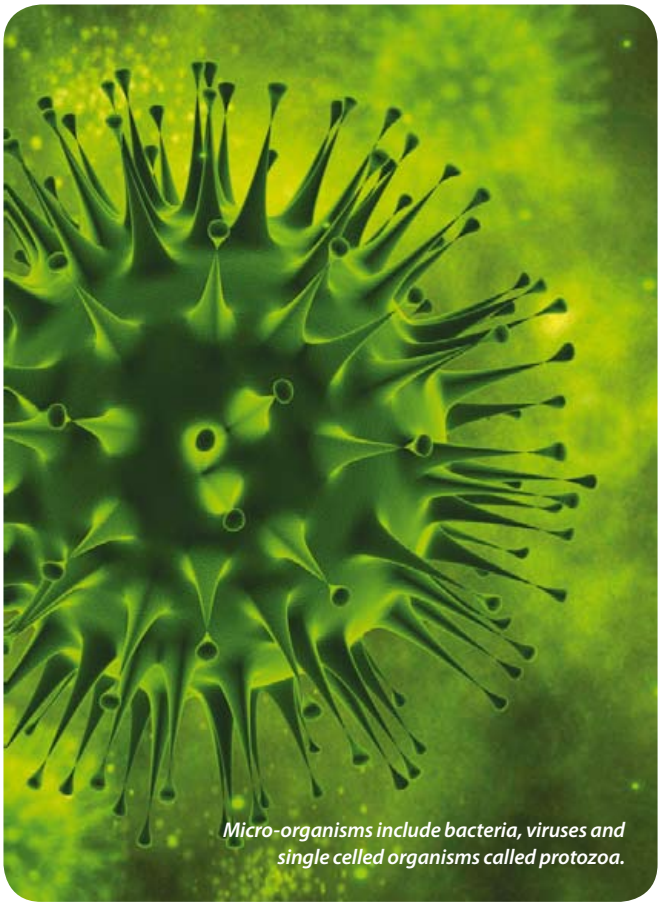
- fermentation — we use bacteria to produce wine, bread and cheese
- fixing nitrogen from the atmosphere so that plants can use it
- decay — including treating our wastewater.

Our lives depend on many of them. Faecal coliforms, such as Escherichia coli (E. coli) are found in the gut of humans and warm-blooded animals — without E. coli we would not be able to digest our food. Although few of them are themselves pathogens, they are used as indicator organisms to alert us to potential human contamination.

Few pathogenic bacteria can be transmitted by water. The main ones are:

- Vibrio (cholera)
- Salmonella (typhoid)
- Mycobacterium (tuberculosis)
- Shigella (bacterial dysentery)
- Yersina (plague) and
- Camphylobacter (gastroenteritis).

Water-transmitted diseases such as cholera and typhoid that ravaged communities in the past have been brought under control by good water management and vaccination. Our immune systems keep pathogens at bay. Immunity is developed by exposure to the pathogens or by vaccination. Lack of exposure can put an individual at risk.



Micro-organisms include bacteria, viruses and single celled organisms called protozoa.

Viruses

Viruses are very small — an electron microscope is needed to see them. They are not typical living organisms for they don't take in food, get rid of waste or reproduce normally. A virus is just a package of genetic material.

Viruses are highly specialized and can only infect specific host cells so, for example, a virus that infects the liver cells of a rabbit cannot infect any other cells in the rabbit or the liver cells of any other animal. Very few viruses can cross species, rabies being one that can.

Viral infection does not always cause a disease — some hosts can have an infection without showing any symptoms whereas others can become very ill indeed. Viruses found in water include *poliovirus, hepatitis A & E* and Norwalk Agent.

What can get into water?

Cryptosporidium and Giardia

These single celled organisms — protozoa — are parasitic and can cause diarrhoea. They have relatively recently been identified so there are things we don't know about them, such as how many need to be ingested to cause an infection.

Although they are most often transmitted by direct contact, water, particularly in swimming pools, is commonly implicated. It is likely that these parasites have always been with us and generally our immune systems cope well.

They cannot multiply in water but can survive for long periods. Ingestion of their oocysts (eggs) can cause infection but these are relatively large and easy to filter.

Suspended particles

Wastewater also contains some particles that are suspended in the water rather than dissolved in it. They include fine particles of silt, paper fibres and other insoluble matter. They cause the water to appear cloudy and coloured.

Source: From waste-d-water to pure water (2008). Text and images courtesy of Jenifer Simpson and the National Water Commission.

WaterSecure acknowledges the Queensland Government, Mick Smith and Russell Knightly for some images used in these materials.

Printed on recycled paper using vegetable based inks.

Did you know?

Water treatment plants vary in size and complexity and so does the quality of their products – from sewage treatment to purified recycled water.

A time for change

Increasing population and climate change have put pressure on our water supplies and we're facing shortages. We need to change the way we manage our urban water supply and recycle water more. New technology is now available to recycle water for different uses - even to purify wastewater to drinking quality standards. Microfiltration, membrane filtration, which includes reverse osmosis, advanced oxidation and ultraviolet treatment can produce water that is purer than drinking water. Purified water can be used by industry, pharmaceutical manufacturing, power stations and to replenish our drinking water supplies.

Further reading

From waste-d-water to pure water booklet
www.nwc.gov.au/www/html/983-distilled-35---jan09---from-waste-d-water-to-pure-water-reprint.asp

National Water Commission
www.nwc.gov.au

WaterSecure
www.watersecure.com.au

Queensland Water Commission
www.qwc.qld.gov.au

Seqwater
www.seqwater.com.au

Water Quality and Treatment CRC
www.waterquality.crc.org.au

Waterwise
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