Bacteria in Your Water

The Fact Sheet

As a general rule the most dangerous chemicals found in drinking water are colourless and odourless, while other contaminants including bacteria are invisible to the naked eye. The clearest of spring waters can be teeming with harmful bacteria and be heavily polluted by pesticides while giving the impression that it is safe to drink. Although some contaminants are removed by simple filtration techniques, other forms of treatment such as ion exchange and adsorption are required to extract others. These different removal methods are covered in more detail in further sections of this manual.

All contaminants can be referred to in relation to their size. Particle sizes are measured in microns.

1 micron = one thousandth of a millimetre

For comparative purposes and in order to gain a fuller understanding the following examples may be of assistance:

the diameter of a human hair	**50 microns**
the smallest the naked eye can see	**20 microns**
a single red blood cell	**7 microns**
typical coliform bacteria	**2 microns**

The 1000 Filtration System
cartridge removes particles below **1 micron**

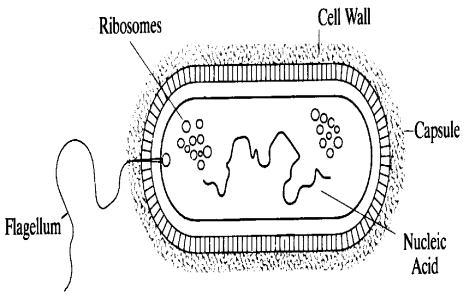
As shown in part one of this section contaminants can essentially be grouped under three headings:

Microbiological
Chemical
Aesthetic

Microbiological
Only a very small proportion of the myriads of micro-organisms that abound in nature are disease producing or pathogenic to man.

For all intents and purposes microbiological organisms can be placed in four categories:
1. Bacteria
2. Protozoa
3. Viruses
4. Helminths

Bacteria
The cell structure of a typical bacterium.
A very large number of bacteria to man are considered to be beneficial and necessary for many of our food and life processes.

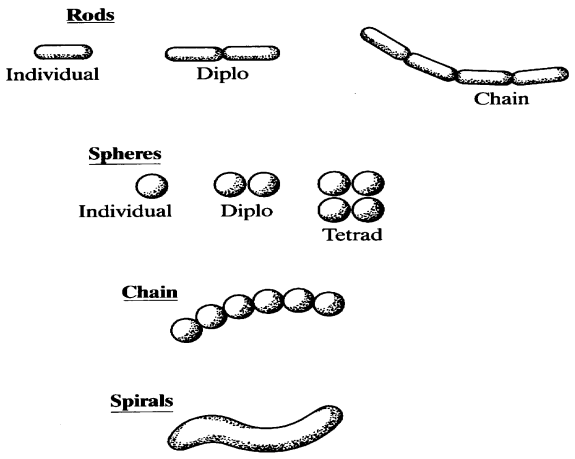


The bacteria which turns milk into yoghurt are a perfect example of harmless bacteria, as are the type that provide us with blue veined cheese. Dr Alexander Fleming discovered penicillin and saved countless lives through harnessing the effects of beneficial bacteria. We have billions of colonies of bacteria in our mouths and some 200 beneficial strains of bacteria in our stomachs which fight off disease and help us to digest our food, which in turn contains many other types of harmless bacteria.

Bacteria are small micro-organisms with a relatively simple form of cell structure. In most cases the cells have rigid walls that maintain their characteristic shape, these may be:

Spherical	coccus
Rod shaped	bacillus
Comma shaped	virbris
Spiral	spirochaete or filamentous

Characteristic Shapes of Bacteria



It is very seldom that any natural water is found to contain no bacteria though some supplies obtained from very deep boreholes approach this condition.

Numerous bacteria are added to water by contact with soil, vegetation etc. The number and species of bacteria differ widely; thus the bacteria in water collected on inhabited and agricultural areas which are fouled by sewage and manure will be vastly more numerous and varied than those found in water collected from high mountainous areas. Many of the bacteria found in water are thus derived from the air, soil and vegetation. Some of these are able to multiply and continue their existence, whilst others die out.

Contamination by sewage or by human or animal excrement is the greatest danger associated with drinking water. Sewage from human or animal sources may contain harmful species of bacteria.

Harmful bacteria better described as disease causing enteric pathogenic bacteria are thankfully few in number. Essentially only six different types of bacteria are of primary concern relative to drinking water. These include cholera, shigella and salmonella species.

For several reasons monitoring for the presence of specific pathogenic bacteria, viruses and other agents in water is impracticable and unnecessary for routine control purposes. Any pathogenic micro-organisms present in water are usually greatly out-numbered by, and in general tend to die out more rapidly than, the normal commensal bacterial flora of the human or animal intestine. Although it may be possible to isolate microbial pathogens from contaminated water, especially when it is heavily polluted, large volumes of water may need to be examined. In such cases selective media are required for isolation and the subsequent identification of the organisms requires biochemical, serological and other tests on pure cultures. Reliance is therefore placed on relatively simple and more rapid bacteriological tests for the detection of certain commensal intestinal bacteria such as Escherichia coli (E.coli).

E. coli and other coliform bacteria are easy to isolate and characterise because they are always present in the faeces of humans and warm blooded animals and hence in sewage large numbers. Faecal indicator bacteria are selected from the species that live exclusively in the intestinal tract of man and other warm blooded animals without causing disease.

Because these indicator bacteria are always present in faeces and are excreted in large numbers their presence in water indicates beyond reasonable doubt that the water has been contaminated by faecal bacteria and is likely to contain pathogens. It should be stressed that public water supplies in the UK through the use of chlorine are of high bacteriological standard. Accidents however do happen and although the incidents are rare, indicator and pathogenic bacteria have been detected in public drinking water supplies on several occasions over the last few years.

Very few harmful bacteria are smaller than 1 micron in size and are easily removed by the Fresh Water Filter System which filters down below this level. Recent tests carried out involved challenging the Fresh Water Filter System 1000 cartridge with vast quantities of differently sized particles. The system successfully removed all (99.99%) particles of 0.9 microns in size, and 99.95% of particles between 0.6 - 0.7 microns. Countless other tests involving actual bacteria of all pathogenic groups have been carried out and complete removal has been obtained.

IMPORTANT NOTE
Our Filter Systems is not designed to remove all bacteria from water which would result in sterilisation. The product removes 99.99% of pathogenic enteric disease causing harmful bacteria. As mentioned above many bacteria are beneficial and some assist in keeping the body's natural immunity systems functioning properly. Sterile water consumed over a period of time could allow this defence mechanism to weaken or lapse.

Some water filters have been criticised for their ability to harbour and possibly breed bacteria. Products purchased from ItDoesTheJob.com do not harbour or allow the release of any pathogenic bacteria. These organisms if present are trapped in the outer layers of the ceramic shell where they are cut off from their food source are unable to breed and subsequently die. The life cycle of pathogenic bacteria is very short, with some species as little as two hours. Most filters should not be used where the water is of questionable bacteriological quality. The reverse applies to ItDoesTheJob.com products which is an effective and reliable device to guard against the possibility of infection.

Viruses
Viruses are the smallest and simplest infectious particles known and can be up to 1000 times smaller than some species of bacteria.
Their structure is basically very simple and consists of a nucleic acid core surrounded by a protein capsule. They do not contain any of the enzyme systems normally found in a bacterial cell which makes them immune to many antibiotics and chemical agents.

Their method of reproduction requires a suitable living cell. On infection the nucleic acid enters the cells, takes over its metabolic functions and diverts them to production of large numbers of particles identical to the original virus. In effect this process is a form of cloning.

There are five groups of enteric pathogenic viruses of concern including those responsible for hepatitis and polio. Most of the viral infections in the UK are thought to be of air borne as opposed to water borne origin.

Viruses have no ability to travel independently. All viruses carry a positive or negative surface charge which enables them to adhere to microscopic particles of dust or colloids and in effect hitch a ride. Infection takes place through inhalation or digestion of the dust particle

Viruses can be removed through adsorption and what is known as the locomotive effect. By filtering out a particle to which a virus is attached you also remove the viral particle.

Some viruses can survive for long periods in water and are considerably more resistant to disinfection procedures than bacteria. It should not be assumed that the absence of indicator bacteria such as E. Coli confirms the absence of viruses.

Often wrongly referred to as bacteria the best known protozoan organism found in UK water supplies is cryptosporidium the cause of cryptosporidiosis. The previous section on point of use purification page 3 contains further additional information on this particular parasite.

The organism in particular together with giardia lamblia the cause of giardiasis (more commonly referred to as gippy tummy, Delhi belly, beaver fever) and Entamoeba histolytica the cause of amoebic dysentery pose a far greater threat to public health in the UK than any of the other micro organisms.

As discussed earlier in this section pathogenic bacteria are rarely found in drinking water due to the disinfection procedures carried out by the water authorities. Protozoan organisms however are chlorine resistant in their cyst form at which stage they are also resistant to freezing heating and abrasion. It has been found that cryptosporidium cysts can survive for up to two minutes in boiling water in the oocyst stage. Protozoan organisms are reportedly also resistant to ultra violet light.

The following extract was taken from the April 1990 issue of Water and Waste Treatment which is essentially the trade magazine bible for water authorities and relevant governmental authorities etc..

Given that this particular magazine has an obvious tendency to play down serious health risks associated with water the gravity of the problem becomes more apparent.
As mentioned in the previous section on page 3 the most recent outbreak of cryptosporidiosis took place in October 1992. Many other cases occurred between these two dates which would seem to indicate that a more serious outbreak could be just around the corner.

As stated previously the Fresh Water Filter system easily removes all traces of the organism and indeed all other protozoan organisms found in drinking water supplies.

Helminths
Helminths are not considered to be of any concern relative to the public water supplies in the UK. They tend only to exist in tropical or subtropical countries. Due to the fact that over 200 million people world-wide are infected by Helminths every year they are however worthy of a mention in this section.

Helminths are in microbiological terms extremely large and in many cases are visible to the naked eye. The Fresh Water Filter system would of course easily remove any of the three categories of Helminths if they were present in the drinking water supply

The three groups of Helminths transmitted by drinking water are classified as follows:

Tremoda	flukes
Crestoda	tapeworms
Nematoda	roundworms

Very few Helminths are transmitted solely through drinking water with one exception this being Dracunculus medinesis more commonly referred to as the guinea worm. Drinking water is the sole route of exposure for this parasite.

On a more light hearted note the squeamish reader should turn to another section of this manual whereas avid fans of Alien may care to read on. Once ingestion has taken place fertilised female guinea worms burrow deeply into the flesh of their human host to mature. Following several weeks of growth the adult worm then migrates to lie subcutaneously within a nearby limb or eye socket. Numerous larvae then develop within the rapidly growing parasite thus causing a blister to form on the surface of the skin which eventually breaks down. The female then exposes her prolapsed uterus and discharges the larvae whenever she senses water thereby allowing the life cycle to continue. Any attempt at dislodging the worm usually causes an additional infection or abscess.