Micro Biological analysis of drinking water

The most common and widespread health risk associated with drinking water is contamination; wither directly or indirectly, by human or animal excreta, particularly faeces. If such contamination is recent, and if those responsible for it include carriers of communicable enteric disease, some of the pathogenic microorganisms that cause these diseases may be present in the water. Drinking the water, or using it in food preparation, may then result in new cases of infection.

The pathogenic agents involved include bacteria, viruses, and protozoa, which may cause diseases that vary in severity from mild gastroenteritis to severe and sometimes fatal diarrhea, dysentery, hepatitis, or typhoid fever, most of them are widely distributed throughout the world. Faecal contamination of drinking water is only one of several faeco-oral mechanisms by which they can be transmitted from one person to another or, in some cases, from animals to people.

Other pathogen cause infection when water containing them is used for bathing of for recreation involving water contact, rather than by the oral route. Some may also cause infection by inhalation when they are present in large numbers in water droplets, such as those produced by showers and some air-conditioning systems or in the irrigation of agricultural land.

Ideally, all samples taken from the distribution system including consumers' premises should be free from Coliforms organisms. In practice, this is not always attainable. To control purity of water the following microbiological parameters for water collected in the distribution system is therefore recommended.

Indian standard IS 1622 : 1981

a. Throughout any year, 95 % of samples should not contain any coliform organisms in 100 ml.
b. No sample should contain E.Coli in 100 ml.
c. No sample should contain more than 10 coliform organisms per 100 ml.
d. Coliform organisms should not be detectable in 100 ml of any two consecutive samples.

E.Coli

E.coli is a gram-negative, non-spore forming, rod-shaped bacterium which can be either motile or nonmotile (motile cells are peritrichous); growth is aerobic or facultatively anaerobic. Metabolism is both respiratory and fermentative; acid is produced by the fermentation of glucose and lactose.

1. E.coli is found in large numbers in the faeces of humans and of nearly all warm-blooded animals; as such it serves as a reliable index of recent faecal contamination of water.
2. E.Coli is abundant in human and animal faeces, in fresh faeces it may attain concentrations of 10^9 per gram. It is found is sewage, treated effluents, and all natural waters and soils subject to recent faecal contamination. Whether from humans, wild animals, or agricultural activity.

3. E.Coli may be present or even multiply in tropical waters not subject to human faecal pollution. However, even in the remotest regions, faecal contamination by wild animals, including birds, can never be excluded, because animals can transmit pathogens that are infective in humans, the presence of E.coli must not be ignored.

Total Coliform

The term "coliform organisms (total coliforms)" refers to gram negative, rod shaped bacteria capable of growth in the presence of bile salts or other surface-active agents with similar growth-inhibiting properties, and able to ferment lactose at 35 – 37^{o}C with the production of acid, gas, and aldehyde within 24 – 48 hours.
They are also oxidase-negative and non-spore-forming. These definitions have recently been extended by the development of rapid and direct enzymatic methods for enumerating and confirming members of the coliform group.
The existence both of non-faecal bacteria that fit the definitions of coliform bacteria and of lactose-negative coliform bacteria limits the applicability of this group as an indicator of faecal pollution.
The coliform test can therefore be used as an indicator both of treatment efficiency and of the integrity of the integrity of the distribution system.

In our study for microbiological water quality we followed next methodology:

Sample collection procedure for Bacteriological analysis of drinking water.

1. Remove any attachment from the tap.
2. Using a clean cloth outlet of the tap wipe to remove any dirt.
3. Turn on the tap for maximum flow and the water may run for two minutes.
4. Outlet of the tap is sterilized by means of flame from cigarette lighter.
5. Tap again opened to flow for 1 to 2 minutes at medium flow rate.
6. Sterile 250 ml plastic bottle is taken for sample collection.
7. Carefully unscrew the cap and immediately hold the bottle under the water jet and fill.
8. Water filled up to 200 ml and a small air space is left to make shaking before analysis.
9. Collected sample delivered to laboratory within 20 to 30 minutes and inoculated immediately.

Method for testing Total Coliform & E.coli

Name of the method: Multitube fermentation technique/MPN method

Presumption test:
1. Inoculated in 10 ml tubes containing Macconky broth and Durham tubes.

2. Tubes are kept in the incubator 37^{o}C for 24 to 48 hours.
3. Any presence of bacteria will show gas production or colour change of the broth from violet to yellow.

Conformation test for total coliform:

1. Inoculate from the positive tube from presumption test in Brilliant green broth which contains Durham tubes.
2. The temperature is 37 $\pm$ 0.5^{0} C.
3. Presence of gas production confirm the presence of bacteria..

Conformational test for E.coli

1. Inoculate from the positive tube from presumption test in EC broth which contains Durham tubes.
2. The temperature is 44 $\pm$ 0.5^{o} C.
3. Presence of gas production confirm the presence of bacteria.

Completed test for E.Coli

1. Inoculate from the positive tube from conformation test for E.coli in EMB agar.
2. Presence of metallic sheen confirm the presence of E.coli.

Totally from the period of time: 08.01.02 – 14.12.02 were analyzed 372 samples for microbiological quality of water.

Water were collected from the Auroville places: guest houses, schools and kindergarten, public places, production units, communities and four villages located within Auroville.
Sources of collection:
Tanks – untreated water
Filters – different types of purification system

Guest Houses	Number of collection		Water contaminated	
	From tanks	From filter	From tanks	From filter
Kottakarai	2	2	1	0
Center	12	11	8	0
Samasti	8	8	3	0
College	3	3	3	0

Schools and kindergarten	Number of collection		Water contaminated	
	From tanks	From filter	From tanks	From filter
Deepanam School	3	1	3	1
Kinder Garden	8	10	4	1

Miramuki School	1	-	1	-
Transition School	11	9	6	0

Public places	Number of collection		Water contaminated	
	From tanks	From filter	From tanks	From filter
Certitude Sport Ground	1	-	1	-
Information Center Cafeteria	10	3	6	0
Matrimandir	14	7	6	0
Pizzeria	-	8	-	2
Pour Tous	-	12	-	1
Roma's kitchen	13	13	12	0
Solar kitchen	38	41	4	10
Visiters Centre	1	-	1	-

Units	Number of collection		Water contaminated	
	From tanks	From filter	From tanks	From filter
Maroma	10	9	10	0
Aurolec	-	9	-	3
Aquadyn	-	1	-	0
Food Processing	1	1	1	0

Communities	Number of collection		Water contaminated	
	From tanks	From filter	From tanks	From filter
Adventure	1	2	0	1
Annapurna	1	2	1	-
Anusuya	1	1	1	0
Aspiration	1	1	1	0
Auromodele	4	-	3	-
Dana	1	-	0	-
Darkali	2	-	0	-
Douceur	11	5	9	0
Gratitude	1	-	1	-
Grayas Garden	1	1	0	0
Invocation	3	1	0	0
Kottakarai Orchard	12	-	11	-
Orchard	1	1	0	0
Prathna	1	1	1	0
Promesse	4	1	1	0
Quiet	4	2	4	0
Sangamam	2	-	2	-
Shradhanjali	1	-	0	-

Silence	1	1	1	1
Simplicity	2	-	2	-
Veritie	2	-	0	-
Vikas	4	-	1	-

Villages	Number of collection		Water contaminated	
	From tanks	From filter	From tanks	From filter
Kottakarai	1	-	1	0
Edayanchavadi	1	-	0	-
Kuilapalayam	1	-	0	-
Periyamudaliachaudy	1	-	0	-

Conclusion:
There are different water purification system in Auroville, microbial removing process can be based on the micro filtration, UV radiation, chlorination, reverse osmosis.
Each of the system has advantages and disadvantages but none of them is absolutely reliable. The microbiological examination is still remaining important way to control purity of the water and it suitably for drinking purpose.