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Faculty of exact sciences and natural and life sciences
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MASTER’S THESIS

Field : Nature and life sciences
Sector : Biological sciences
Specialty : Applied biochemistry
Ref. : ………………………………………………

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On : Thursday, October 08, 2020

Study of the effect of the addition of Zamzam water on physico-chemical characteristics of mineral Guedila water

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Academic year : 2019 - 2020

Acknowledgements

A big thank, a little thank, no matter its size it has no dimension... it is a little word very simple but which weighs heavy when it comes from the deep of the heart.

At the end of this work our sincere thanks go first of all to Allah, the almighty one for having given us the strength, the will and the courage to make this modest work.

This work was carried out within the analysis laboratory of ADE (Algerienne Des Eaux) of Biskra unit.

We would like to thank madam KORAIBI and DJOUAMAA Ilyes from the ADE of Biskra for the welcome in their laboratory and for their effective help during physicochemical analysis of our samples.

Our deepest thanks go to our supervisor BEBBA Nadjet, who did us the honor to lead and guide us with patience, Kindness and enormous support, to her many advices with her scientific rigor for all the efforts, her invaluable orientations throughout of the realization of this work.

Finally, we address our most respectful thanks to all those who have contributed directly or indirectly to the preparation of this memory.

Dedication

I have the great honor to dedicate this work to the arms that hold me over the course of this trip.

To everyone who gave me advice, patience and motivation when I needed it:

My mother: who was the background she struggled in her life to see me reach this noble goal, and really stood by my side giving me love and motivation HALIS Fatima Zohra.

My big brother: who was the support, guide and backer, he didn’t leave me in a need of anything TOUANE Houcine.

My three sisters: who were litterely the shining flame of joy and pleasure pushing the stress and confusion away from me TOUANE Dikra, TOUANE Isra and especially TOUANE Arafa with her special useful touches.

My two best friends: who supported me spiritually from the bottom of heart and were a real friends AMARA Imene and ACHOUR Imene.

Assala

Dedication

To the almighty Allah.

Praise to you, Glory too early for having assisted us from your light and in all circumstances morning and evening, he was and always will be next to me to successfully complete any job.

I dedicate this work to my dearest beings in the world:

My mother and mu father for their lova, their tenderness and for their support moral and material during all stages of my life.

To my dear sisters Hadjer and Khadidja.

To my pride and honor: My cousin Zin eddinne.

To my promotion colleagues and my best friends in particular Assala and Hassina.

To all my teachers in our Biology department.

Thank you for your advice and encouragement.

Imene

Table of contents

Second part : EXPERIMENTAL PART

Chapter 3: MATERIALS AND METHODS

Chapter 4: **RESULTS AND DISCUSSIONS**

List of Tables

List of Figures

List of abbreviations

ft: feat.

PBUH: Peace Be Upon Him.

CO_2: Carbon dioxide.

WHO: World Health Organization.

ADE: Algérienne des Eaux.

N: Normality.

EDTA: Ethylene Diamine TetraAcetic.

$CaCO_3$: Calcium Carbonate.

H_2SO_4: Sulfuric Acid.

Cond: Condictivity.

Introduction

Human existence depends on water. The geosphere, the atmosphere and the biosphere maintain all three have a close relationship with water. Water interacts with solar energy to determine climate, and transforms and transports physical and chemical substances necessary for all life on Earth. It is the only compound that can be found in all three states matter (solid, liquid, or gas) at ordinary temperature. it is a nutrient Vital, but it is also involved in many physiological functions essentials such as digestion absorption, thermoregulation and elimination of waste (Kirkpatrick et Fleming, 2008).

Water intended for human consumption is drinkable when it is exempt from chemical and biological elements liable to a more or less long term to the health of individuals (Lansing *et al,* 2010). In Algeria, surface water is the main source for our drinking water supply, but increasingly the individual and municipality turn to exploitable groundwater. They are characterized by their microbiological purities and constant chemical compositions per week of the same slick (JORA, 2004) . They have always been known for their power therapeutic, which are linked to the nature of the mineral elements that contain those (THOMAS et THOMAS, 2005).

Water quality control is an essential factor in responding to regulatory requirements established by organization of public health for the prevention from diseases witch related with water, because water is exposed to all kinds of pollution and considered a potential transporter of many diseases. According to WHO (2005) ,each year 1.8 million people, 90% of whom are children under the age of five, most in developing countries die of diarrheal diseases (including cholera); 88% of diarrheal diseases are attributable to poor and bad water quality.

So the quality of the drinking water available is far from satisfying demand of consumers. Man has always had difficulty in appreciating the quality of the water in Consume.

With this major importance, this work aims to focus on aspect determination of the physicochemical quality of bottled water (Guedila) and Zamzam in order to evaluate the effect of adding Zamzam water on the characteristic physicochemical quality of normal water (Guedila) for healthier and ideal consumption.

This study was structured by an approach in two interdependent parts:

- ✓ The first part is devoted to the bibliographical study which is composed of two chapters. The first chapter is a reminder on water in the general way. The second chapter shows the physicochemical characteristics of drinking water (intended for human consumption).
- ✓ The second part consists of an experimental study grouped into two chapters. The The first chapter entitled material and methods, is essentially devoted to methods and to the techniques used to realization of this study : physicochemical analysis of water(Guedila, Zamzam) .The second chapter mentions in the form of presentations graphs, the different results obtained during this practical study with their discussions.

Finally we have sketched by a final conclusion and we propose some perspectives.

Bibliographic parts

Chapter 1: Generality

1. Introduction

Water is part of our natural environment just like the air we let us breathe and the earth which carries and nourishes us; it constitutes one of the elements familiar of our daily life. Water must be considered as a liquid element with its characteristics physicochemical particular and its multiple uses, but also as a component of a natural environment, an ecosystem. water has also become a strategic issue due to its uneven distribution on our earth and international rules have been enacted for regulating its uses, avoid and settle conflicts, distribute responsibilities related to right that was given to man, user and citizen (Grosclaude, 1999).

2. Classification of raw water

2.1. Surface water

Surface or surface waters for 40% of the volume produced. They included all the waters circling or stored, which exist on the surface of the continent. These waters which found on terrestial surface can be running or stagnant waters (Rejsek, 2002).

2.2. Rivers water

Waters whose flow regime is turbulent, have very often become turbid (they have lost their clarity), since they carry try suspended matter from forest or agricultural land. It’s are moreover, often cold since it’s come from springs, melting snow or melting glaciers. Finally, their color index is low because they contain no organic matter in solution (Graindorge et Landot, 2007). The rivers also played an essential role on trade before emergence of modern civilization and its new ways of fast communication (trains, trucks and planes). Rivers also established robust natural boundaries between nations (Lécuyer, 2014).

2.3. The lakes water

Most of the earth's lakes are stagnant freshwater storage in valleys, flood plains and depression and it’s are fed and drained by rivers (Lécuyer, 2014). The lakes constitute natural tanks of water which has the effect of:

- reduce the turbidity of the water, since, because their low turbulence, the suspended matter tends to settle on the bottom.

- reduce the concentration of bacteria and pathogenic viruses in these waters, because of the effect combined with sedimentation and long stays of water in the lakes, where the conditions are not favorable the survival of these organisms (Graindorge et Landot, 2007).

2.4. Sea water

In the absence of surface water or deep water it is sometimes necessary to resort to brackish water (15,000 mg / l of dissolved salts) or even seawater (25,000 mg / l and more). To desalt in these waters, the two main techniques are membrane: electro dialysis or reverse osmosis. But they are expensive and consume a lot of energy (Graindorge et Landot, 2007).

2.5. Groundwater

Groundwater comes from springs or wells. In general, they have the Characteristics following:

- low color because they contain little organic or colloidal matter in solution.
- low turbidity because they have been filtered in the ground.
- Presence of calcium and magnesium (depending on the region), which react with the soap to form a precipitated (Graindorge et Landot, 2007).

Underground water supplies over 60% of our drinking water. This shows the importance of aquifers which constitute an important and irreplaceable reservoir. in addition, they are often less sensitive during drought episodes, and depending on the depth of the aquifers (Graindorge et Landot, 2007).

3. Drinking water

Water intended for human consumption must therefore meet general hygiene rules and all measures to protect human health. The potability of water is essentially based on notions of world health organization (Rejsek, 2002).

2.1. Guedila water

It’s natural non-carbonated mineral water exceptional purity and lightness.

2.1.1. The origine of Guedila

Guedila's natural mineral water has long been renowned for its purity and exceptional lightness and mineral balance. Guedila mineral water gushes at the foot of the Guedila mountain, which reaches an altitude of 500m, on the southern slope of the aures mountain range, the limestone rocks constitute a natural and ideal filter, promoting the birth of a healthy water and protected from any polluting activity (agricultural or industrial).

2.1.2. Characteristics of Guedila

The laboratory is a tool that allows the company to ensure the quality of its finished product in accordance with regulatory and normative requirements (good laboratory practice). Quality control and chemistry, which allows us to ensure the reliability of the results of control and analysis. The control takes place throughout the production process (from the drilling point to the bottling and packaging of the finished product), with a great deal of control over the quality of the contents as well as the container to ensure a product that meets regulatory requirements and consumer satisfaction (site web 1).

3.2. Zamzam water

3.2.1. Location and description of the Zamzam well

Mecca city is located in western part of Saudi Arabia about70 km to the south of the city of Jeddah on the coast of the red sea. Mecca is bound by latitudes 21°26′48″N and longitudes 39°53′46″E with an elevation of about +1399 ft. The city of Mecca contains ALMsgied Alharam. The ka’ba Amosharafa is located inside the alharam and Zamzam well located at about20 m east of the Ka’ba. The recharge of Zamzam well may have occurred during the last Holocene humid period and that the aquifer is now discharging ancient groundwater resources (Al-Barakah *et al*, 2017).

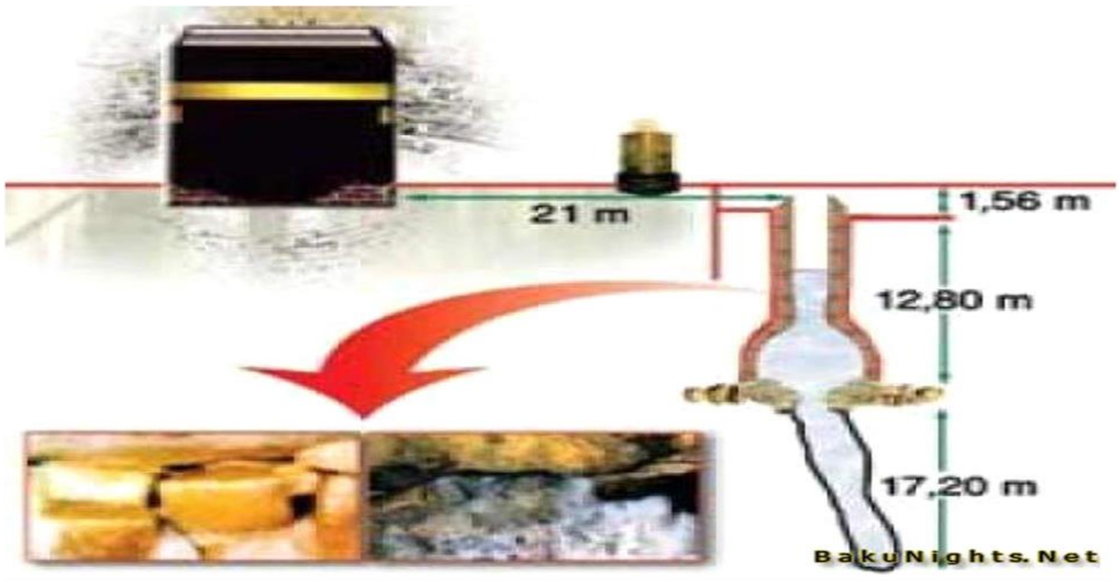

Figure 1: Depth and location of Zamzam well near to Ka'ba Amosharafa

The Zamzam well is hand-excavated and is about 30.5 m deep, with an internal diameter ranging from 1.08 to 2.66 m. The well lies within wadi ibrahim, which runs through the holy city of makkah. The well is now housed in a basement room, protected by glass panels that formerly allowed a clear view of the well. Electric pumps draw water from the well, replacing the ropes and buckets of former times (Shomar, Zamzam water: Concentration of trace elements and other characteristics, 2012).

3.2.2. Qualities of Zamzam water

Ibn Abbas (May Allah be please with him) narrated a prophetic hadeeth which says: the best water on the surface of the earth is Zamzam water; it is food for the hungry and a healing for the sick.

Imam Ibn Qayyim Al-Jawziyah (May Allah have mercy on him) said: "Zamzam water is the best and noblest of all waters, the highest in status, the dearest to people, the most previous and valuable to them.

The noble prophet Muhammed (PBUH,) described the water of Zamzam saying: "it is blessed! It is a kind of food" a hadeeth narrated by Imaam Muslim...

Zamzam water has ever been proved to be the best pure water which is free, even till date, from those three elements, color, taste and odor .that is to say, the pure water must be colorless, tasteless and odorless and those are the exact basic qualities of Zamzam water. There are various scientific experiments which the scientists have carried out in order to prove or confirm the purity of this water Zamzam. The results were amazing, because it was found out that Zamzam water was absolutely free from all kinds of germs or viruses that cause water contamination (Okeneye, 2017).

3.2.3. Zamzam Water for Healing

Allah's messenger (PBUH) speaks the truth as he describes Zamzam water as: "cure for illness" the similitude of this hadeeth as narrated by Ibn Abbas runs thus: the best water on the face of the earth is the water of Zamzam. In it is complete nourishment and healing from sickness there are many other authentic ahadeeth (prophetic sayings) which declare that there is healing in the water of Zamzam. the prophet (PBUH) once said: the water of Zamzam is for the purpose for which it is drunk" related by Ibn Majah this latter hadeeth shows, in relation to healing, that whoever drinks Zamzam water for the purpose of asking healing from Allah, he shall heal him by his grace. Another efficacy of Zamzam water: nutrition and strength for the pregnant women, multiply and improve the quality of breast milk, clean your face and acre clean up and sharpen the eyes (eye treatment) , counteract the influence of magic, filling the stomach, improve digestion, blood circulation, launched defection… (Okeneye, 2017).

Chapter 2: Physicochemical properties of water

1. Physicochemical properties of water

1.1. The temperature

It is important to know the water temperature with good accuracy. This plays a role in the solubility of salts and especially gases, in the dissociation of dissolved salts therefore on the electrical conductivity, in the determination of pH, for the knowledge of the origin of water and possible mixtures, etc . . . Generally speaking, the temperature of surface water is influenced by air temperature, especially that its origin is shallower (Rodier, 2005).

1.2. The hydrogen potential (pH)

The pH of water represents its acidity to its alkalinity. It is an important parameter in water quality and even in treatment operations. For natural waters, it is linked to the nature of the land traversed and to discharges. The pH of distribution water varies between 6.5 and 8.5 with other parameters such as hardness, temperature, CO2 and alkalinity. The pH is used to define the aggressive or encrusting nature of the water. If less than 7, it leads to corrosion of cement and piping metals. If it is greater than 7, it can lead to deposits encrusting in the pipes (Rodier, 2005).

1.3. The hydrotimetric title (HT)

The hydrotimetric title (TH), is an indicator of water mineralization, which corresponds to the content of water in calcium (Ca2+) and magnesium (Mg2+).

The unit used to express the hydrotimetric title is the French degree (°f): 1°f = 10 mg/l of calcium carbonate (limestone) or 4 mg/l of calcium or 2.4 mg/l of magnesium or 0.2 Mill-equivalents per liter (meq/L) (Davezac *et al*, 2012).

1.4. Conductivity (σ)

Conductivity (or specific conductance) refers to the ability of a substance to conduct an electric current. The conductivity of a water sample is a function of the water temperature and the concentration of dissolved ions (Dissmeyer, 1994).

1.5. Salinity (Sal %)

Salinity is defined as the weight in grams of the dissolved solid material contained in 1 kg of sea water when all the bromine and iodine have been replaced by an equivalent quantity of chlorine, all the carbonates converted into oxides and all organic matter oxidized.

It is clear from this definition that salinity is measured in grams per kilogram, or parts per thousand (‰) (Mamayev, 2010).

1.6. Total Dissolved Solids (TDS)

TDS is the term used to describe the inorganic salts and small amounts of organic matter present in solution in water. The principal constituents are usually calcium, magnesium, sodium, potassium cations and carbonate, hydrogen-carbonate, chloride, and nitrate anions. Presence of high levels of TDS in water may be objectionable to consumers owing to the resulting taste and to excessive scaling in water pipes, heaters, boilers, and household appliances. Water with extremely low concentrations of TDS may also be unacceptable to consumers because of its flat, insipid taste; it is also often corrosive to water supply system (Arvind, 2004).

1.7. The turbidity

Turbidity is the measurement of scattered light that results from the interaction of incident light with suspended and undissolved material in a water sample and it is an important water quality indicator. Turbidity is defined by the International Standards Organization (ISO) as the reduction of transparency of a liquid caused by the presence of undissolved matter (Nikos, 2009).

1.8. The Complete Alkali metric Title (CAT)

The complete alkalimetric title (CAT) of the water is a measure of the alkalinity of the solution. The CAT is mainly explained by the pH and the concentration of carbonate ions (Lazzarotto, 2010).

1.9. The cations and anions containing in water

1.9.1. The cations

1.9.1.1. The calcium [Ca^{+2}]

The element calcium, atomic number 20, is it third most abundant metal in the earth crust. Calcium compounds account for 3.64% of the earth crust. The distribution of calcium is very wide as it is found in almost every terrestrial area.

Calcium ions dissolve in water form deposits in pipes and boilers and when the water is hard, that is, when it contains too much calcium.

Calcium occurs in water naturally. One of the main reasons for the abundance of calcium in water is it natural occurrence in the earth crust. Calcium functions as a pH stabilizer, because of its buffering qualities, and it also gives water a better taste (Ferrante *et al*, 2013).

1.9.1.2. The magnesium [Mg^{+2}]

Magnesium, atomic number 12, is an element with symbol Mg. it is an alkaline earth metal and the eighth most abundant element in the Earth's crust and ninth in the known universe as a whole. Due to magnesium ion's high solubility in water, it is the third most abundant element dissolved in seawater (Ferrante *et al*, 2013).

1.9.1.3. The potassium [K+]

Potassium, atomic number 19, is an alkali metal and the seventh most common element on earth. Potassium is an essential element in humans and is seldom, if ever, found in drinking water at levels that could be a concern for healthy humans. It occurs widely in the environment, including all natural waters. It can also occur in drinking-water as a consequence of the use of potassium (Ferrante *et al*, 2013).

1.9.1.4. The sodium [Na+]

Sodium (Na) is an essential element required for normal body function including nerve impulse transmission, fluid regulation, and muscle contraction and relaxation (Mayo, 2019). Sodium is a common element in the natural environment and is often found in food and drinking water. In drinking water, sodium can occur naturally, be the result of nearby road salt application or water softening units (Jeffery *et al*, 2017).

In water, sodium has no smell but it can be tasted by most people at concentrations of 200 milligrams per liter (mg/L) or more (Jeffery *et al*, 2017).

1.9.2. The anions

1.9.2.1. The chloride [Cl^-]

Chlorine is the most abundant of the halogen elements. Although chlorine can occur in various oxidation states. The chloride form (Cl^-) is the only one of major significance in water exposed to the atmosphere. Chloride is widely distributed in nature, generally as sodium chloride (NaCl) and potassium chloride (KCl) and it constitutes approximately 0.05% of the lithosphere (National Research Council of Canada, 1997). Chloride is present in all natural water. Normally at low concentrations (Schneider *et al*, 2003).

The chloride concentration is one of the important indicators of water pollution. The maximum permissible limit i.e. 500mg/L. for drinking water prescribed by WHO.

1.9.2.2. The alkalinity [HCO_3^-]

The alkalinity of water results primarily from carbonate and bicarbonate ions and this variable tends to buffer water against excessive pH change. A basic understanding of the relationships among pH, carbon dioxide, and alkalinity are essential to the student of water quality (Claude, 2006). of Physico-chemical parameter of water quality from human consumption

2. Algerian norms

Table 1: Physic-chemical parameter of water quality from human consumption

Parameter	Unity	Norm of Algerian waters
Temperature	C°	25
Salinity	‰	
TDS	mg/l	
Conductivity	µs/cm	2400
Ph		6.5-8.5
Chlorine	mg/l	500
CAT	mg/l	500
Hco3	mg/l	
TH	mg/l	
Calcium	mg/l	200
Magnesium	mg/l	150
Turbidity	mg/l	5
Sodium	mg/l	200
Potassium	mg/l	12

3. Conclusion

This party was illustrated with generalities on water and physic-chemical characteristics through which we can evaluate the effect of the addition of Zamzam water on Guedila water as water bottled for human consumption.

Experimental part

Chapter 3: Materials and methods

1. Introduction

This chapter deals with analysis of physicochemical characteristics which presents a very important role in the control of water quality. The objective is to identify there characterization in order to assess the influence of Zamzam water on selected bottled water.

The analyzes were carried out on the following samples:

- Drinking water brand registered at the market: Geudila is manufected during February 2020.
- Zamzam water from the period of 2020.

2. Physicochemical analysis

2.1. Analysis equipment and devices

The devices recorded in Tables (2) and (3) below give the type of device and reagent used for the different analyzes in our study.

Table 2: Types of equipment used for the different analyzes

<table>
<tr><th>Parameters measured</th><th>Types of devices</th></tr>
<tr><td>Temperature</td><td rowspan="4">- Multi parameter (Consort C5020)</td></tr>
<tr><td>Conductivity</td></tr>
<tr><td>Salinity</td></tr>
<tr><td>TDS</td></tr>
<tr><td>pH</td><td>- pH meter (HI 2211 pH/ORP Meter)</td></tr>
<tr><td>Na^+</td><td rowspan="2">- Flame spectrophotometer (PFP7 Flame Photometer)</td></tr>
<tr><td>K^+</td></tr>
<tr><td>Turbidity</td><td>- Turbidimeters (TL 2300)</td></tr>
</table>

Table 3: Types of solution and reagents used for the different analyzes

Parameters measured	Types of solutions and reagents
Cl^-	- Silver nitrate solution (AgNO3) 0,02 mol/l - Potassium chromate indicator solution (K2CrO4) 100 g/l
Ca+	- Sodium hydroxide, 2 N solution - Calcium, reference solution (100 mg/l) - EDTA, standard solution (0.01 mol / l) - Murexide (indicator)
TH	- EDTA, standard solution (0.01mol/l) - Buffer solution (pH 10) - Mordant noir 11, indicator
TAC	- Sulfuric acide (0.02N) - Methylorange solution (0.5%)

2.2. Physico-chemical analysis methods

2.2.1. Ultraviolet-Visible Spectrophotometry analysis

Ultraviolet-Visible spectrophotometry is a qualitative and quantitative analysis technique where a light beam of monochromatic wavelength passes through the solution to be analyzed.

It is by this method that we were able to measure the following parameters:

2.2.1.1. Simultaneous determination of sodium [Na^+] and potassium [K^+]

- **Principle**

When the atoms of an element are excited by a flame, they emit photons of determined wavelength, the intensity of which can be measured by spectrophotometry.

The initial concentration of the cation to be dosed is deducted from the absolute value of the intensity of the measured spectral emission (Rodier, 2005).

- **Operating mode**

Nebulize the sample in an air-acetylene flame by interposing permuted water between each solution. Read the flame spectrophotometer at a wavelength of 589 nm for sodium and 766.5 nm for potassium.

2.2.2. Electrochemical methods

Is a class of techniques in analytical chemistry which study an analyte by measuring the potential (volts) and/or current (amperes) in an electrochemical cell containing the analyte.

It is by this method that we were able to measure the following parameters:

2.2.2.1. Temperature measurement (°C)

The temperature measurement is to be carried out in the field. It is necessary to determine the temperature of the area in the same place and at the same time (Rodier, 2005).

- **Operating mode**

The water temperature is measured either with an electrometric device (multi parameter of type Consort C5020) or with an accurate thermometer, the reading is made after a 10-minute immersion and expressed in degrees Celsius.

2.2.2.2. Hydrogen potential measurement (pH)

- **Principe**

The pH is related to the concentration of H+ hydrogen ions present in water. Its measurement can be by different methods. By means of glass electrode, it gives more precise value because it does not modify equilibrium or concentrations and it is not sensible to redox (Rejsek, 2002).

- **Operating mode**

A pH measurement involves two electrodes: the indicator electrode (also called the glass electrode) and the reference electrode. These two electrodes are often grouped together in the same body and give rise to a single electrode called the combined electrode.

When a glass electrode and a reference electrode are immersed in a solution, a galvanic cell is created. The potential difference depends on the two electrodes.

Ideally, the potential of the reference electrode remains constant while the potential of the indicator electrode will vary depending on variations in the pH to be measured.

The results are read directly.

2.2.2.3. Conductivity measurement (σ)

- **Principle**

The conductivity of a solution is a measure of the ability of ions to carry electrical current. This passage of the electric current takes place by the migration of the ions in an electric field produced by an alternating current (IGZ, 2004).

- **Operating mode**

- Pour about 60 ml of sample into a container.

- Place the containers on the sampler carousel and start the analyzer by using Multiparameters with a cell to measure conductivity.

- The results are read directly and are expressed in µS / cm.

2.2.2.4. Salinity measurement (S)

- **Direct salinity measurement**

The first method that comes to mind to measure this salinity, is to allow one kg of water to evaporate and to weigh the residue that remains, but it does not work because some compounds also evaporate instead of crystallizing (Hervé, 2014).

- **Indirect salinity measurements**

By the multi-parameter.

2.2.2.5. Total Dissolved Solids measurement

The standard method for determining the TDS is to evaporate a known amount of a sample of water by heating it to 180 ° C. It then suffices to weigh the solid residue obtained. Of course, all these operations are carried out under rigorous conditions. The accuracy of the standard method depends on the nature of the dissolved species (IGZ, 2004).

The TDS method built into the conductivity meters or TDS meters provides a quick and easy way to determine the TDS based on a conductivity measurement by the following equation: (ADE-laboratory)

$$\mathrm{TDS} = \frac{\mathrm{Condictivity}}{2}$$

2.2.3. Volumetric methods

The volumetric method is an operation which consists in determining the title of a solution, that is to say its concentration. Indeed, the solution of known concentration is poured drop by drop into the dosing solution in which a few drops of colored indicator have been previously put to detect the equivalent point.

It is by this method that we were able to measure the following parameters:

2.2.3.1. Datarmination of chloride [Cl^-]

- **Principle**

Reaction of chloride ions with silver ions to produce insoluble silver chloride which is quantitatively precipitated. Addition of a small excess of silver ions and formation of the red-brown silver chromate with chromate ions which have been added as an indicator. This reaction is used to indicate the turn. During the titration, the pH is maintained between 5 and 9.5 in order to allow precipitation (ADE-laboratory).

- **Operating mode**

- place 100 ml of the sample in a white porcelain capsule or in a flask or in a conical beaker

- placed on a white background

- Add 1 ml of potassium chromate indicator

- titrate the solution by adding dropwise Silver nitrate solution until the solution takes on a brick red color.

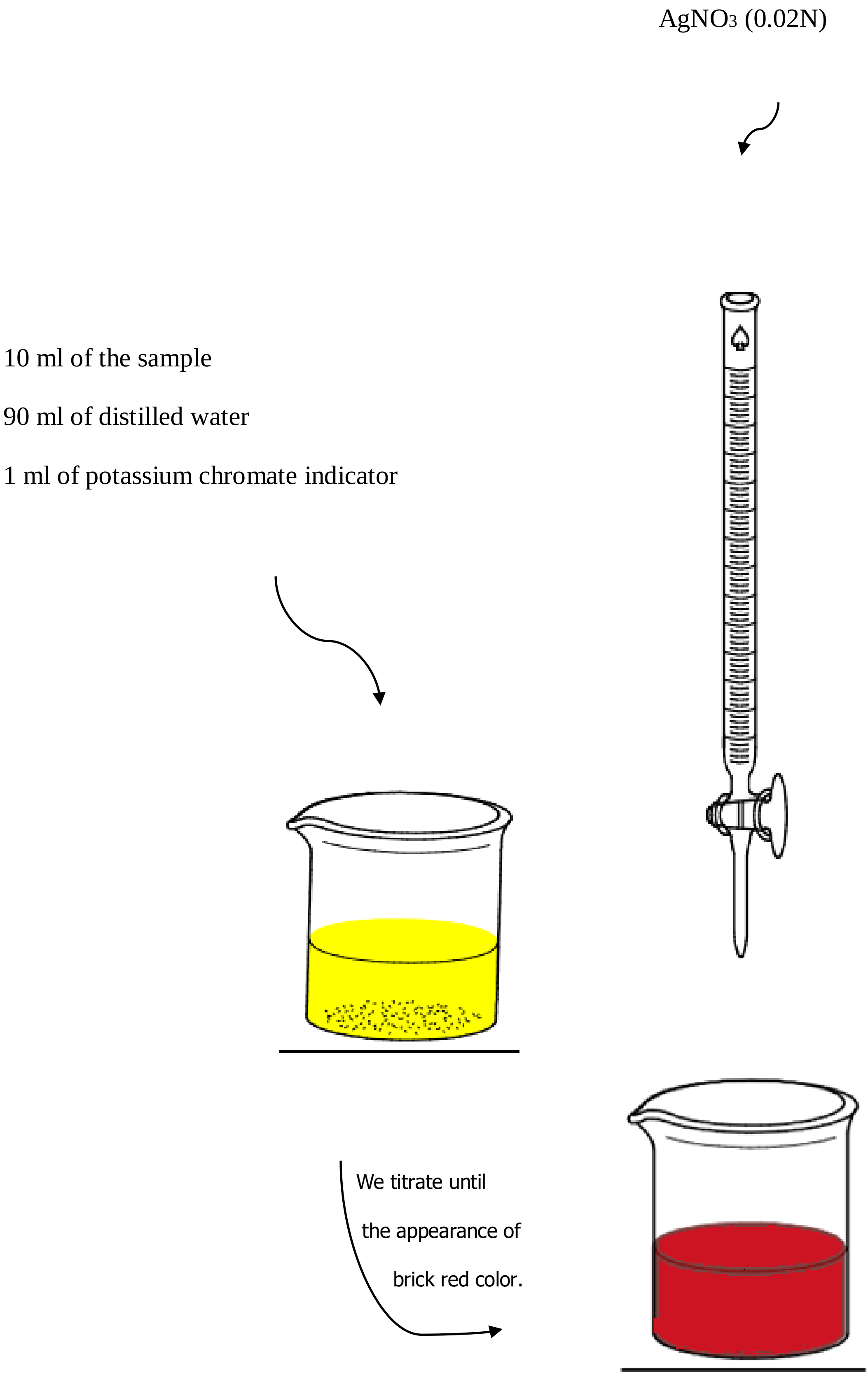

Figure 2: Determination of Chloride by Titration

- **Expression of results**

The concentration of chloride P_{Cl} expressed in milligrams per liter, is given by formula:

$$P_{Cl} = \frac{(Vs - Vb)}{Va} C \times f$$

- P_{Cl} : Is the concentration in milligrams per liter of chloride.
- Va : Is the volume, in milliliters, of the test sample.
- Vb: Is the volume, in milliliters of Silver Nitrates solution used for the titration of white.
- Vs: Is the volume, in milliliters of Silver Nitrates solution used for the titration of the sample.
- C: Is the actual concentration expressed in moles of $AgNO_3$ per liter of the Silver Nitrate solution.
- f : Is the conversion factor (f = 35453 mg / mol).

2.2.3.2. Calcium dosage [Ca^{+2}]

- **Principle**

Titration of calcium ions with an aqueous solution of EDTA at a pH between 12 and 13. The indicator used is murexide, which forms a pink complex with calcium.

During the titration, the EDTA reacts with calcium ions, the indicator then changes from pink to purple (ADE-laboratory).

- **Calculation of the correction coefficient (Fc)**

Take 50 ml of the calcium reference solution at 100 mg / l. Use it to titrate the EDTA solution by slowly pouring in the EDTA until it turns purple. When the purple color is obtained, note the volume of EDTA poured.

The correction factor (Fc) is equal to:

$$Fc = \frac{volume\ paid}{theoretical\ volume\ (12.5\ ml)}$$

If: $0.96 \leq$ **Fc** ≤ 1.04, So the EDTA solution can be used for the assay.

- **Operating mode**

- Take a 50 ml test portion of the sample; add 2 ml of the hydroxide solution (2N) and a pinch of indicator (Murexide). Mix everything well.
- Titrate with the EDTA solution, pouring slowly.
- The turn is reached when the color becomes clearly purple.

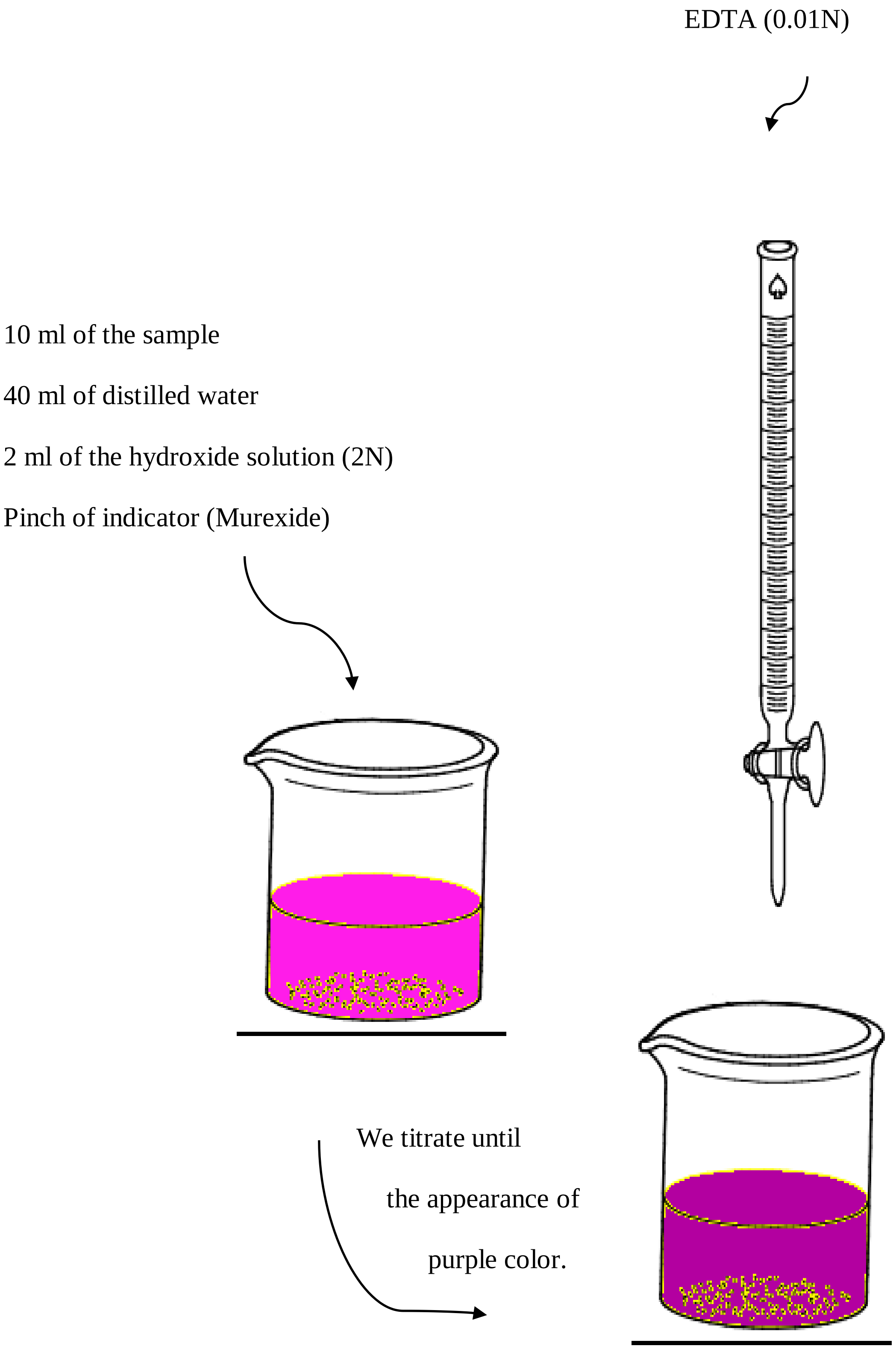

Figure 3: Determination of Calcium by Titration

- **Measurement and calculation of the result**

The calcium content, expressed in mg / l, is given by the equation:

$$Ca = \frac{C1 \times V1 \times A}{V0} \times Fc \times 1000 \times F$$

- **C_1** : Concentration, expressed in moles per liter, of the EDTA solution (0.01N).
- **V_0** : Is the volume, in milliliters, of the test portion (50 ml).
- **V_1** : Is the volume, in milliliters, of the EDTA solution used for the determination.
- **A** : Is the atomic mass of calcium (40.08 g).
- **Fc** : Correction factor.
- **F** : Dilution factor.

2.2.3.3. Determination of total hardness (TH)

- **Principle**

Titration by complexometry of calcium and magnesium ions with an aqueous solution of disodium salt of ethylene diamine tetraacetic acid (EDTA) at a pH of 10. The indicator used is black Eriochrome T, which gives a pink color in the presence of the ions calcium and magnesium.

During the titration with EDTA the solution turns blue (ADE-laboratory).

- **Operating mode**

- Take a 50 ml test portion of the sample
- add 4 ml of the buffer solution and a pinch of NET indicator.
- Mix well, the solution should be colored pink.
- Titrate immediately with the EDTA solution, pouring slowly until the color turns blue

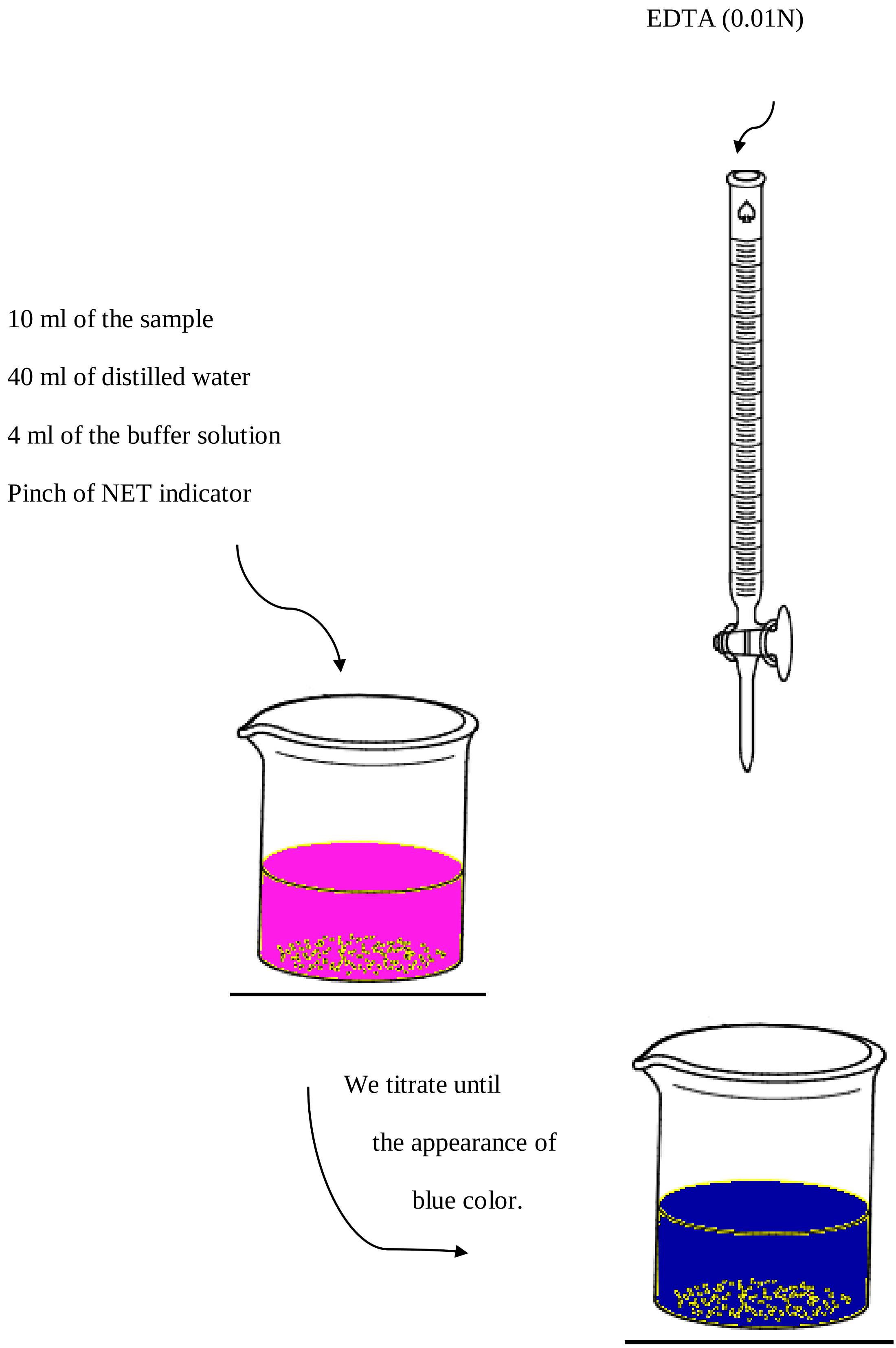

Figure 4: Determination of total hardness by Titration

- **Measurement and calculation of the result**

The total concentration of calcium and magnesium ions, expressed in ° F, is given by the formula:

$$TH = V2 \times 2 \times F \times Fc$$

- **TH**: Hardness expressed in ° F.
- **V_2** : Is the volume, in milliliters, of the dosed sample.
- **Fc** : Correction factor.
- **F** : Dilution factor.

2.2.3.4. Magnesium dosage [Mg^{+2}]

- **Calculation method**

Magnesium can be estimated by the difference between hardness and calcium expressed as CaCO3 (Rodier, 2005).

Using the following relation:

$$[Mg^{+2}] = ([TH] - [Ca^{+2}]) \times 24.305$$

2.2.3.5. Complete Alkalimetric Titel measurement

- **Principle**

These determinations are based on the neutralization of a certain volume of water with a dilute mineral acid, in the presence of a colored indicator (Rodier, 2005).

- **Operating mode**

- Take a 100 ml test portion of the sample
- add 2 drops of methylorange solution
- Mix well, the solution should be colored orange.
- Titrate immediately with H_2SO_4, pouring slowly until the color turns brick red.

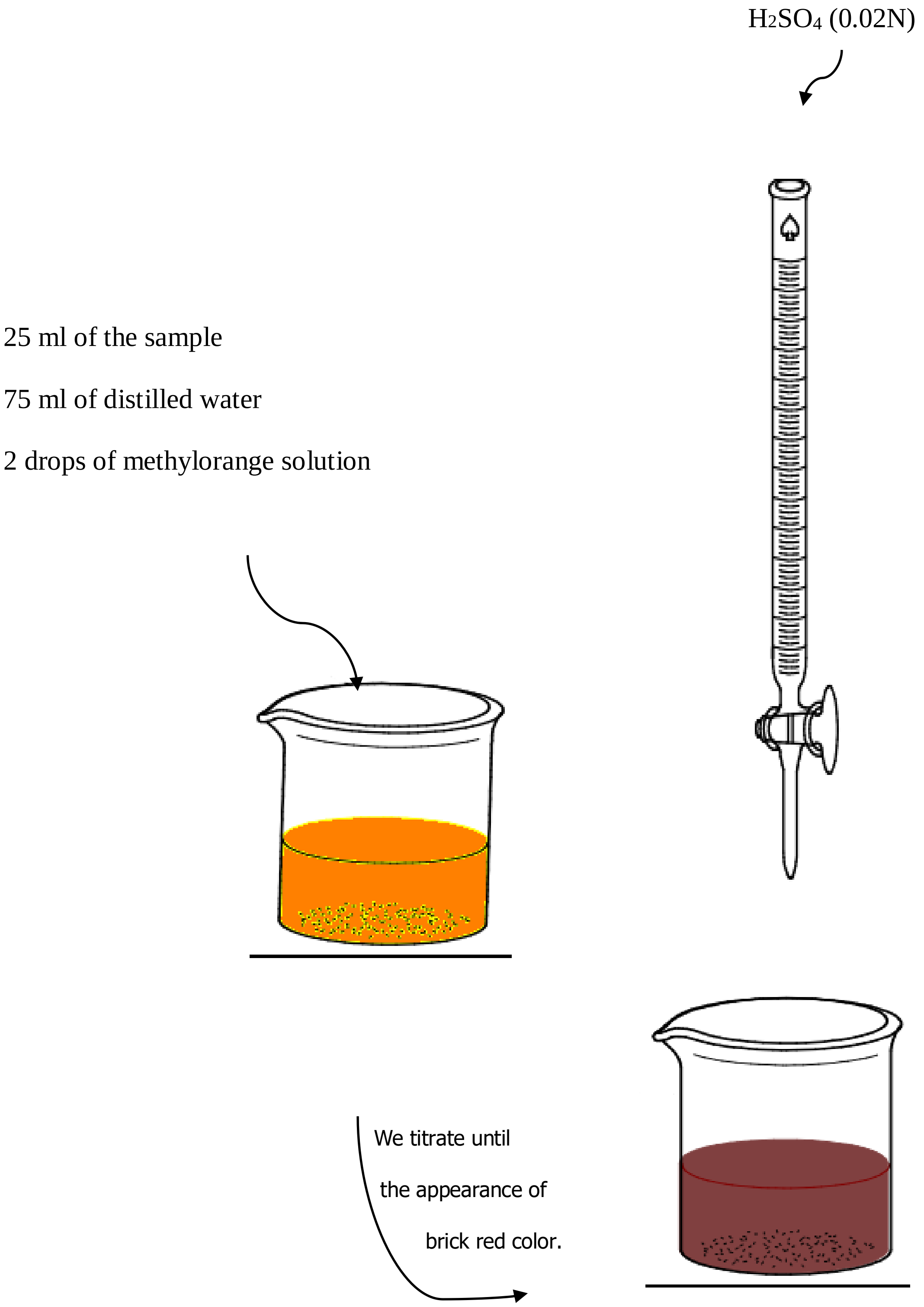

Figure 5: Determination of Complete Alkali metric titel by Titration

- **Expression of results**

$\frac{V-0.5}{5}$: Express the full alkalimetric titer in milliequivalents per liter.

$V-0.5$: Express the full alkalimetric title in French degrees.

2.2.3.6. Determination of alkalinity [HCO_3^-]

- **Calculation method**

Using the following relation: (ADE-laboratory)

$$[HCO_3^-] = \mathrm{TAC} \times 1.22$$

2.2.3.7. Turbidity measurement

- **Principe**

Water turbidity measurement can be done using the Tyndall effect or opacimetry. The Tyndall effect is used more specifically for the measurement of low turbidity (drinking water), opacimetry is applied to water with high turbidity (raw water, waste water) (Rodier, 2005).

- **Dosage**

- Rinse the measuring cuvette with the water to be measured.

- Gently fill the cuvette to the mark with the water to be measured, avoiding the formation of bubbles. Close with the cap.

- Dry the outside of the bowl with a soft paper towel, taking care not to leave fingerprints on it.

- Check the cleanliness of the bowl after wiping.

- Place the cuvette in the measuring well, orienting the cuvette if necessary.

- Close the measuring cell with the valve or shutter and The result appears after a few seconds on the device screen.

- The measurements are expressed in Nephelometric Turbidity Unit (NTU)

5. Conclusion

In this chapter we have tried to present the material and methods used to determine the physicochemical parameters of our samples according to techniques of Algerian water-Biskra laboratory.

Chapter 4: Results and discussions

1. Introduction

In this chapter ,we are interested in presenting our results, comparing them with Algerian standard and with other results of previous work obtained to determine effect of Zamzam water with different concentrations on the quality of Guedila water according to the following parameters: temperature, pH, salinity, TDS, conductivity, chlorine TAC, HCO3, TH, calcium, magnesium, turbidity, sodium, potassium.

2. Results of measures

The results of the physico-chemical parameters obtained are shown in Table 4

Tableau 4 : Variation of physico-chemical parameters

	Results				
Parametres	Guedila	Zamzam (100%)	Zamzam (75%)	Zamzam (50%)	Norms
T C^{O}	25.4	25	25	25	**25**
Salinity ‰	0.3	0.3	0.3	0.3	
TDS mg/l	310	324	330	349	
Cond µs/cm	620	648	660	698	**2800**
pH	8.37	7.78	7.95	8.02	**6.5 / 8.5**
Cl^{-}	72.99	27.81	24.33	24.33	**500**
TAC	109.80	54.90	62.75	86.27	
HCO_3	133.96	66.98	76.56	105.25	**250**
TH	300	150	280	230	**500**
Ca^{+2}	80.16	40.08	36.07	40.08	**200**
Mg^{+2}	24.312	12.156	46.19	31.61	**150**
Turbidity	0.007	0.169	0.335	0.231	**5**
Na^{+}	7	11	8	10	**200**
K^{+}	2	20	12	16	**12**

2.1. Physical parameters

2.1.1. Temperature

The experimental temperatures obtained are given in Table 4 and in Figure 6.

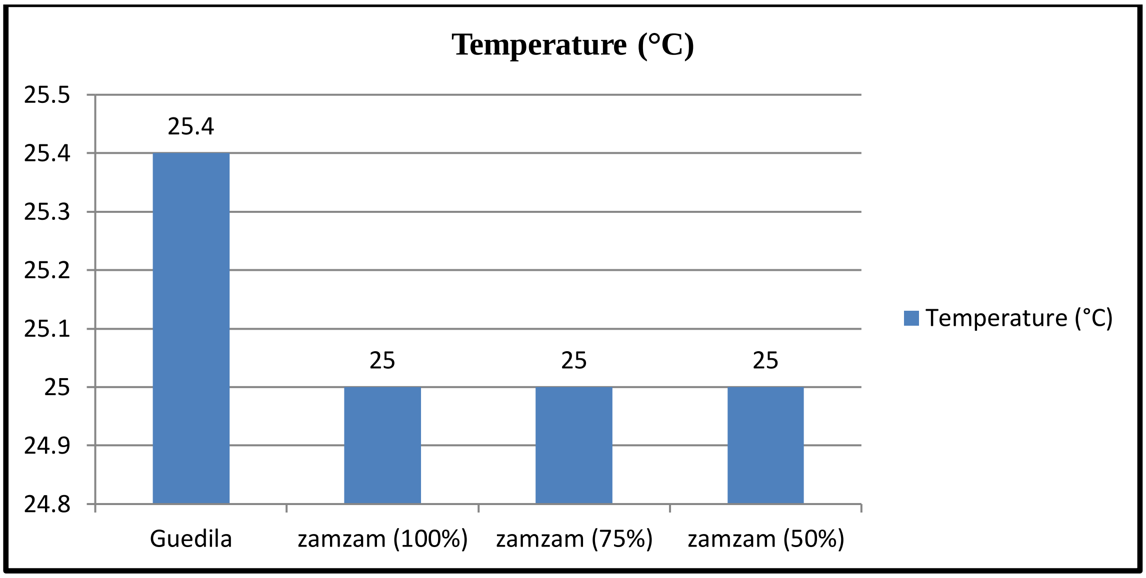

Figure 6: Temperature measurement

We observe that the temperature of Zamzam water (100%) is 25°C, and the temperature of Guedila water is 25.4°C.

By adding different concentrations of Zamzam water to the Guedila water, we notice a decrease in the Guedila water temperature which becomes equal to the Zamzam water temperature and this is for the two concentrations.

So, from it we can say that the Zamzam water has the same effect on Guedila water temperature regardless of its different concentration.

2.1.2. Turbidity

The Figure 7 shows the variation of turbidity in water for the different samples studied

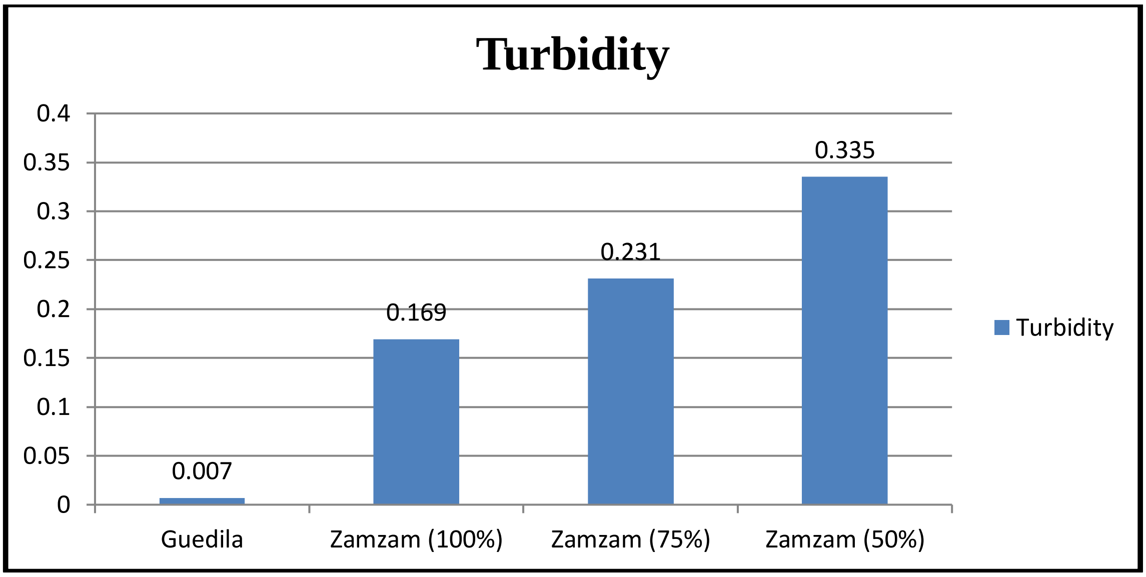

Figure 7: Turbidity measurement

We note that the turbidity of Zamzam water (100%) is higher than the turbidity of Guedila water. when we compare between different concentrations of Zamzam water adding to Guedila water; we find that; the turbidity of [75%] Zamzam is less than the turbidity of [50%] Zamzam.

So, we conclude that, this change is not related to the concentrations of Zamzam water only but also it linked to Zamzam water itself. That's to say; there's no proportional relationship between the concentrations of Zamzam water and the change happened, any concentrations of Zamzam water increase or decrease the turbidity of Guedila water.

2.1.3. pH

The values of the pH of the water examined for the four samples are given in table 4 and in figure 8.

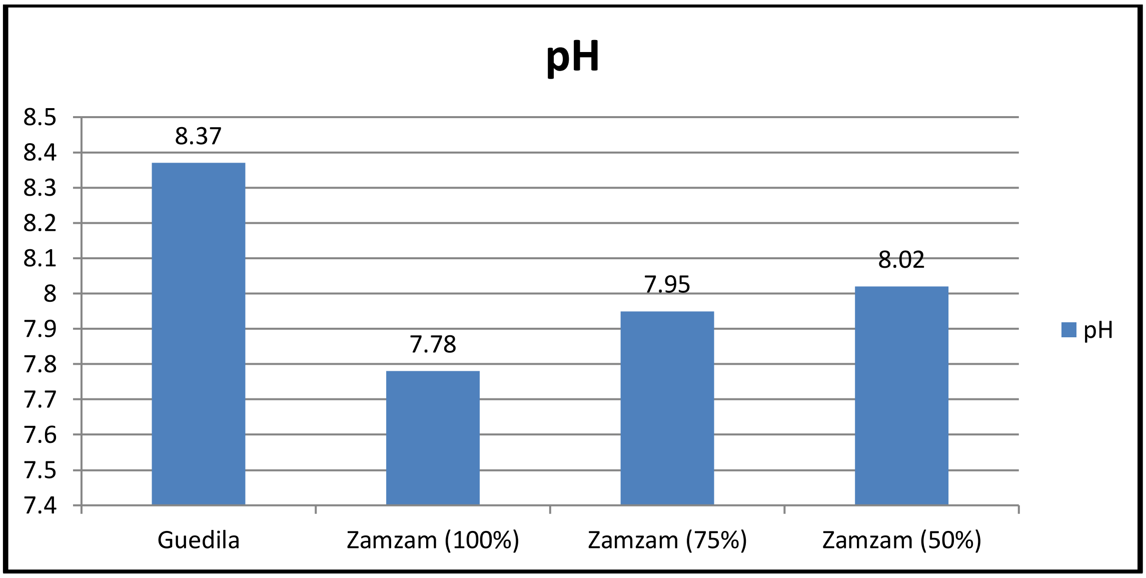

Figure 8: pH measurement

We find that the pH of Zamzam water (100%) is7.78which is less than the pH of Guedila water: 8.37. And by adding different concentrations of Zamzam water to Guedila water, we notice an increase in the pH of the mixed water according to the concentrations of Zamzam water, that mean's pH of 75% Zamzam < pH of 50% Zamzam.

So, we can say that; there is a proportional relationship between concentrations of Zamzam water adding to Guedila water and the pH of Guedila water.

2.1.4. Conductivity

The conductivity values are grouped in Table 5 and shown in Figure 9.

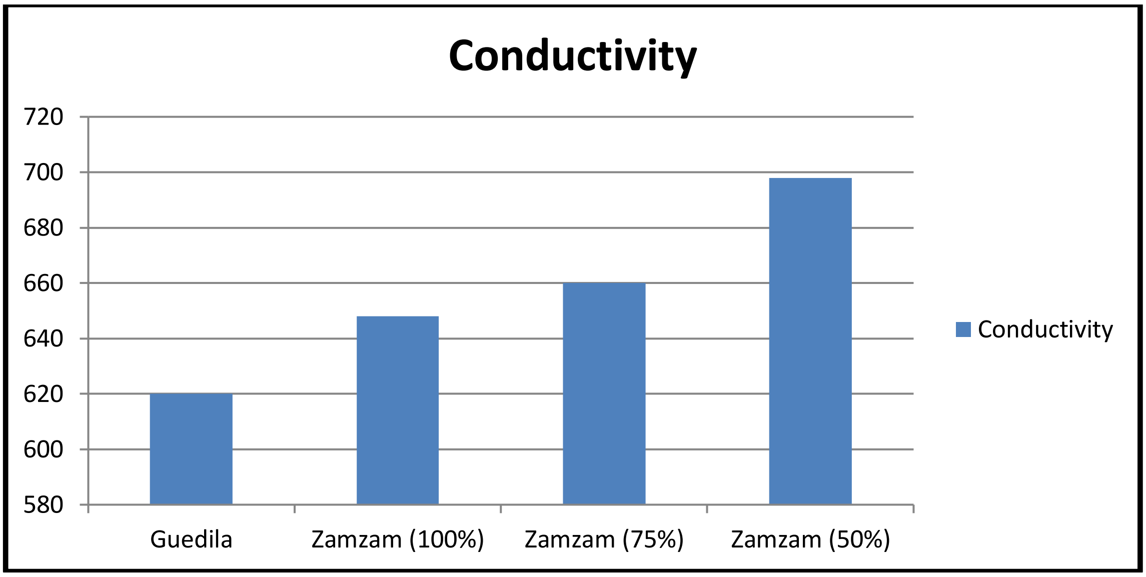

Figure 9: Conductivity measurement

We observe that the conductivity of Zamzam water (100%) is higher than the conductivity of Guedila water. When we compare between different concentrations of Zamzam water adding to Guedila water, we find that, the conductivity of [75%] Zamzam is less than the conductivity of [50%] Zamzam.

So, we can say that, the changing of concentrations of Zamzam water adding to Guedila water influence on the conductivity of Guedila water by increasing or decreasing, because the conductivity depends on a number of factors:

- Concentration, mobility and valence of ions.
- Temperature.

2.1.5. Salinity ‰

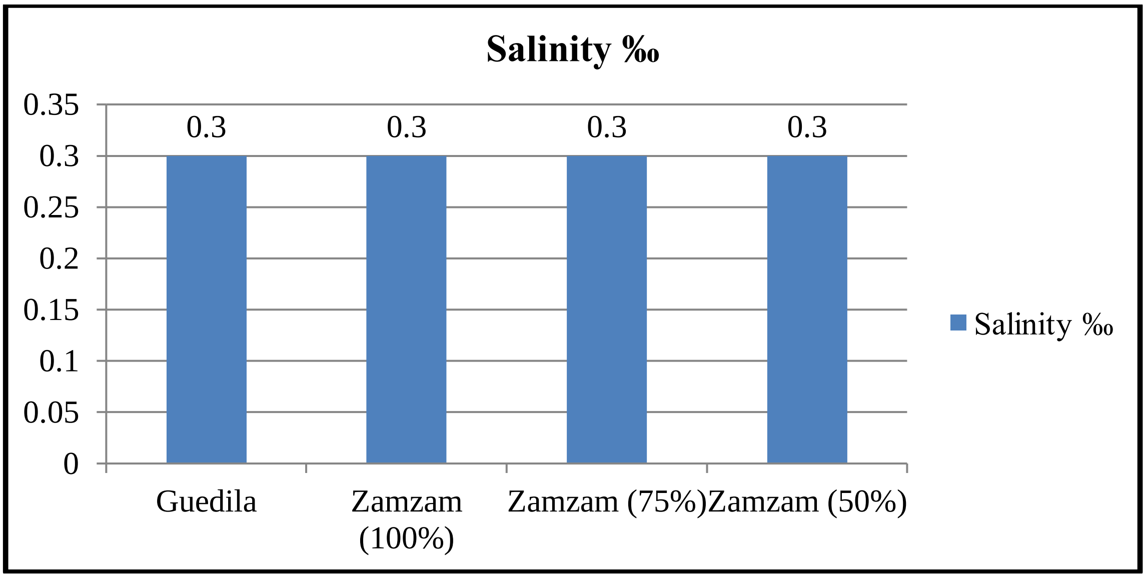

Figure 10: Salinity measurement

We find equality in the salinity of the four samples: salinity of Zamzam 100%= Guedila =Zamzam 75%=Zamzam 50%=0.3.

So, we conclude that different concentrations of Zamzam water adding to Guedila water have no effect on the salinity of Guedila.

2.1.6. TDS

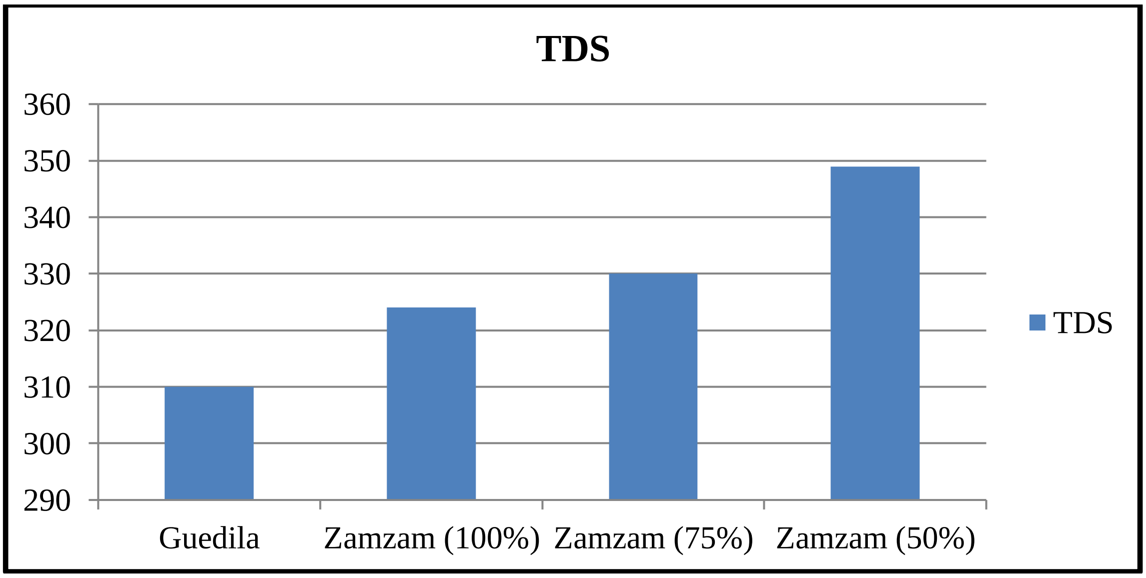

Figure 11: TDS measurement

We find that the TDS of Zamzam water (100%) is higher than the TDS of Guedila water. when we compare between different concentrations of Zamzam water adding to

Guedila water; we find that; the TDS of [75%] zamzam is less than the TDS of [50%] Zamzam.

So, we can say that, the changing of concentrations of Zamzam water adding to Guedila water influence on the TDS of Guedila water by the same way on the conductivity because of the relationship these two parameters which is:

$$TDS = {}^{Cond}/_{2}$$

2.2. Chemical parameters

2.2.1. Hydrotimetric title

Figure 12 represents the variation of Hydrometric Title in water for the different samples studied.

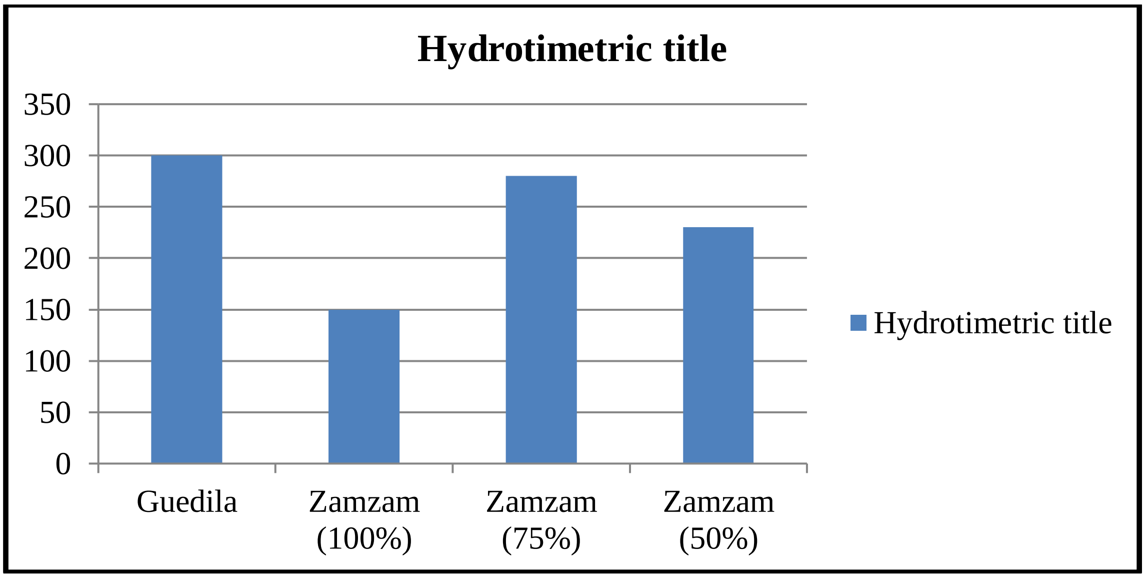

Figure 12: Hydrotimetric title measurement

We note that the TH of Zamzam water (100%) is 150 which is less than the TH of Guedila water: 300. when we compare between different concentrations of Zamzam water adding to Guedila water; we find that; the TH of [75%] Zamzam is higher than the TH of [50%] Zamzam.

So, we conclude that the increasing of concentrations of Zamzam water adding to Guedila water have a positive effect on the TH of Guedila water.

2.2.2. Complete Alkali metric title

Figure 13 represents the variation of TAC in waters for the different samples studied.

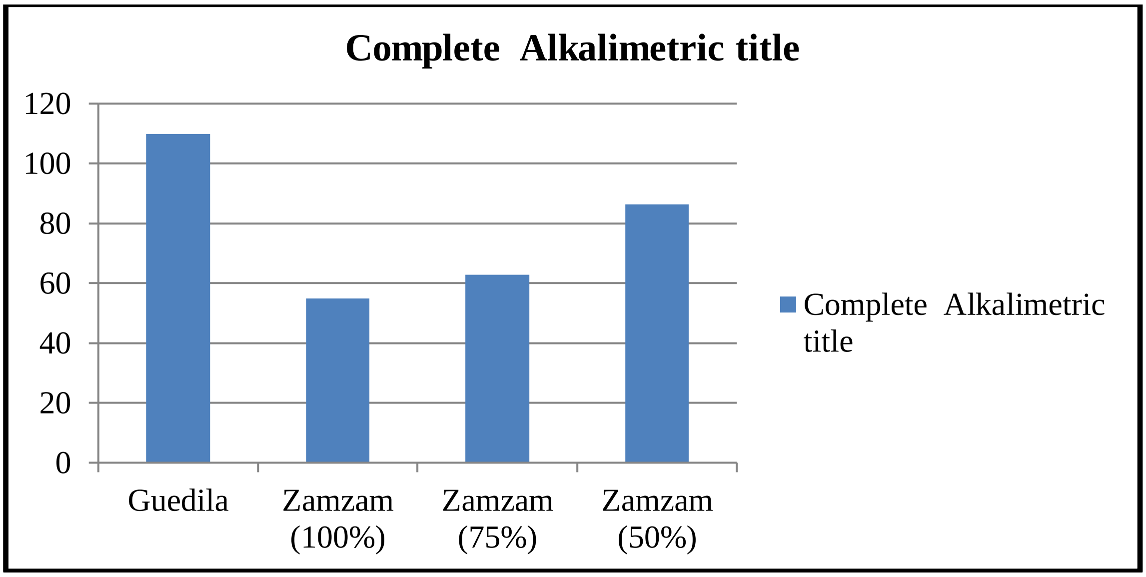

Figure 13: Complete alkali metric title measurement

We observe that the TAC of Zamzam water (100%) is less than the TAC of Guedila water. And by adding different concentrations of Zamzam water to Guedila water, we notice an increase in the TAC of the mixed water according to the concentrations of Zamzam water, that mean's [TAC]of 75% Zamzam < [TAC]50% of Zamzam.

So, we can say there is a proportional relationship between concentrations of Zamzam water adding to Guedila water and TAC of Guedila water.

2.2.3. Calcium

Figure 14 represents the variation of calcium ions in waters for the different samples studied.

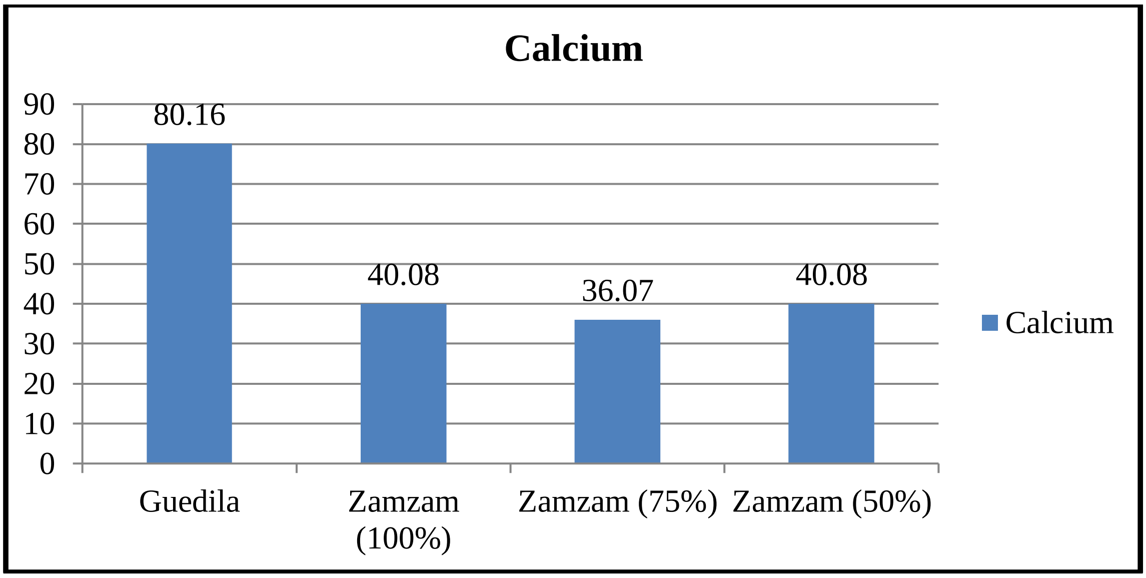

Figure 14: Calcium measurement

The concentration of calcium in Zamzam water (100%) is 40.08 mg/l, and its concentration in Guedila water is 80.16 mg/l.

By adding Zamzam water with a concentration of (75%) to Guedila water, we notice a decrease in the calcium concentration of Guedila water to 36.07 mg/l, this value is very close to the value of the calcium concentration in Zamzam Water (100%). And by adding Zamzam water with a concentration of (50%) to Guedila water, we also notice a decrease in the calcium concentration of Guedila water to be equal to the value of the calcium concentration in Zamzam water (100%).

Therefore, we can say that Zamzam water has the same effect on the value of calcium concentration in Guedila water regardless of its different concentration.

2.2.4. Magnesium

Figure 15 shows the variation of magnesium ions in water for the different samples studied.

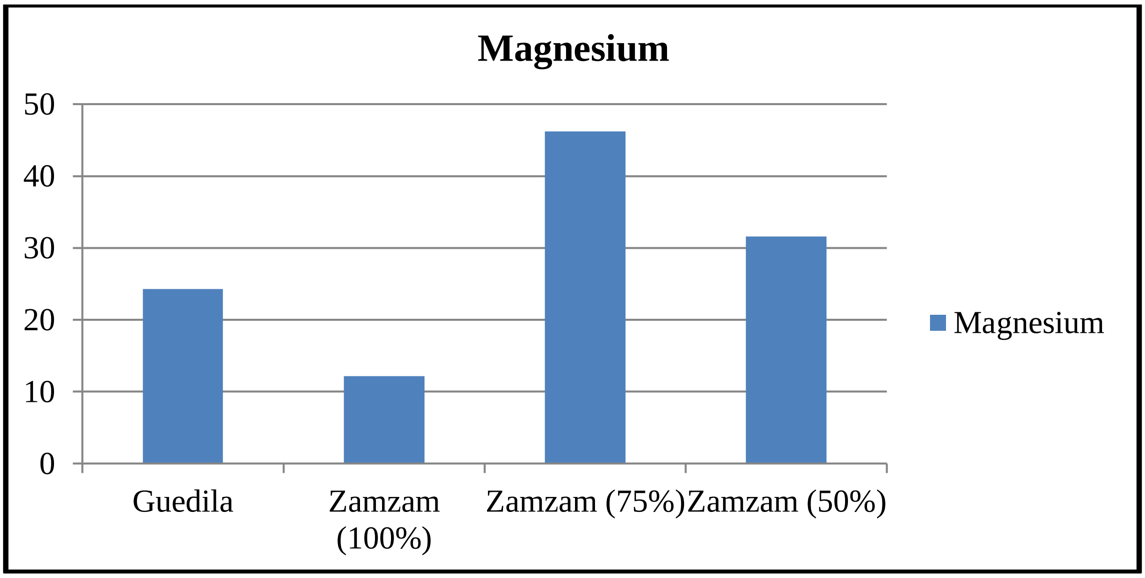

Figure 15: Magnesium measurement

We observe that the [Mg^{+2}] of Zamzam water (100%) is less than the [Mg^{+2}] of Guedila water. And by adding different concentrations of Zamzam water to Guedila water, we notice an decrease in the [Mg^{+2}] of the mixed water according to the concentrations of Zamzam water, that mean's [Mg^{+2}] of 75% Zamzam>[Mg^{++}] 50% of Zamzam.

So, we can say there is a positive effect of concentrations of Zamzam water adding to Guedila water and [Mg^{+2}] of Guedila water.

2.2.5. Chloride

Figure 16 shows the variation of Chloride ions in water for the different samples studied.

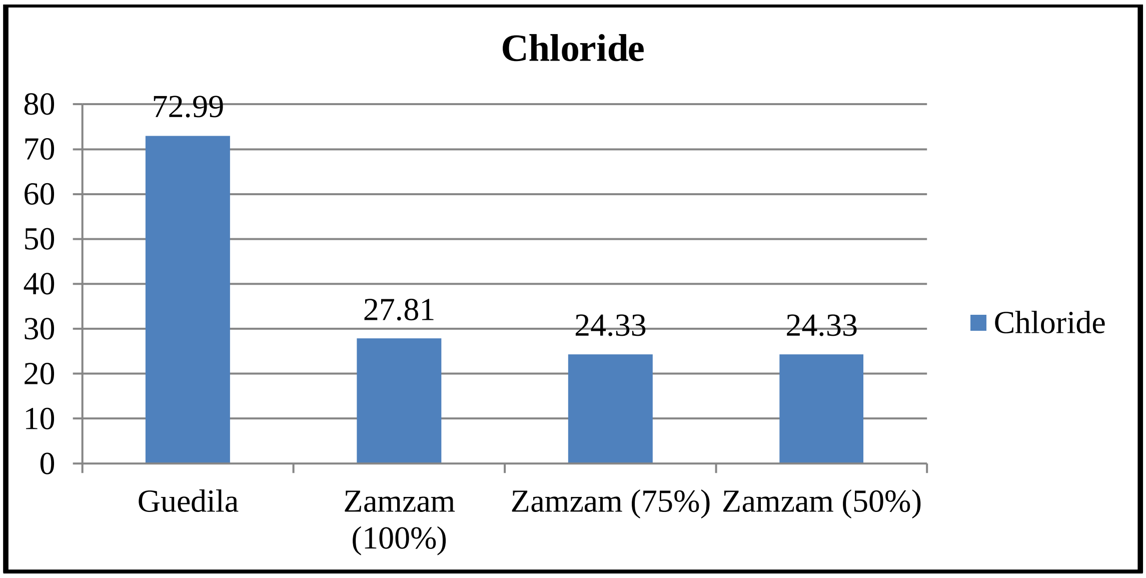

Figure 16: Chloride measurement

The concentration of chloride in Zamzam water (100%) is 27.81 mg/l, and its concentration in Guedila water is 72.99 mg/l.

By adding Zamzam water with a concentration of (75%) to Guedila water, we notice a decrease in the chloride concentration of Guedila water to 24.33 mg/l, this value is very close to the value of the chloride concentration in Zamzam Water (100%). And by adding Zamzam water with a concentration of (50%) to Guedila water, we notice the same thing as well

Therefore, we can say Zamzam water has the same effect on the value of chloride concentration in Guedila water regardless of its different concentration.

2.2.6. Sodium

Figure 17 shows the variation of sodium ions in water for the different samples studied.

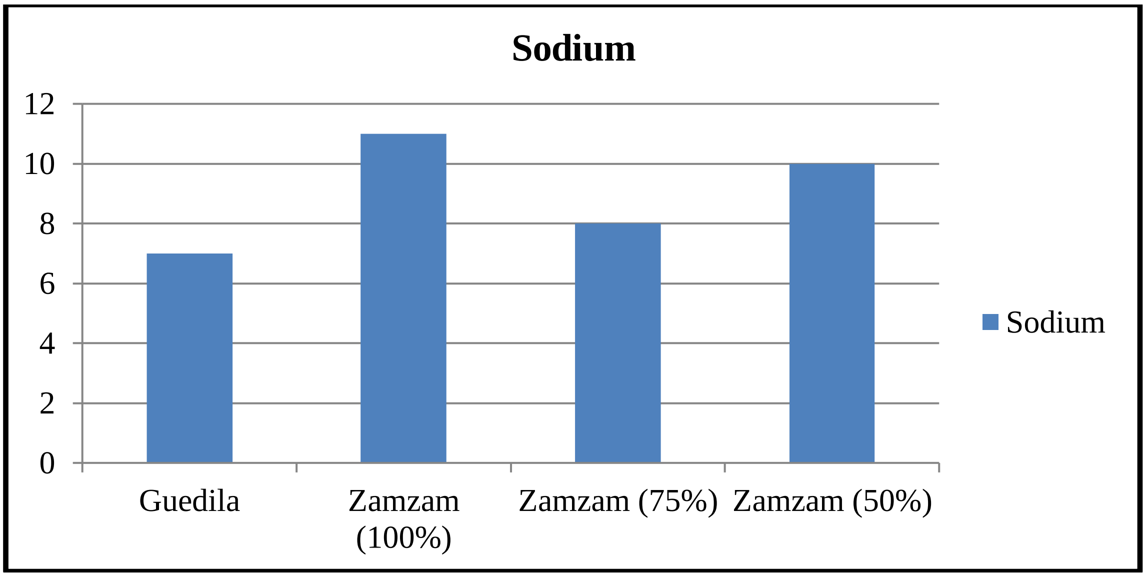

Figure 17: Sodium measurement

By comparing between these results, we find [Na^+] of Zamzam water 100% is higher than the [Na^+] of Guedila water and the [Na^+] of Zamzam water 75%is less than the [Na^+] of Zamzam water50%. That’s mean Adding different concentrations of Zamzam water to Guedila water change the [Na^+] of Guedila water by increasing or decreasing according to these concentrations added.

2.2.7. Potassium

Figure 18 shows the variation of potassium ions in water for the different samples.

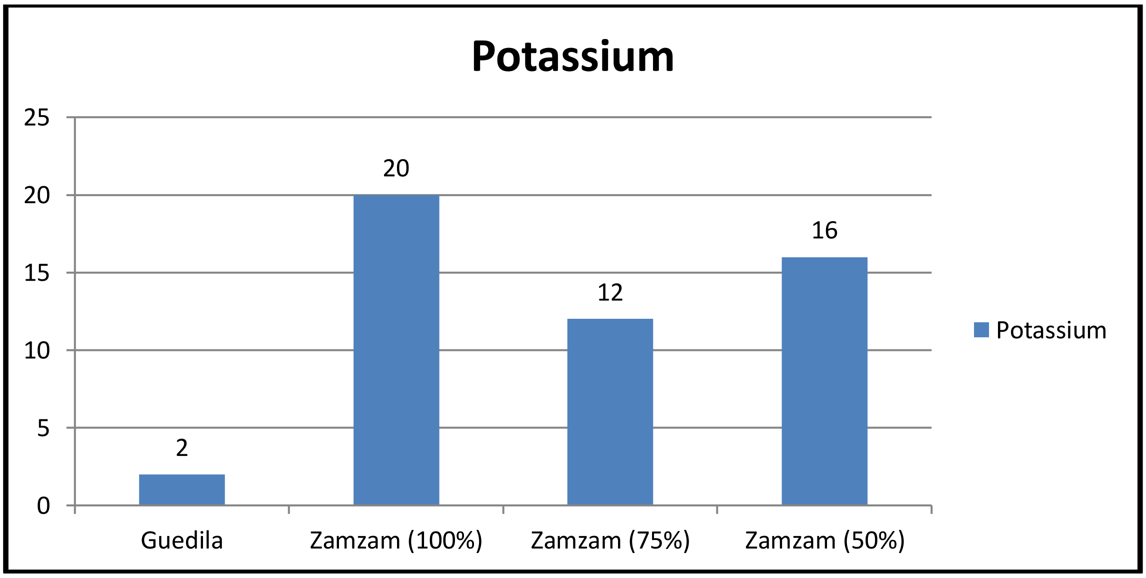

Figure 18: Potassium measurement

According to the graphic results, we notice that the [K^+] of Zamzam water 100% is higher more than the [K^+] of Guedila water. The addition of different concentrations of Zamzam water to Guedila concluded in: the [K^+] of Zamzam water 75%is less than the [K^+] of Zamzam water50%.

Thus, the different concentrations of Zamzam water effect on the [K^+] of Guedila water by rising or redacting because of the instability of Zamzam water.

2.2.8. Alkalinity

Figure 19 shows the variation of Alkalinity in water for the different samples studied.

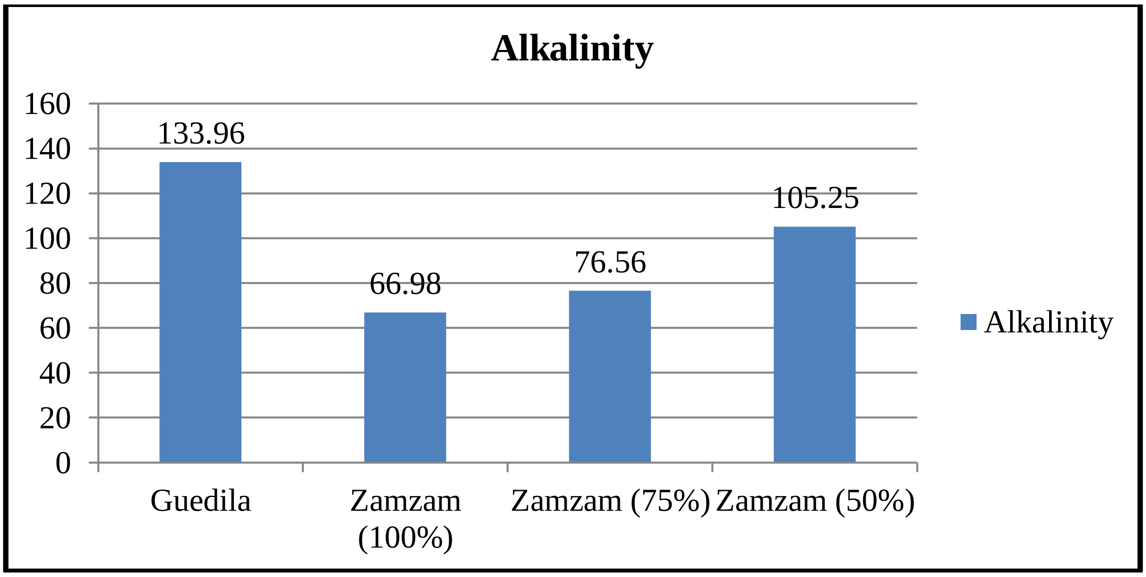

Figure 19: Alkalinity measurement

The graphic shows that, the [HCO_3^-] of Zamzam water 100% is less than the [HCO_3^-] of Guedila water. The addition of different concentrations of Zamzam water to Guedila, we note: the [HCO_3^-] of Zamzam water 75%is less than the [HCO_3^-] of Zamzam water50%.

Consequently, the different concentrations of Zamzam water effect positively on the [HCO_3] of Guedila water by raising its value.

Tableau 5: Compared the our values of Zamzam water with the previous results of other works

	01	02		03				04				05	06	07	08		09	10
Parametres	Zamzam (100%)	Pipe zamzam water2005	Well zamza water2005	Samples collected in 2007 from pilgrims in Germany	The same samples analyzed in 2008	Samples collected from local markets in Germany	Samples collected directly from Makkah. NM: Not Measured.	Zamzam water collected from big container#1 in the Haram mosque2011	Zamzam water collected from big container#2 in the Haram mosque	Piped Zamzam water collected from taps outside the Haram mosque	Commercial Zamzam water available small plastic bottles in Riyadh	Well zamzam water2013	Zamzam 100% 2014	Zamzam 100% 2017	zamzam 2018	zamzam 2018	zamzam 100%2019	zamzam 2020
T C^O	25	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Salinité ‰	0.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
TDS mg/l	324	840	835	-	-	-	-	810	798	812	818	-	1000	607	-	627	-	885
Cond µs/cm	648	-	-	1252	1133	1289	1280	1280	1270	1270	1250	-	1390	-	-	1012	673	204
pH	7.78	7.9	8	8	8	7.83	8	7.5	7.5	7.6	7.7	7.75 /8.0	7.73	7.8	-	7.56	7.9	7
Cl^-	27.81	159.7	163.3	162	146	120	133	164.5	164.7	164.9	161.9	-	260	91	76.08	102	56.32	15
TAC	54.90	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
HCO_3	66.98	195.4	195.4	257	187	178	188	-	-	-	-	-	110	195.4	-	-	-	268
TH	150	-	-	-	-	-	-	303.84	303.84	315.01	324.56	-	300	210	-	-	-	-
Ca^{+2}	40.08	96	96	95	68	60	62	92	92	94	97	-	220	125	65.545	112	14.40	56.2
Mg^{+2}	12.156	38.88	38.88	21	20	19.0	NM	18	18	19.5	20	0.019/0.024	80	85	12.113	10	10.17	19.5
Turbidité	0.169	-	-	-	-	-	-	0.11	0.10	0.11	0.12	-	Nil	0.6	-	-	-	-
Na^+	11	135	133	101	99	10.7	NM	129.5	129.2	130	133.6	-	-	133	94.432	110	71.37	80
K^+	20	43.2	43.3	50	48	41	NM	44.5	44.8	44,6	43.6	-	-	13	40.156	44	35.40	24

3. Results Interpretation

3.1. Physical parameters

3.1.1. Temperature

In general, the water temperature is strongly influenced by environmental conditions Linked to the geographical position of the locality, to the geology of the origin from which they come (superficial or deep) (Rodier, 2005), hydrology and especially climatic variations (Dib, 2009).

The temperatures recorded during the study period indicate that the waters tested (Zamzam, Guedila, mixed 50% and 75%) are a good quality and compliant with Algerian standards.

3.1.2. Turbidity

Turbidity greatly affects on potability of drinking water. Consumers very often have requirements with regard to this parameter, it is a factor which is in direct relation with the suspended matter.

All of these turbidity values are below standard, it stated that elevated in Zamzam water (100%, 75%, 50) could have been caused while that redistributing the water in small bottles by individuals.

3.1.3. Hydrogen potential (pH)

The pH of a water represents its acidity or alkalinity, it is linked to the geological nature of the terrain crossed (Cardot, 1999). In our study, the recorded pH values are within the range of drinking water standards ($6.5 < pH < 8.5$)

3.1.4. Electrical conductivity

Generally, the electrical conductivity increases with the concentration of ions in solution and the temperature (Dib. 2009), (because the dissolution of mineral salts depends on it) and with the phenomenon of evaporation which concentrates the salts in water.

The results obtained are lower than the Algerian standard of 2800 µS / cm.

3.1.5. Salinity

Salinity is proportional to conductivity. Its variation follows the same pace. It is influenced by the geological composition of the origin of water. Therefore, equality in the results obtained.

3.1.6. TDS

The global mineralization is proportional to the conductivity. So the results obtained are relative with conductivity results.

3.2. Chemical parameters

3.2.1. TH

The total hardness has a natural character linked to the leaching of the traversed ground and corresponds to the content of calcium and magnesium (Hakmi, 2006). This parameter presents a large variation which would be related to the lithological nature of the aquifer formation (Ghazali et Zaid, 2013).

The water hardness values of the four samples studied were followed Algerian standards.

3.2.2. The Complete Alkalimetric Title (CAT)

The TAC (Complete Alkali metricTitle) reflects the basic character of water HCO + CO_2^- + OH^- . It is influenced by the pH and the quantity measurable by titration of bicarbonates HCO_3^-.

The concentrations of the TAC at the water of the four samples studied are generally average and respectable with the standards Algerian.

3.2.3. Calcium

It is a major component of water hardness. It is usually the dominant element in drinking water. Its content varies essentially according to the nature of the traversed ground (Queneau et Hubert, 2009). Presence of this element in the waters has for the geology of the origin (the dissolution carbonate and gypsum formations) because gypsum rocks are the most dominant in the Zamzanm well region (Aouissi, 2010).

For the concentrations of water studied, the results are lower than the Algerian standards.

3.2.4. Magnesium

Magnesium cations have the same origin and the same provenance as that of Calcium (dissolution of carbonate formations).

According to Algerian drinking water standards for magnesium, the results of the concentrations of the water studied are lower than the standards Algerian.

3.2.5. Chloride

Water almost always contains chlorides but in very variable proportions. The ions chlorides come from the clayey lenses present in alluvium. Their presence in the groundwater results from the dissolution of natural salts, by the dissolution of sylvite (KC) and of Halite (NaCl) (Saoud, 2014).

The chloride concentrations in the analyzed water are generally lower than Algerian standards.

3.2.6. Sodium

The values of all the samples are generally convergent but lower than the Algerian standards required because the dissolution of natural salts specially halite (NaCl) (Saoud, 2014) in Zamzam water considering the alluvium is the component of the Zamzam well area.

3.2.7. Potassium

In Zamzam water the contents are exceeding the required standards due to the dissolution of natural salts (sylvite KCl) (Saoud,2014) with are in the alluvium of the Zamzam well area.

The contents are exceeding the required standards due to the dissolution of natural salts, by the dissolution of sylvite (KCI) (Saoud, 2014), in Zamzam water considering the alluvium is the component of the Zamzam well area.

3.2.8. Alkalinity

The concentrations of bicarbonates in natural waters are directly related to the pH of the water, the temperature, the concentration of Dissolved CO2, the nature lithological of the soil and the phenomena of evaporation (Aouissi, 2010).

According to Algerian standards, the results obtained are respectable.

4. Discussion

Through the results listed in the table 04, which represent the values obtained from our Zamzam water analysis, and previous results of other work, we notice a good agreement between the results with very small differences due to several reasons, including:

- Source of used Zamzam water

- Samples collected directly from the well

- Samples collected from pilgrims in Germany (Shomar, 2012)

- Samples collected from local markets in Germany (Shomar, 2012)

- Samples collected directly from Makkah (Packed in bottles) (Shomar, 2012).

- Samples collected from big container#1 in the Haram mosque (Sulaiman et A Khan, 2011)

- Samples collected from big container#2 in the Haram mosque (Sulaiman et A Khan, 2011)

- Piped samples collected from taps outside the Haram mosque (Sulaiman et A Khan, 2011)

- Preservation period

The samples used in our study date back several years

- 2005 (Khounganian et Al Zuhair, 2005)

- 2007, 2008 (Shomar, 2012)

- 2011 (Sulaiman et A Khan, 2011)

- 2013 (Abdullah *et al*, 2013)

- 2014 (Nauman *et al*, 2014)

- 2017 (Abdel-Azeem *et al*, 2017)

- 2018 (Sajid *et al*, 2018) (Halim *et al*, 2018)

- 2019 (Hegazy et Ibrahim, 2019)

- 2020 (Jabbar Alwan, 2020)

The table clearly shows the variations in each parameter, it could be attributed to the geological and the hydrogeological sources, geochemistry of the rock, case of weathering, the geochemical behaviour of elements in Zamzam water.

According to the Saudi Geological Survey, granite represents the major rock of the aquifer rocks in the study area (Site web 2). The alkaline nature of the Zamzam water most likely stems from alkaline waters being associated with granitic environments (Shomar, 2012).

The alkalinity of the water and the relatively low total dissolved solids (TDS) might explain the elevated concentrations of Ca^{+2}, K^{+}, and HCO_3^{-}, as this environment enhances the dissolution of silicate minerals in surrounding rocks (Shomar, 2012).

The alkaline nature of the Zamzam water could explain its healing properties. Several studies have discussed the mechanism by which alkaline water promotes healing. For example (Kellas et Dworkin, 1996) stated that alkaline drinking water plays an important part in ridding the body of mercury and other toxins. The more acidic the body is the more it holds onto (heavy) metals. Heavy metals in turn create a high oxidative stress that acidifies the body. Consequently, alkaline water has been used for improving bone density and healing (Wynn *et al*, 2009); controlling gastric functions (Bertoni *et al*, 2002); improving capacity for aerobic activities and flushing toxins and acidic waste.

So Zamzam water may represent a powerful tool for therapy of several diseases because his sanctity and holiness.

Geography factor, which means a factor of dry climate cause water to evaporate by capillary action (even in a soil, water may evaporate) and lead to increase the concentration of ion in Zamzam water. This agrees with the elevated Calcium and Potassium in Zamzam water (Halim, 2018).

A direct relationship between Zamzam water salinity and rainfall is recorded.

The long residence time with aquifer materials of basic lava origin (basalt) led to the formation of ferro-magnesium minerals, soluble calcium and magnesium, in water (Al-Gamal, 2009).

The water quality may also be affected by treatment type, container type and length of storage. Most groundwater sources have natural variations that are seasonal or related to recharge events. Man made contamination can also affect such sources and quality (Sulaiman et A Khan, 2011.

5. Conclusion

In this chapter, we are interested in presenting our results, comparing them with the Algerian standard; we can conclude that our water tested are good physico-chemical quality. The comparison of our results of Zamzam water with other results of previous work confirms:

Firstly, Zamzam water has a rich essential mineral profile witch mean highly significant rea dings in some inorganic elements, including Na^+, Ca^{+2}, Mg^{+2}, K^+, HCO_3^- and Cl^-. The levels of these elements in Zamzam water play a strongly effect on Guedila water, enriched it

Second, instability in the concentrations of the studied parameters of Zamzam water (considerable variations in different years) plays an essential role in the effect exerted on other type of water (Guedila). It makes the observed effect on Guedila characterized by diferente variability.

So, Guedila water changes at the physicochemical level depending on the richness in composition of the Zamzam water and its changement.

Conclusion

A good quality of water intended for human consumption is an important factor for the protection of public health. The theme of this work falls within the framework of evaluating physicochemical quality of adding Zamzam water on bottled water (Guedila).

At this work, we determined some physicochemical parameters of samples water studied. The analysis are carried at laboratory ADE, allowed us to learn the analysis techniques used and to acquire knowledge about water study. The results obtained during this study made it possible to demonstrate that:

- The studied parameters of Zamzam water in different years have considerable variations.
- The samples studied have a good quality because almost all of the analyzed physical parameters conformed to national regulations.

According to the cations as well as the major anions found that:

Zamzam water (100%) contain much of sodium and potassium, Zamzam water (75%) contain much of magnesian, on Guedila chloride and calcium bicarbonate are the major elements, while the Zamzam water (50%) contain of calcium bicarbonate and sodium potassium with aquality way.

The Zamzam water has a positive effect on bottled water (Guedila) by enriched it at the biological and energy level.

So, the perspectives that we propose to the unit are the following:

- ✓ The repetition of physicochemical analyzes at least three times for reliable and confirm results, after presenting these results using software that gives in statistical presentation to facilitate the comparison and saving time.
- ✓ The dosage of other parameters such as sulphates (a dehydrating and irritating effect on the gastrointestinal part), phosphates, nitrates and nitrites as indicators of pollution for a complete physicochemical plan.
- ✓ Understand better the production process (from the point of drilling to bottling and packaging of the finished product), for monitoring the quality water, that is to say the points where the contamination has been carried out.

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Annexes

The reagents used for analysis

1. Chloride [Cl^-]

▪ Silver nitrate solution (AgNO3) 0,02 mol/l

Dissolve in water 3.3974 g of silver nitrate (AgNO3) dried beforehand at 105 ° C and make up to 1000 ml in a volumetric flask. If the solution is kept in the dark in a brown glass bottle with a glass stopper, it remains stable for several months. The solution is calibrated with 10 ml of a standard reference solution of sodium chloride (NaCl)

▪ Potassium chromate indicator solution (K2CrO4) 100 g/l

Dissolve 10 g of potassium chromate (K2CrO4) in water and dilute to 100 ml.

2. Calcium [Ca_{+2}]

▪ Sodium hydroxide, 2 N solution

Dissolve 8 g of sodium hydroxide (NaOH) in 100 ml of distilled water, store in a polyethylene bottle.

▪ Calcium, reference solution (100 mg / l)

Preparation of the daughter solution at 100 mg / l of calcium:

- Introduce 5 ml of the mother solution at 1 g / l of calcium using a pipette into a 50 ml volumetric flask.

- Adjust with distilled water.

- A solution with a concentration of 100 mg / l is obtained.

▪ EDTA, standard solution (0.01 mol / l)

- Dry a portion of EDTA at 80 ° C for 2 hours.
- Then dissolve 3.725 g of dry salt in distilled water and dilute to 1000 ml.
- Store the EDTA solution in a glass bottle.

Abstract

ملخص

الماء هو الحياة. الماء الشروب الموجه للاستهلاك البشري يحتاج إلى نوعية صحية ممتازة. التحاليل الفيزيوكيميائية مأخوذة من أجل مقارنة نوعية: ماء معبأ قارورة (قديلة)، ماء زمزم (100%)، ماء زمزم (75%)، ماء زمزم (50%)و يستند ذللك على القياسات بأجهزة مختلفة وتقنيات خاصة. وقد كشفت النتائج المنجزة أن معظم المعايير الفيزيوكيميائية متجاوبة مع المعايير الجزائرية، المعايير المدروسة لماء زمزم خلال سنوات مختلفة تملك اختلاف طفيف، وجود ثلاث أنواع هيدروكيميائية، وأن زمزم يملك تأثير ايجابي على ماء معبأ قارورة (قديلة)من خلال تدعيمه طاقويا.

الكلمات المفتاحية: ماء معبأ قارورة (قديلة)، ماء زمزم، التحليلات الفيزيوكيميائية، نوعية، تأثير.

Résumé

L'eau est la vie. L'eau potable destinée à la consommation humaine nécessite une excellente qualité sanitaire. L'analyse physicochimique est portée pour la comparaison de la qualité de: l'eau embouteillée (Guedila), l'eau Zamzam (100%), l'eau Zamzam (75%), l'eau Zamzam (50%), on se basant sur des mesures par un appareillage différent et des techniques spécifiques. les résultats des analyses effectuées ont fait ressortir que la majorité des paramètres physico-chimiques répondent aux normes algériennes, les paramètres étudiées de l'eau de Zamzam pendant des différents années ont des variations considérables, présentent trois faciès hydrochimiques différents, et l'eau de Zamzam exerce un effet positive sur eau embouteillée (Guedila) par enrichi là.

Mots clé: mots clés: eau embouteillée (Guedila), eau de Zamzam, analyses physico-chimiques, qualité, effet.

Abstract

Water is life. Drinking water intended for human consumption requires excellent sanitary quality. The physicochemical analysis is carried out on the comparison of the quality of: bottled water (Guedila), Zamzam water (100%), Zamzam water (75%), Zamzam water (50%), based on the measurements by a different apparatus and specific techniques. The results of the analyzes carried out to show that the majority physicochemical parameters respectable with Algerian standards, the studied parameters of Zamzam water in different years have considerable variations, presentment hydrochemical faces different, and also Zamzam water has a positive effect on bottled water (Guedila) by enriched it.

Keywords: bottled water (Guedila), Zamzam water, physico-chemical analyzes, quality, effect.