УДК 631

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## GROUNDWATER BACTERIOLOGICAL ASSESSMENT IN YAOUNDÉ, CAMEROON

*The paper describes the groundwater bacteriological assessment results in Yaoundé. The municipal, domestic and industrial wastes are emphasized to be discharged into an open sewerage system in new and old parts of Yaoundé. Most of wells situated within 2 km of the open sewerage network were found to be contaminated with coliform bacteria and faecal coliform. The average amount of total and coliform bacteria according to samples from the lake made 227 and 79 CFU/100 ml and 63 and 34 CFU/100 ml from the well bore respectively. The contamination level is beyond the permissible limit for organisms in groundwater during winter season, which may affect human health.*

### Introduction

Water used for drinking should be potable which means it could be consumed in required amount without adverse effect on health. The issue of quality water supply becomes very important in Yaoundé city due to fast urbanization depended on groundwater supply particularly in areas densely populated (Gupta et al., 2004; Jayalakshmi and Belagali, 2005; Nair et al., 2006; Prakash and Somashekar, 2006).

Lack of proper amenities in many houses and apartments worsens the problem. On the other hand, accenting on poor sewage disposal facility state both in the old and new areas, groundwater is noted to be significantly contaminated.

Yaoundé city is situated in Cameroon, where most people suffer from lack of drinking water. In this context, this **research goal** is to investigate the suitability of ground water for drinking, analyze of bacteriological parameters like total coliform (TC) and facal coliform (FC). The above values are to be studied to confirm or refuse enteric pathogens in water (Fatoki et al., 2001).

### Materials and methods

The water samples collected from the source using standard methods were filtered through a thin sterile membrane filter (pore size 0.45 µm) with a filter fitted with a suction flask. The filter discs (Sartorious, Cellulose Nitrate filter) containing filtered and trapped microorganisms were aseptically transferred to a sterile Petri dish with an absorbent pad saturated with a selected medium, and incubated at 37°C for 24 h. The obtained bacteria colonies were counted using colony counter (Digital Colony Counter, DCC-100). Results are expressed in terms of CPU/100 ml of water sample by using the formula:

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$$\text{No. of Colony forming Units (CFU) per} = \frac{\text{Colony Count} \cdot 100}{\text{Volume of Sample100 ml of water}}$$

*Table 1.* **Characterization of the sampling sites and coliform count of water samples**

| Types of Sample | Number of Samples | TC and FC CFU / 100 ml | | | | | |
|---|---|---|---|---|---|---|---|
| | | Total coliform | | | Faecal coliform | | |
| | | Min. | Max. | Avg. | Min. | Max. | Avg. |
| Lakes | 7 | 238 | 104 | 227 | 68 | 106 | 79 |
| Open wells | 13 | 2 | 214 | 82 | Nil | 38 | 14 |
| Well bores | 43 | 6 | 104 | 63 | Nil | 88 | 34 |

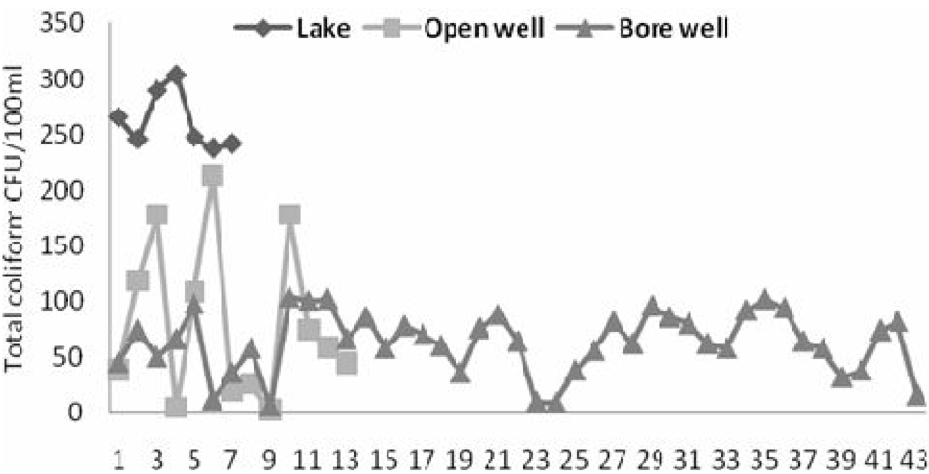


*Figure 1.* **Density of total coliform in samples from the lake, open and closed-in bore wells**

**Results and discussion**

Coliforms are normal inhabitants of digestive tracts of animals and human and are found in faeces and in soil material as well (Subba Rao, 2004). They are also considered as organisms indicating water pollution caused by faecal contamination which is believed to be a serious problem due to a risk of diseases caused by pathogens. Although the concentration of pathogens from faecal contamination is low, a possibility of different pathogens is high.

The range of TC and FC detected in the lake samples varied from 238 - 304 and 68 - 106 CFU/100 ml; in the open wells, 2 - 214 and 0 - 38 CFU/100 ml and in the well bore (pipe) - 6-104 and 0 - 88 CFU/100 ml (Table 1).

Comparatively higher values were obtained during the winter (December - January). Total coliforms were noticed in all samples from lakes, well bores and open wells, while faecal coliforms were present in all samples from lakes, 95% from well bore and 69% from open wells.

Among 63 locations, all the samples showed TC and FC counts above the permissible limits (except 4 and 2 samples in open and closed-in well bore respectively).

As per WHO guidelines TC and FC count should be zero in potable water. The actual values indicate high pollution of groundwater (Polo et al., 1998) via filtration under natural hydraulic pressure. Faecal coliform are species of the total coliform bacterial group found in human and animal intestinal wastes. The faecal coliform bacteria group includes the genera Escherichia and to a lesser extent, Klebsiella and Enterobacter. They are more precise indicators of sewage contamination comparing to total coliforms.

The highest share of indicator organisms was found in samples from Yaoundé lakes. During observation, sewage disposal, such as pit latrines and septic tanks were noticed to be used. Cracks or holes in the pipe casing caused microbial contamination of groundwater through the permeable soil layer. Low bacterial counts were observed in the samples of Wilson garden and Jackson village where underground drainage systems are installed.

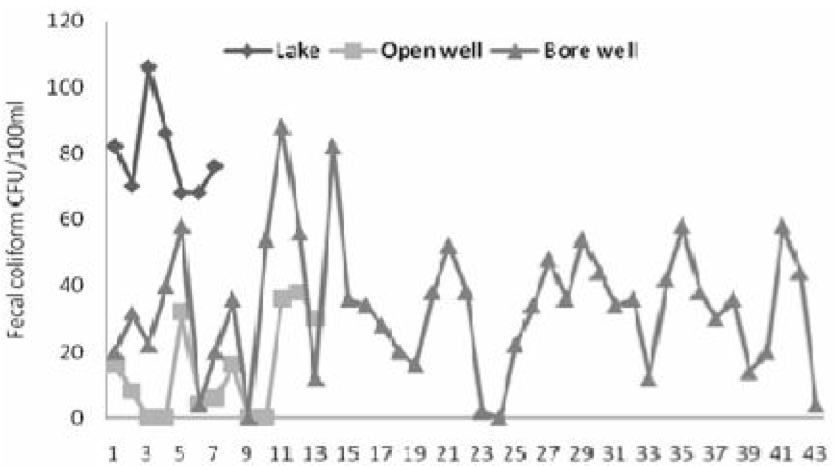


*Figure 2.* **Density of Faecal coliform in samples from the lake, open and closed-in bore wells**

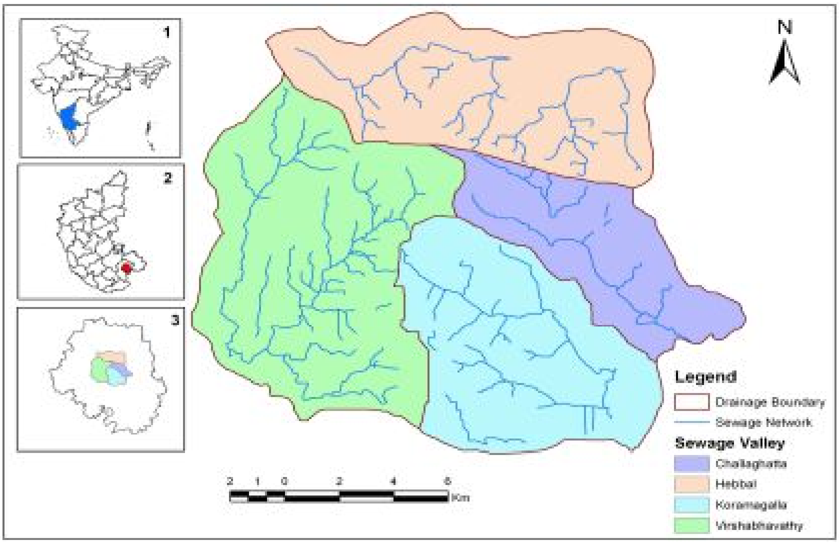


*Figure 3.* **Map of the area with sewerage network system**

Bluefort et al. (1996) also reported that the groundwater contamination in Pennsylvania and Maryland, USA is due to sewage disposal practice like pit latrines and septic tanks. US Geological survey under National Water Quality Assessment Program reported the presence of TC and FC in 30% wells in USA.

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