

# Monitoring of physico-chemical and bacteriological water parameters from drilling and wells of Shkoder city

Nevila Bushati<sup>1</sup>,

<sup>1</sup>Department of Biology-Chemistry, Faculty of Natural Sciences, University of Shkoder, Albania

Gjyzepina Celi<sup>2</sup>

<sup>2</sup>High School "Peter Maringer", Shkoder, Albania

## Abstract

The inhabitants of the city of Shkoder, besides the water supply, use also water from wells and drillings for drinking. The purpose of this article was to present the bacteriological quality of waters from drillings and wells used from inhabitants of Shkoder city. Water quality problems of wells and drilling waters can often be linked to: drilling and wells depth, construction deficiencies, selecting the wrong place, or the presence of cracks, channels and caves formations. Monitoring for the presence of pathogenic bacteria is essential assessment of water quality, which directly or indirectly use leads to serious health problems of man. Problems that come from drinking waters are numerous, because the consumption of contaminated water can be: abdominal typhoid, gastroenteritis, dysenteries by pathogenic bacteria, parasites etc. Fresh water is essential for human life and in general, it is an essential input to human production and to the economic development. Water pollution is not only a serious environmental issue but also an economic and human health problem. Water samples from drilling and wells were collected according to European recommendations and WHO legislation. The bacteriological parameters measured were: *Escherichia coli*, *Enterococcus faecalis* etc. The bacteriological parameters were carried out at the Centre for Microbiological Diagnostication, "Wolf Dieter Sixl", Albania.

**Keywords:** drillings, pathogenic bacteria, *Escherichia coli*, *Enterococcus faecalis* etc.

## Introduction

Water is a vital part of both our environment and our body systems. It covers nearly three quarters of the earth's surface and makes up between 60 and 70% of the human body matter. It is an essential component of nearly everything we eat and drink (USGS, 2010). For humans and ecosystems water quality is as important as water quantity (UNESCO 2012). Contamination of a private well can impact not only the household served by the well, but also nearby households using the same aquifer (CDCP, 2010). The quality of drinking waters from wells and drillings most depends from physico-chemical and bacteriological parameters. To ensure that a drinking water is drinkable water samples should be examined regularly. Groundwater represents an important source of drinking water and its quality is currently threatened by a combination of over-abstraction and microbiological and chemical contamination (Pedley S., 1997 & Reid D. 2003). Most bacteria in the coliform group

do not cause disease, but the greater their number the likelihood that disease-causing bacteria may be present. *Escherichia coli* and *Enterococcus faecalis* provides definite evidence of faecal pollution; in practice, the detection of thermotolerant (faecal) coliform bacteria is an acceptable alternative. In most communities, the principal risk to human health derives from faecal contamination (WHO, 1997). Heterotrophic bacteria detects a broad group of bacteria including nonpathogens, pathogens, and opportunistic pathogens. HPC may be an indicator of poor general biological quality of drinking water (WHO, 1997).

## Material and Methods

Standard Methods for the Examination of Water and Wastewater were used during collection, preservation and estimation of different parameters. European recommendations and WHO (World Health Organization) helped in a standard analysis. ISO/DIS 8199 (1986); ISO 5667-2 (1991), ISO 9308-1 (2000) helped conduct sampling properly and water samples. Sampling of water samples from drillings and well waters was carried out on June 2017. 26 water samples were collected in different houses of Shkodra city. Water samples for physico-chemical and bacteriological analysis were taken through sterile bottles. Physico-chemical parameters measured were: i) pH, temperature, conductivity was measured "in situ" with equipment type of AQUALYTIC system ii) turbidity was measured using Turb 430 IR/T, a handheld precision turbidimeter. Meanwhile for bacteriological parameters were determined: heterotrophic bacteria, *Escherichia coli* and *Enterococcus faecalis*. Standard Methods for the Examination of Water and Wastewater 20th Edition and ISO 9308-1, recommended use of membrane filtration method for *Escherichia coli* and *Enterococcus faecalis*, where incubation temperature is 44°C and incubation time 48 hours. An appropriate volume of a water sample (100 mL water) was filtered through a 0.45-µm pore size nitrocellulose membrane filter that retains the bacteria present in the sample and was then transferred in *Endo Agar* and *Slanetz-Bartley Agar* plates. Heterotrophic bacteria were determined by using Yeast Extract Agar at an incubation of 30 to 35°C for a 48-hour period.

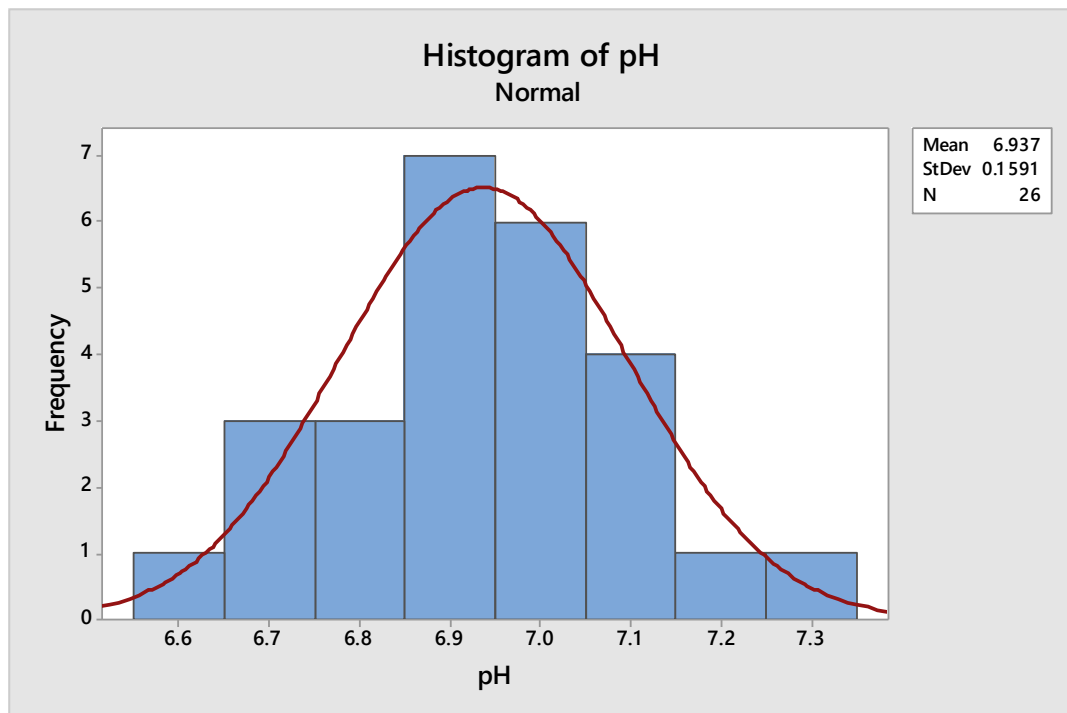
## Results

Statistical processing was conducted by Minitab 17 Statistical program. The results of our study are presented with histograms and probability plot. The ideal pH level of drinking water should be between 6 and 8.5.

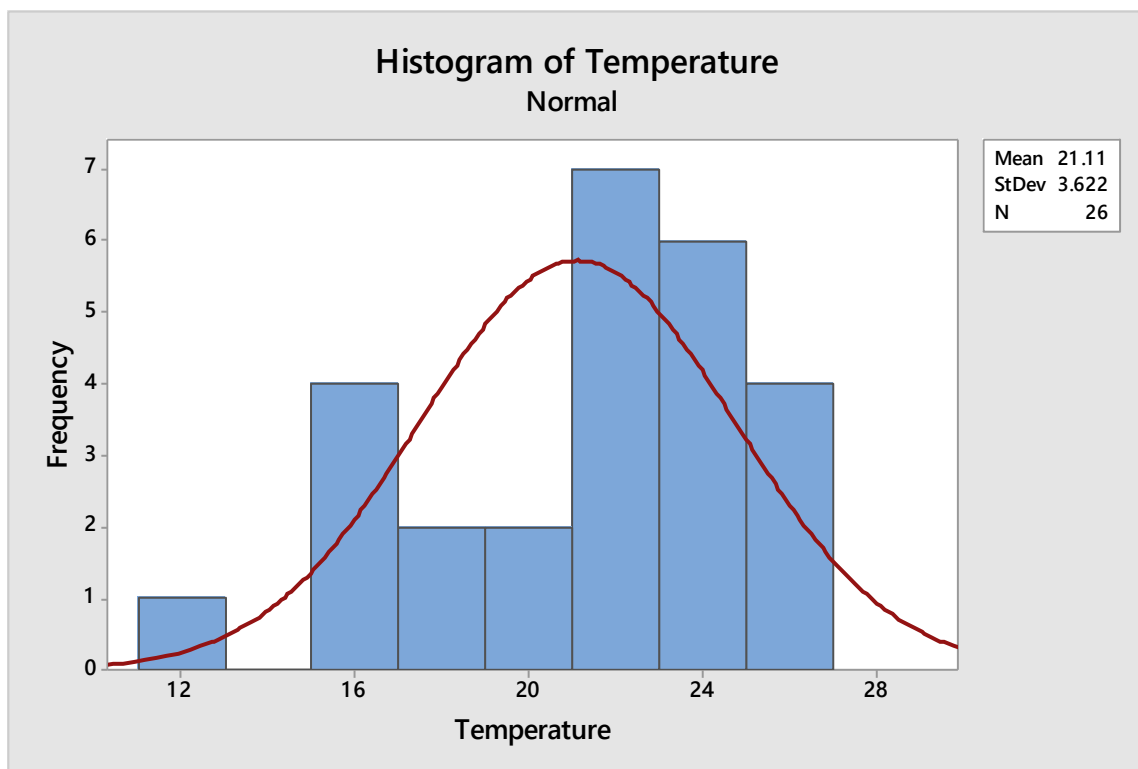
## Discussion

Water samples from wells and drillings were collected in 26 different private houses of Shkodra city. From which, 11 water samples were collected from wells waters, 15 water samples were collected from drilling waters. Depth from wells waters varies from 7.5 meters-12 meters and the age of these wells was from 35-120 years.

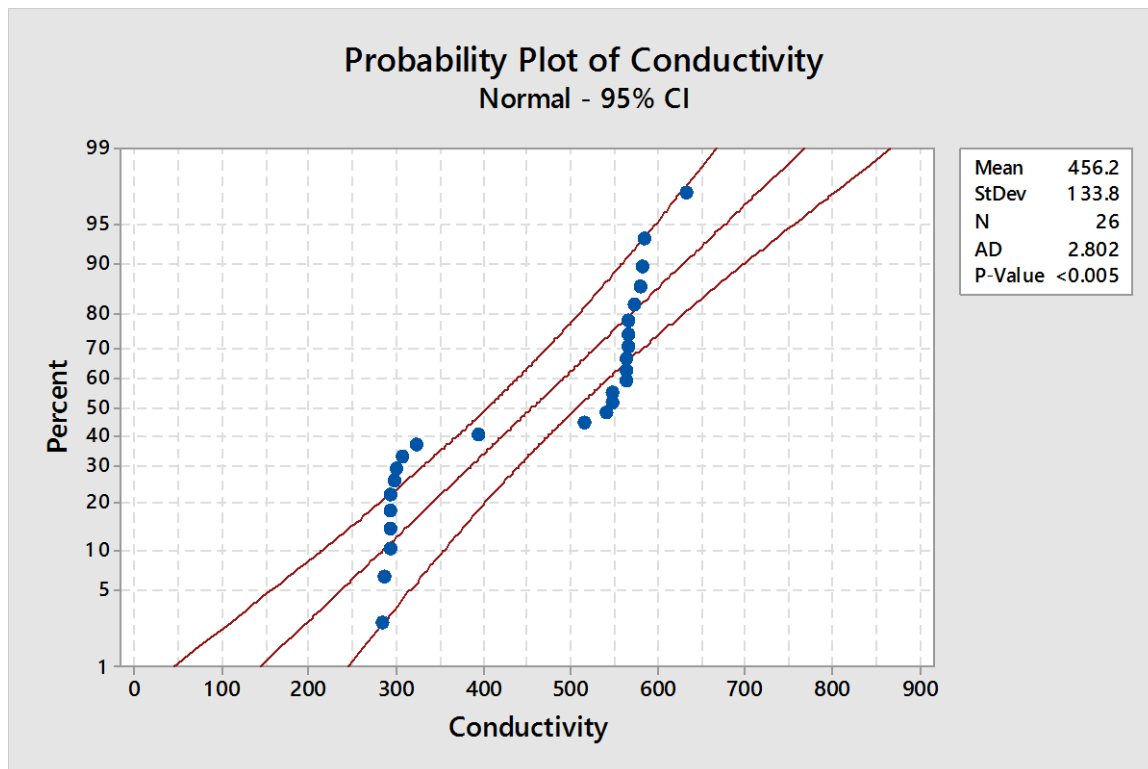
Conductivity of water samples from wells was from 287-632 µS/cm (fig.3). The conductivity of wells waters vary also from the depths of wells. The highest value for conductivity results in wells waters. The pH varies from 6.64-6.97(fig.1). Temperature of wells waters was from 15.3-26.2°C (fig.2).



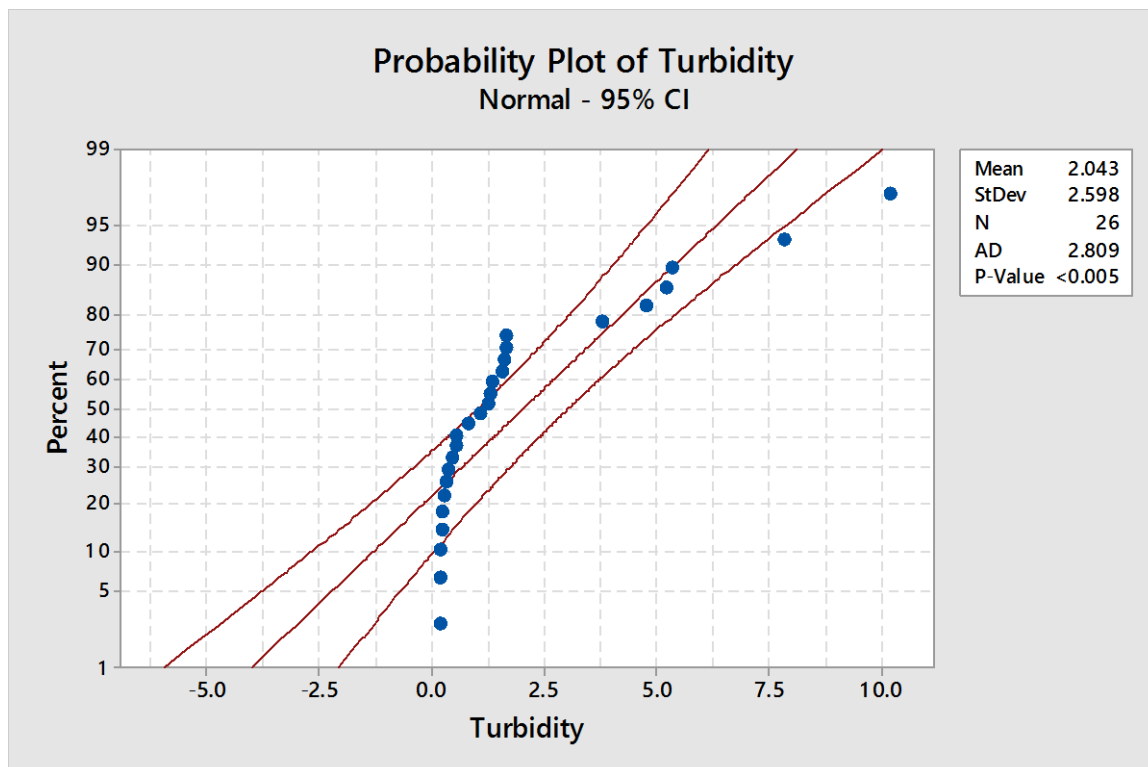
**Figure 1.** represent the results of wells and drilling waters for pH. The standard deviation was around 0.1591 and the mean values was 6.937.



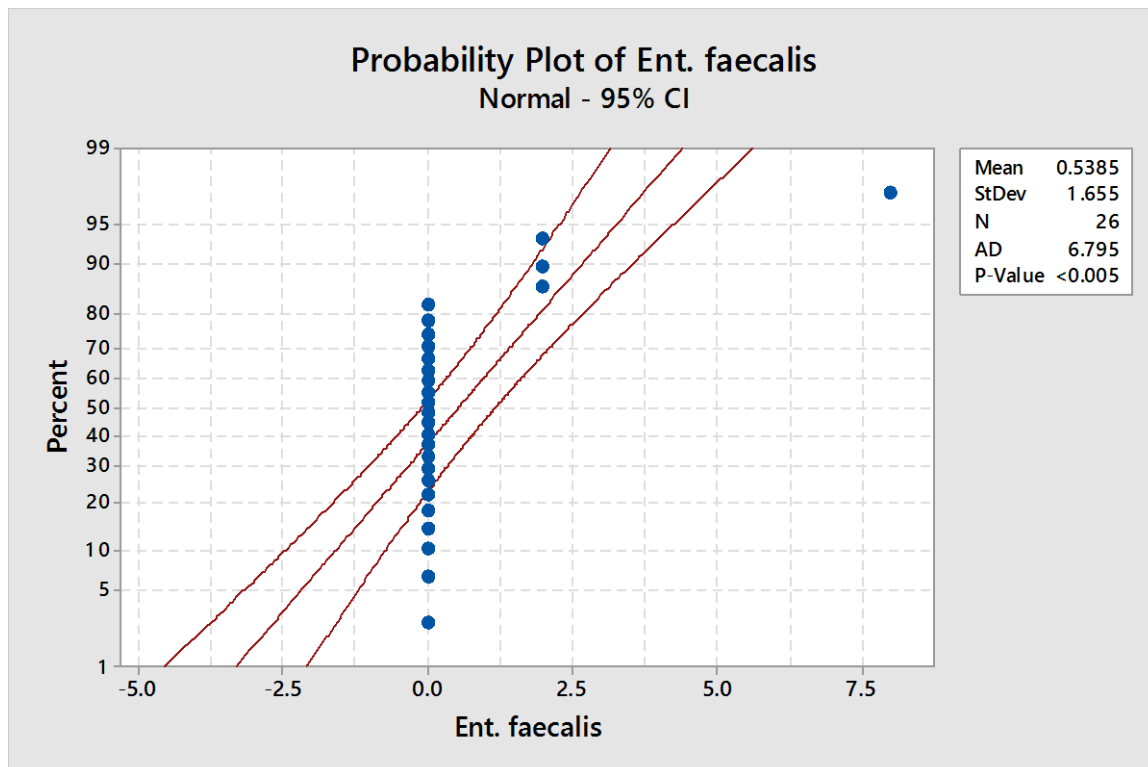
**Figure 2.** represent the results of wells and drilling waters for temperature. The standard deviation was around 3.622 and the mean values was 21.11.



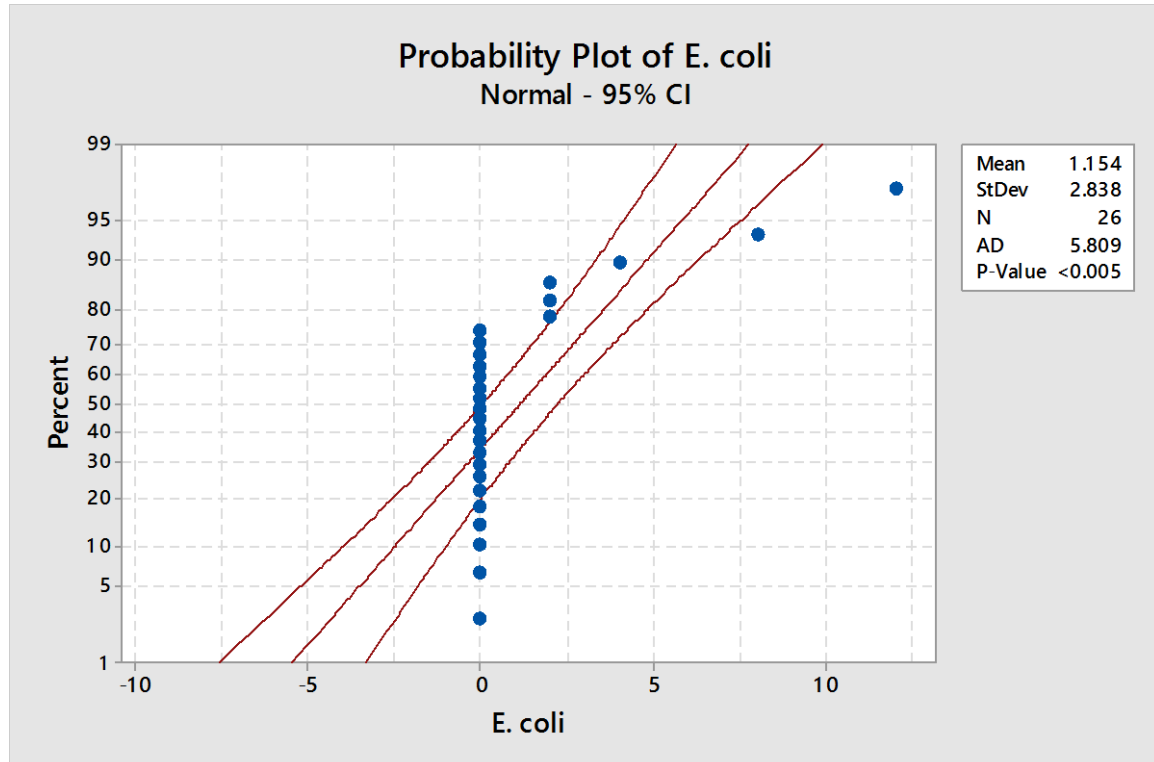
**Figure 3.** represent the results of wells and drilling waters for conductivity. The standard deviation was around 133.8. The mean values were 456.2 and p-value is <0.005. Conductivity relates to the amount of dissolved substances in water, but it, however, does not give an indication of which mineral is present.



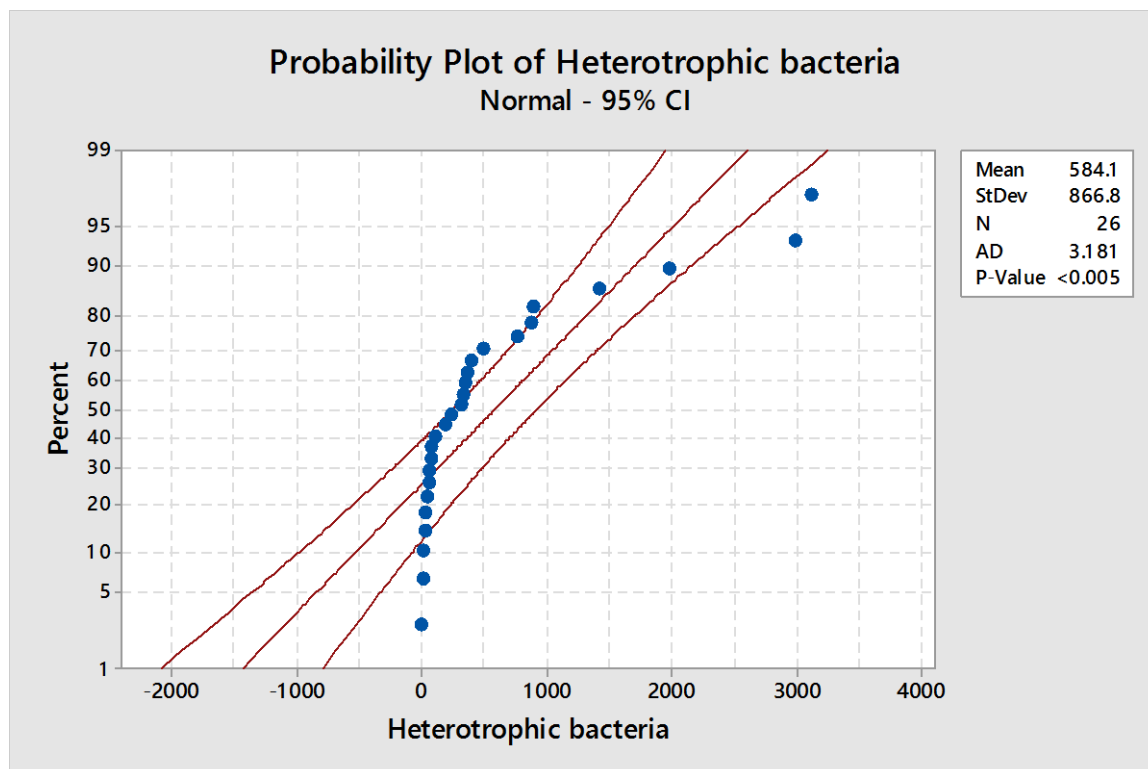
**Figure 4.** represent the results of wells and drilling waters for turbidity. The standard deviation was around 2.598. The mean values were 2.043 and p-value is <0.005.



**Figure 5.** represent the results of wells and drilling waters for *Enterococcus faecalis*. The standard deviation was around 1.655. The mean values were 0.5385 and p-value is <0.005.



**Figure 6.** represent the results of wells and drilling waters for *Escherichia coli*. The standard deviation was around 2.838. The mean values were 1.154 and p-value is <0.005.



**Figure 7.** represent the results of wells and drilling waters for heterotrophic bacteria in 1 ml. The standard deviation was around 866.8. The mean values were 584.1 and p-value is <0.005.

Turbidity of wells water samples varied from 0.21-10.2 NTU-FNU(fig.4). According to the WHO (2011), the turbidity is not necessarily a threat to health, it is an important indicator of the presence of the possible presence of contaminants that would be of concern for health, especially from inadequately treated or unfiltered surface water. 8 water samples from 11 results negative with *Escherichia coli* and *Enterococcus faecalis* and 3 water samples results positive with *Escherichia coli* from 4-12 CFU/100 ml, for *Enterococcus faecalis* with 2 CFU/100 ml (fig.5/6). Heterotrophic bacteria varied from 15-2980 CFU/ml (fig.7).

Drilling waters have a depth which ranges from 7-13 meters. Their age varied from 10-30 years. The pH varies from 6.82-7.34 (fig.1). Conductivity of drilling waters varied from 293-584  $\mu\text{S}/\text{cm}$  (fig.3). Temperature of drilling waters varied from 12.7-25  $^{\circ}\text{C}$  (fig.2). Turbidity of drilling waters varied 0.19-5.34 NTU/FNU (fig.4). From 15 water samples only three samples result with *Escherichia coli* with 2 CFU/100 ml and one sample with *Enterococcus faecalis* with 2 CFU/100 ml (fig.5/6). Meanwhile heterotrophic bacteria have a range from 3-3120 CFU/ml (fig.7). The samples from wells and drilling waters mainly results with low number of *Escherichia coli* and *Enterococcus faecalis* since these are untreated waters. Communities using wells and drilling waters as their source of water they should be educated of the possible risks when wells and drilling water is used for human consumption. The private houses which mainly use wells and drilling waters should disinfected them with chlorine and analysed every time that they suspect for the presence of bacteria. Heterotrophic bacteria consist to a group of opportunistic bacteria, which in some certain condition of health they cause diseases. According to 98/83/EC of 3 November 1998 on the quality of water intended for human consumption. *The main requirement concerning the quality of water for public use is that they must be "healthy" to use.*

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