vinlab H_2O

Your partner in quality water analysis

The importance of getting your drinking water micro tested

Testing for various indicator micro-organisms is a critical water quality parameter. A wide range of pathogenic viruses, protozoa and bacteria are transmitted by water and may be the cause of diseases such as cholera, hepatitis, gastroenteritis, giardiasis, typhoid fever, salmonellosis, dysentery and eye, ear, nose and skin infections. Known sources of contamination of these waterborne diseases are through the drinking of contaminated water, recreational exposure to contaminated water, inhaling contaminated aerosols and the consumption of raw food; being fruits and vegetables irrigated with contaminated water, or the consumption of shellfish and aquatic life exposed to contaminated water.

As it would be impractical and costly to perform all micro tests on all water samples, indicator organisms have been isolated to aid in the routine monitoring for the potential presence of pathogens. Indicator organisms, therefore, fulfil a specific criterion ensuring water is safe for consumption. As a single indicator organism may not fulfil the entire criteria, various tests are done in conjunction ensuring no pathogenic micro-organisms are present in water samples submitted.

Indicator organisms for the microbiological safety of drinking water are Total coliform bacteria, Escherichia coli, bacteriophages (somatic coliphages) and the protozoan parasites Cryptosporidium and Giardia. These indicator organisms are consistently released or excreted by all humans as they form part of the natural microbial flora of humans. Some of these indicators are also consistently excreted by warm-blooded animals.

Heterotrophic bacteria as an indicator organism

Heterotrophic bacterial counts are detected by performing heterotrophic plate counts. This count gives an indication of the general microbial quality of water as it detects a wide range of bacteria which are omnipresent in nature. Heterotrophic plate counts are useful in assessing the efficiency of water treatment processes and the integrity of a distribution system

How do I interpret my HPC results?

Heterotrophic plate counts give an indication of general bacterial populations present and not necessarily faecal pollution or total bacterial populations.

Heterotrophic plate count (count/ml)	Effect
0-100	Risk of microbial infection is negligible
100-1000	A slight risk of microbial contamination as this is indicative of inadequate water treatment processes or post-treatment contamination
> 1000	Increased risk of infectious disease transmission as poor water treatment or post-treatment contamination has taken place.

Total coliforms as an indicator organism

Total coliforms comprise a wide range of various bacteria, including bacteria from the genera *Escherichia*, *Citrobacter*, *Enterobacter*, *Klebsiella*, *Serratia* and *Rahnella.* Although most bacteria classified in the total coliforms group are of faecal origin, there are a few bacteria that are not of faecal origin.

This heterogenous group of bacteria are used to assess the general hygienic quality of water. Testing total coliforms in drinking water is a useful tool in evaluating both the efficiency of drinking water treatment processes and the integrity of the distribution system.

How do I interpret my total coliform results?

As the total coliform group is comprised of bacteria that may be of faecal origin, counts obtained may be indicative that there is a presence of bacterial pathogens.

Total coliform count (count/100 mL)	Effect
0-10	Risk of microbial infection is negligible
10-100	A slight risk of microbial contamination as this is indicative of inadequate water treatment processes or post-treatment contamination
> 100	Increased risk of infectious disease transmission as poor water treatment or post-treatment contamination has taken place.

Escherichia coli as an indicator organism

E. coli is the most commonly used bacterium as an indicator of faecal pollution by warm-blooded animals. Certain strains of E. coli are pathogenic and can be transmitted via the faecal-oral route by contaminated or poorly treated drinking water.

How do I interpret my E. coli results?

There is a direct link between the level of contamination in drinking water and the risk of being infected by pathogenic E. coli. Even if only small amounts of highly contaminated water are consumed, there will be a higher risk of contracting waterborne diseases.

Figure 1: E. coli grown in culture

E. coli (count/100 mL)	Effect
0	Risk of microbial infection is negligible
0-10	Negligible risk if there is only short-term exposure, slight risk of microbial infection with continuous exposure
10-20	Increased risk of infectious disease transmission with continuous exposure; slight risk with short term exposure.
> 20	Significant risk of infectious disease transmission

Coliphages as indicator organisms

Coliphages are bacterial viruses originating from the faeces of warm-blooded animals and humans. Coliphages infect and replicate within E. coli, using E. coli as a host. The presence of coliphages in water indicates E. coli (as a host) is most likely present. Coliphages, therefore, serve as indicators of faecal pollution as well as other pathogenic viruses. Viruses are known to be contributors to the spreading of water borne diseases causing illnesses such as gastroenteritis, hepatitis, poliomyelitis and respiratory diseases.

Somatic coliphages and male-specific coliphages make up the two broad groups of coliphages. These two groups differ in the way in which they infect E. coli. Somatic coliphages are DNA viruses that infect E. coli via the outer cell membrane, whereas, male-specific coliphages can be either RNA or DNA viruses that infect host cells via the F-pilus of male strains of E. coli. Male specific coliphages are produced only under specific conditions, such as elevated temperatures. Optimal temperatures for the replication of male specific coliphages would be conditions similar to that of the gastrointestinal tracts of humans and warm-blooded animals. Replication of male specific coliphages is, therefore, not likely to occur within aquatic environments. They are, however, highly specific indicators for faecal pollution by warm-blooded animals, including humans.

Replication of somatic coliphages in aquatic environments has, however, been demonstrated. Somatic coliphages may occur in the faeces of warm-blooded animals, sewage and natural waters. Detection of somatic coliphages takes place due to their ability to form visible plaques using E. coli as a host.

How do I interpret my coliphage results?

Like with E. coli, there is a direct link between levels of viral contamination and risks of being infected by microbial pathogens. However, viruses have a considerably lower minimum infectious dose than bacteria. Therefore, even at low levels of viral pollution high risks of infection exist.

Coliphage range (count/100 mL)	Effect
0-1	Risk of viral infection is negligible
1-10	Negligible risk if there is only short-term exposure, slight risk of viral infection with continuous exposure. Indicates slight probability of sewage pollution.
10-100	Increased risk of viral infection with continuous exposure; slight risk with short term exposure. Indicates probable sewage pollution.
> 100	Significant risk of viral infection and significant sewage pollution.

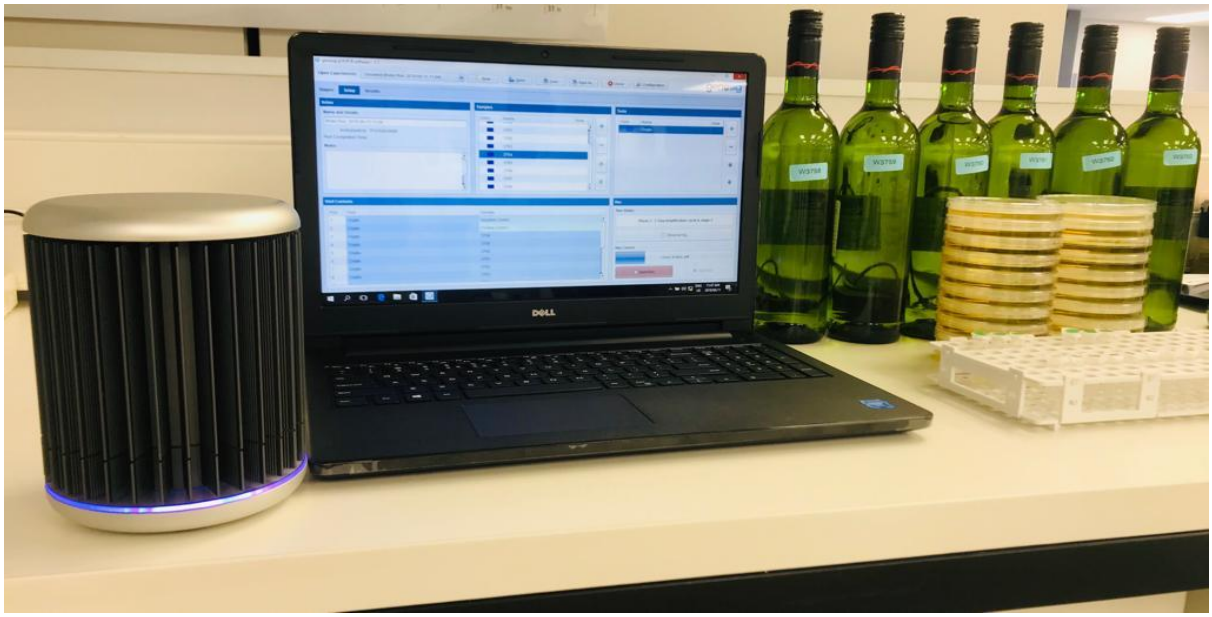

Figure 2: Cryptosporidium, Giardia and somatic coliphage analyses

Protozoan parasites as indicator organisms

The protozoan parasites, Cryptosporidium and Giardia, have several lifecycle stages of which the cysts, being Giardia lamblia, and the oocysts, being Cryptosporidium parvum, are infective to humans. Cryptosporidium and Giardia are excreted by humans and various other warm-blooded animals. Survival in aquatic environments can range anything from days to months due to their resistance to environmental stress and treatment. Treated drinking water and surface water are known sources of contamination as Cryptosporidium and Giardia may enter the aquatic environment through runoff and effluent water discharge. Gastroenteritis, diarrhoea, vomiting and anorexia are just some of the diseases that may result from ingestion of Cryptosporidium and Giardia.

How do I interpret my Cryptosporidium and Giardia results?

Cryptosporidium/Giardia (count/100 mL)	Effect
0	Risk of protozoan parasite infection is negligible
> 1	May be a risk of protozoan parasite infection