

## DESALINATION OF GROUNDWATER BY SOLAR DISTILLATOR (TAMANRASSET)

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**Abstract-** Water is abundant on earth, it represents 1.4 billion km<sup>3</sup>, the problem of water in the world is a problem globally not the quantity but the quality, freshwater is available in form (lakes, rivers, some groundwater), represents only 0.07% of the total resource. The limited freshwater resources in arid areas such as the Middle East and North Africa countries have led to the use of groundwater reservoir water to cover its water needs. To respond to the increase in the need for good quality water in Algeria we did a study of the physicochemical characterizations of treated and desalinated water was conducted at the level of University Center "(Tamanrasset) by water desalination technique using a solar still from the water of In Salah (2015). The results obtained indicate that the salinity is decreased with a yield greater than 70%, Concerning the analysis of other physicochemical parameters in treated water such as conductivity, major ions and pH, indicate temporal variations with respect to the starting water. According to the results, it will be possible to prepare a drinking water of good quality, based on the quality of water treated and the quality of natural groundwater, our principle is determination of the physicochemical characteristics of the mixtures, which obtain by mixing the two waters with varying percentages.

**Key words-** Groundwater, Drinking Water, Solar Distiller, Water Quality, Tamanrasset

### 1. Introduction

Water is one of the most abundant resources on earth, covering three-fourths of the planet's surface. However, about 97% of the earth's water is salt water in the oceans, and a tiny 3% is fresh water[1]. Freshwater is an essential material in our daily lives. Its availability in the world diminishes because of population growth and climate change. To meet the demand for fresh water in areas where reserves are insufficient, several countries have resorted to desalination of salt water. Solar desalination is not a new idea: it has been known for ages, antique sailors used to desalt water with simple and small sized solar stills, It's also a fact that production of fresh water requires a large amount of energy: 1000 m<sup>3</sup> of freshwater per day requires 10 000 tons of oil per year [2]. There are several physical methods for obtaining fresh water from salt water. In addition, there is great potential to use renewable energy sources such as solar energy which has a much lower impact on the environment than other methods. For example the separation of salts from water requires large amounts of energy which, when produced from fossil fuels, can cause harm to the environment[1].

### 2. Materials and methods

The still and the solar collector belong to the same unit and the thermal energy is only used once. Such an installation consists of a basin covered with an absorbent black layer and a transparent cover glass or sometimes inclined plastic. The increase in temperature due to the greenhouse effect warms the evaporating water [3].[4].

The CE electrical conductivity and the pH were measured immediately using a multi-parameter. The total hardness, the permanent hardness and the alkalinity of the treated water were determined by volumetric titration in the chemistry laboratory [5].

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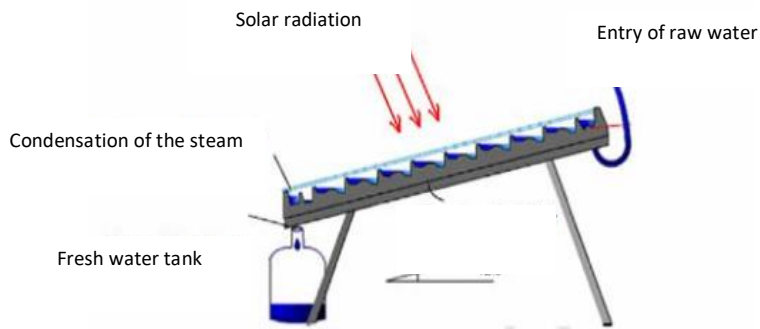


Figure 1. Solar Distiller

### 3. Results and Discussions

#### 3.1. Conductivity

Table 1. The variation of the conductivity

The water	In Salah	Mixed(In Salah water + distilled water) %									Distilled
		90/10	80/20	70/30	60/40	50/50	40/60	30/70	20/80	10/90	
Conductivity	1830	1800	1680	1450	1220	1100	588	567	544	520	500
μS/cm											

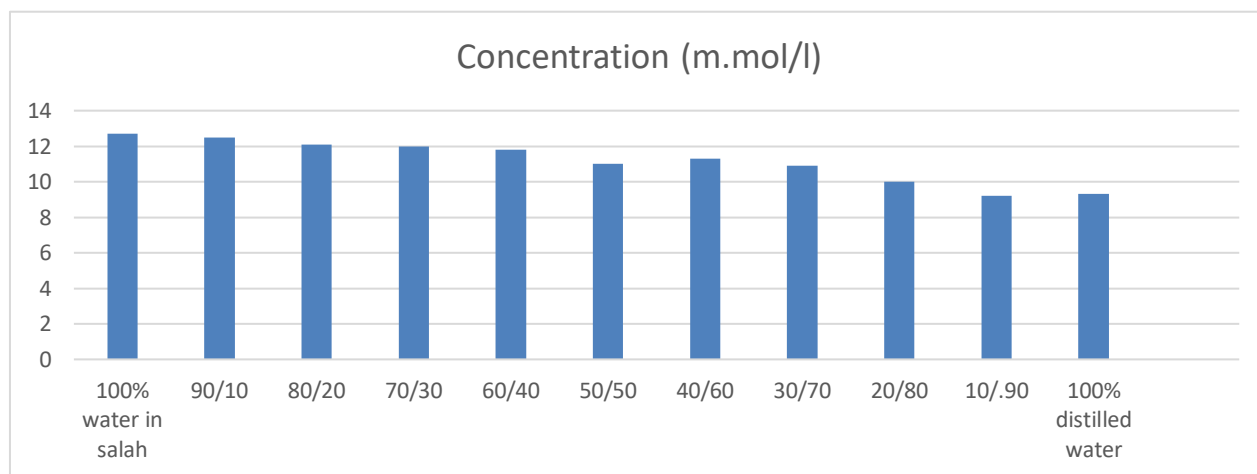


Figure 1. The variation of the conductivity

The results obtained for the electrical conductivity show a variation between 500 μS/cm and 1830 μS/cm. These results are in accordance with Algerian standards for drinking water quality and below the limit value [6] [7].

#### 3.2. pH

The pH measurements that have been performed on the analyzed samples vary between 7.37 and 7.44; these values remain within the norm limits.

Table 2.The pH variation

The water	In Salah	Mixed (In Salah water + distilled water) %									Distilled
		90/10	80/20	70/30	60/40	50/50	40/60	30/70	20/80	10/90	
pH	7.42	7.41	7.40	7.39	7.38	7.37	7.41	7.42	7.43	7.43	7.44

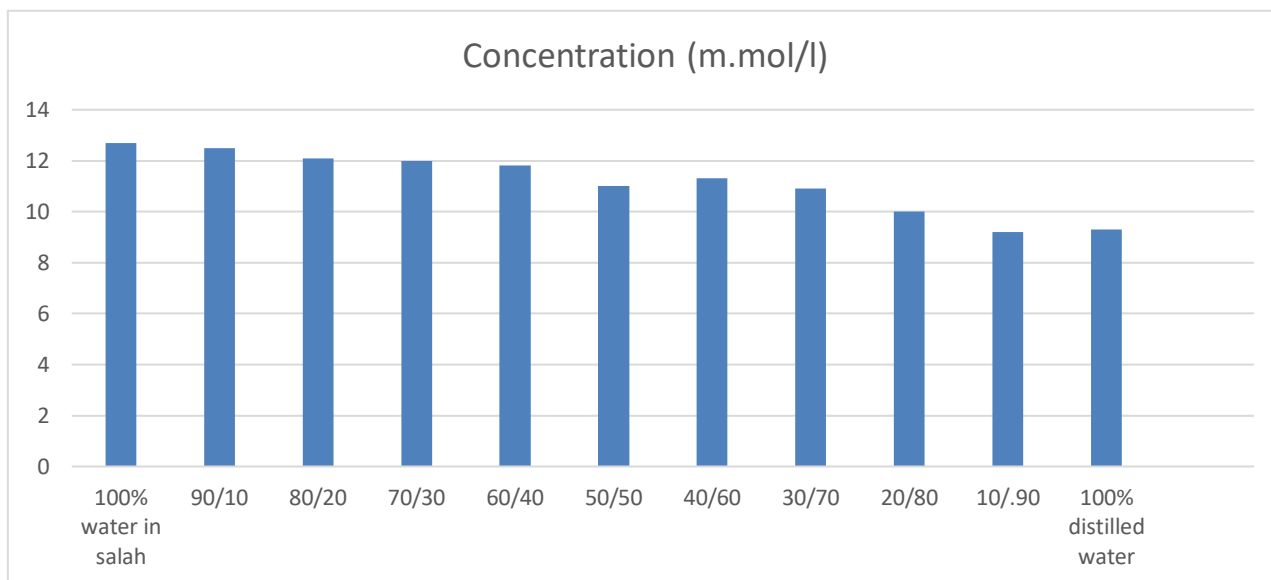


Figure 2.The pH variation

### 3.3. Salinity

Table 3.The variation of salinity

The water	In Salah	Mixed (In Salah water + distilled water) %									Distilled
		90/10	80/20	70/30	60/40	50/50	40/60	30/70	20/80	10/90	
Salinity	0.9	0.79	0.70	0.56	0.55	0.51	0.47	0.35	0.25	0.20	0.1

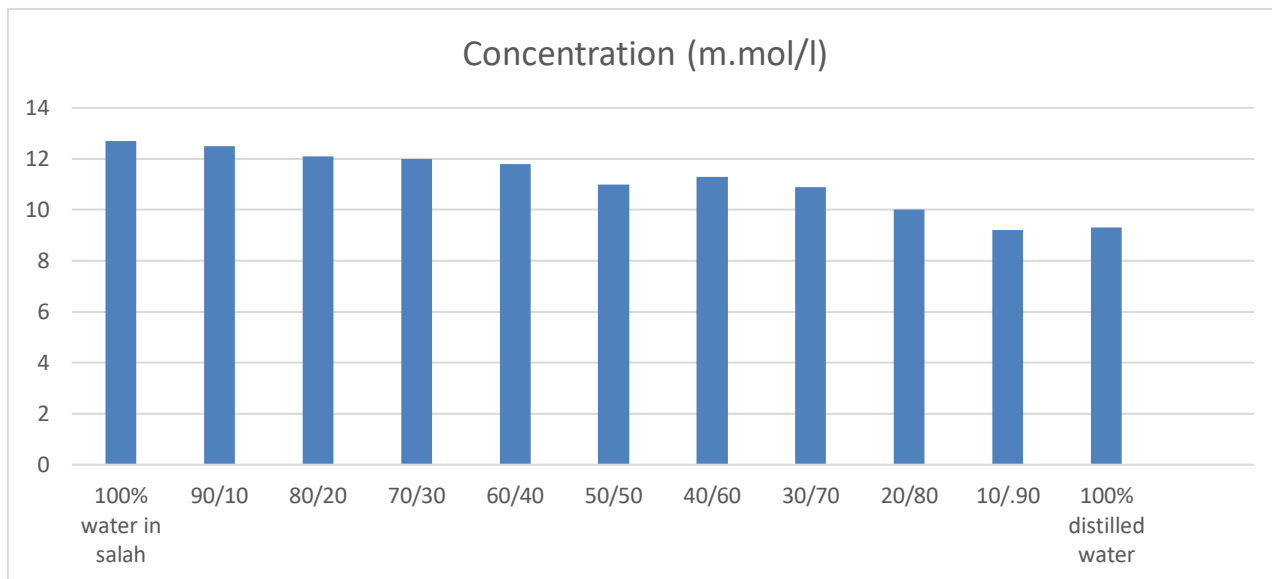


Figure 3. The variation of salinity

Salinity is the total amount of solid residues (in grams) contained in 1 kg of water. It is very difficult to estimate salinity by direct chemical analysis. The salinity of the water corresponds to the concentration of dissolved salts in the water, for this, the salinity appears the same variation of conductivity. [6] [7] [8].

### 3.4. Water Hardness

The total hardness of the water mixture is lower than that of raw water, since the concentrations of calcium ions, magnesium and other cations are decreased. These are the cations responsible for the hardness.

Table 4. The variation of hardness

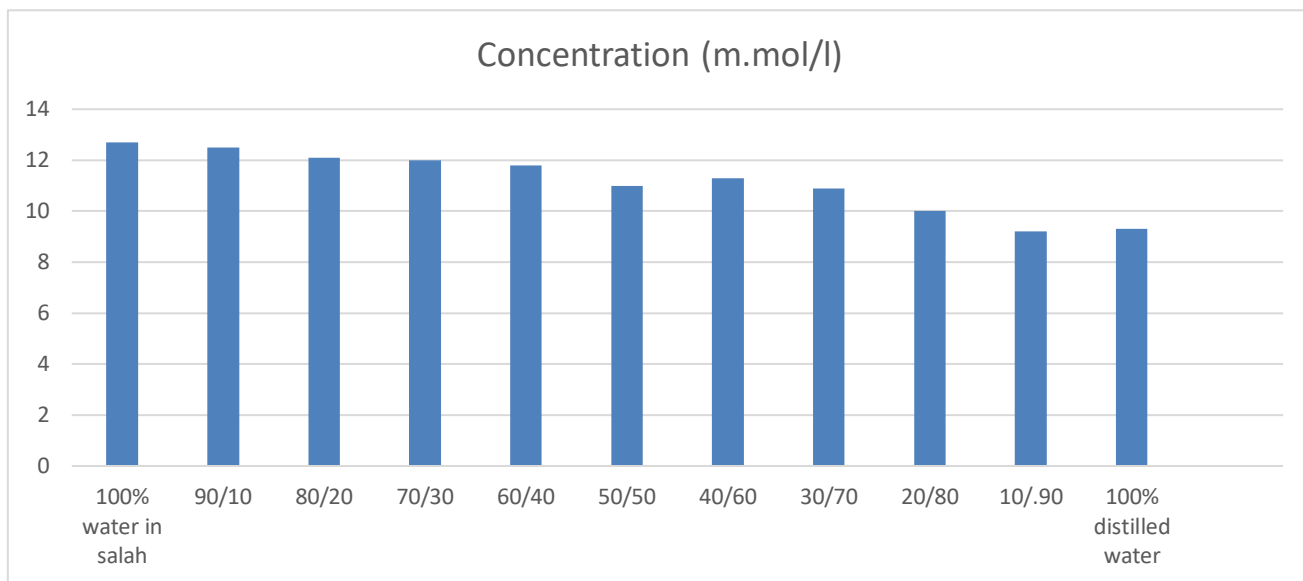


Figure 4. The variation of hardness

In Salah	Mixed (In Salah water + distilled water) %									Distilled
	90/10	80/20	70/30	60/40	50/50	40/60	30/70	20/80	10/90	
<b>30</b>	29	25	23	19	17	15	14	12	08	6.87

### 3.5. Turbidity

The measurement of turbidity makes it possible to specify the visual information on the water. Turbidity reflects the presence of suspended particles in the water, from the values obtain the water of In Salah, the distilled water and the mixture classify in the type of clear water when the turbidity less than 5[7].

Table 5. Variation of turbidity

The water	In Salah	Mixed (In Salah water + distilled water) %									Distilled
		90/10	80/20	70/30	60/40	50/50	40/60	30/70	20/80	10/90	
<b>Turbidity</b>	3.75	3.70	3.69	3.65	3.62	3.58	3.55	3.52	3.50	3.50	3.48

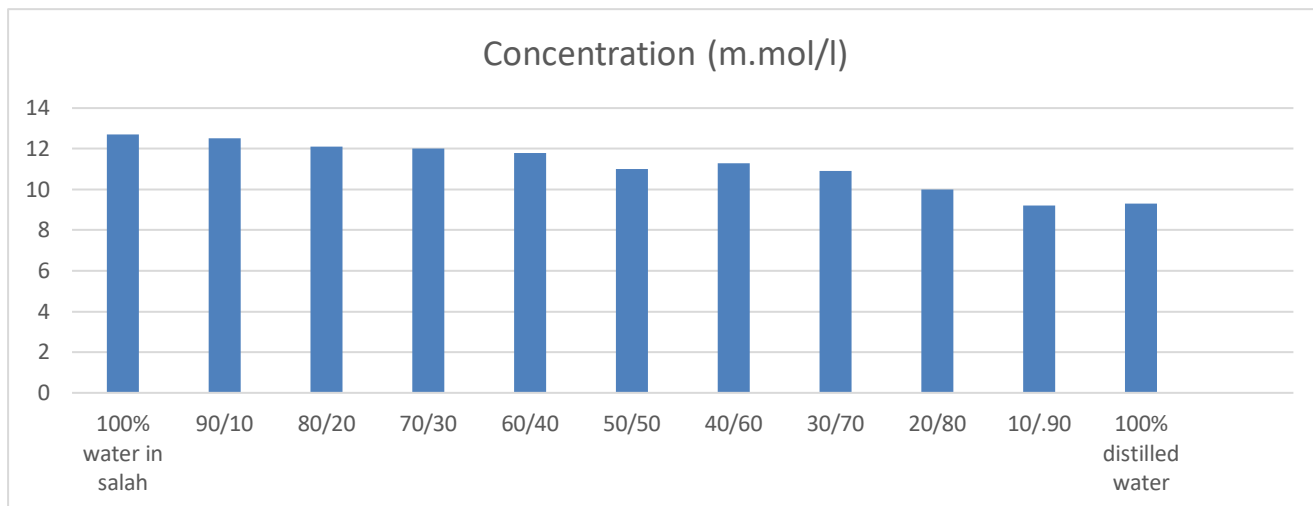


Figure 5.Variation of turbidity

### 3.6. The concentration of potassium and sodium

Table 6.The variation of potassium concentration

The water	In	Mixed (In Salah water + distilled water) %									Distilled
		Salah	90/10	80/20	70/30	60/40	50/50	40/60	30/70	20/80	
Concentration	0.96	0.95	0.83	0.93	0.9	0.7	0.6	0.56	0.42	0.37	0.36
(m.mol/l)											

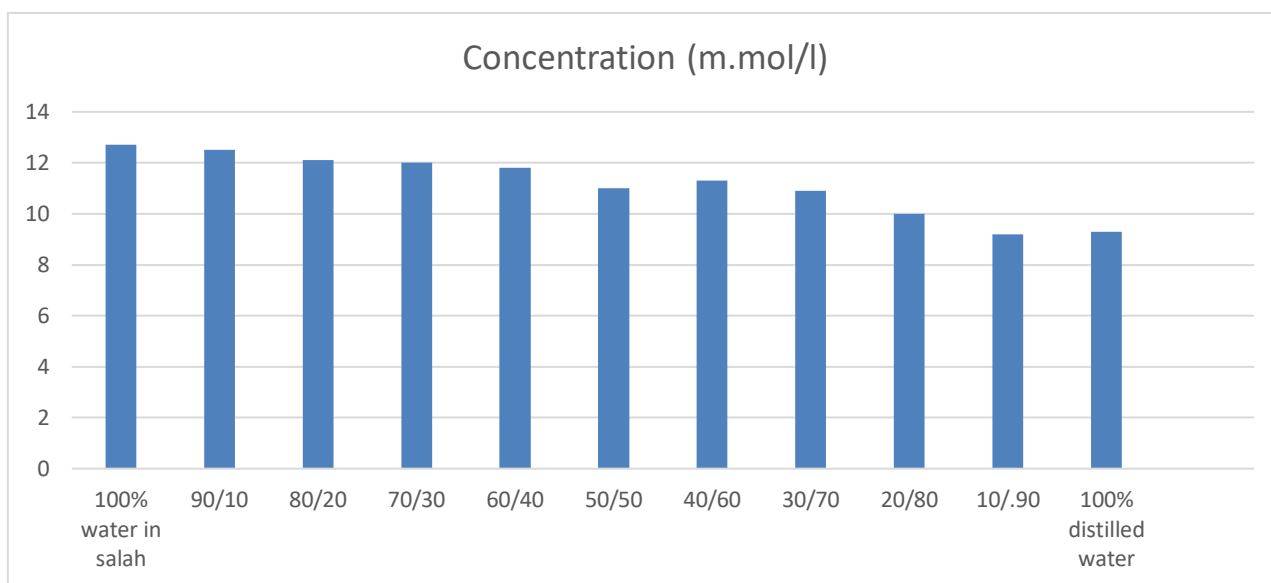


Figure 6.The variation of potassium concentration

Table 7.The variation of sodium concentration

The water	In	Mixed (In Salah water + distilled water) %	Distilled
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	Salah	90/10	80/20	70/30	60/40	50/50	40/60	30/70	20/80	10/90	10/90
<b>Concentration (m.mol/l)</b>	16.8	16.6	16.4	16	15.85	12	11.5	10	8	7	7.3

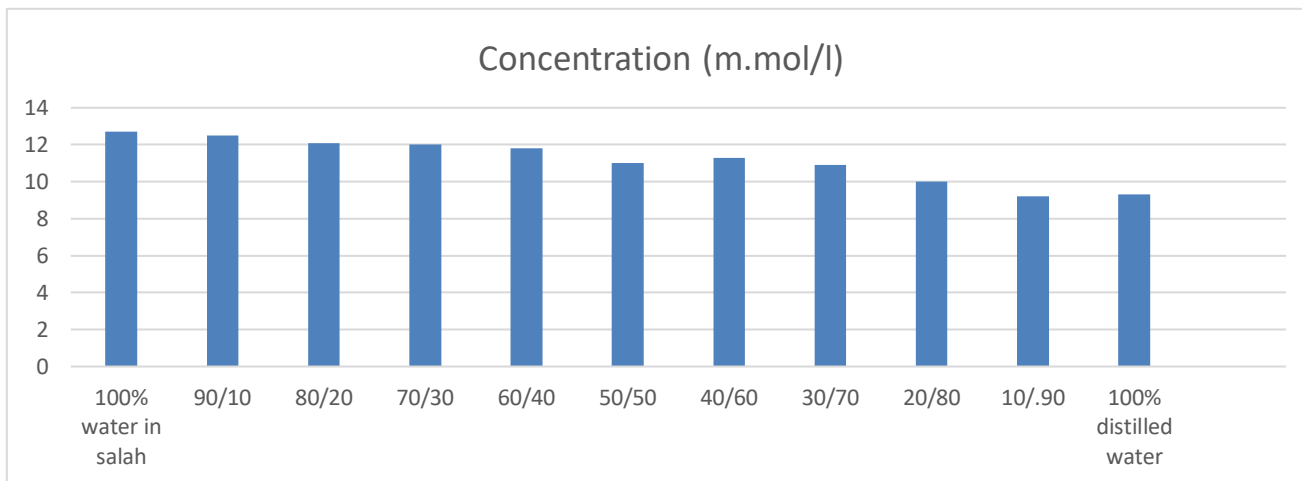


Figure 7. The variation of sodium concentration

The potassium and sodium concentrations are lowered in the distilled water, to increase the concentration of these ions it is necessary to mix the raw water with the distilled water according to a method well determined.

**3.7. Chloride concentration**

Table 8. The concentration variation of Chloride

The water	In Salah	Mixed (In Salah water + distilled water) %									Distilled
		90/10	80/20	70/30	60/40	50/50	40/60	30/70	20/80	10/90	
<b>Concentration (m.mol/l)</b>	12.7	12.5	12.1	12	11.80	11	11.3	10.9	10	9.2	9.3

Chlorine (Cl) is the most widely used product in the world to make drinking water, for three very simple reasons: it is very efficient, inexpensive and safe [7] [8].

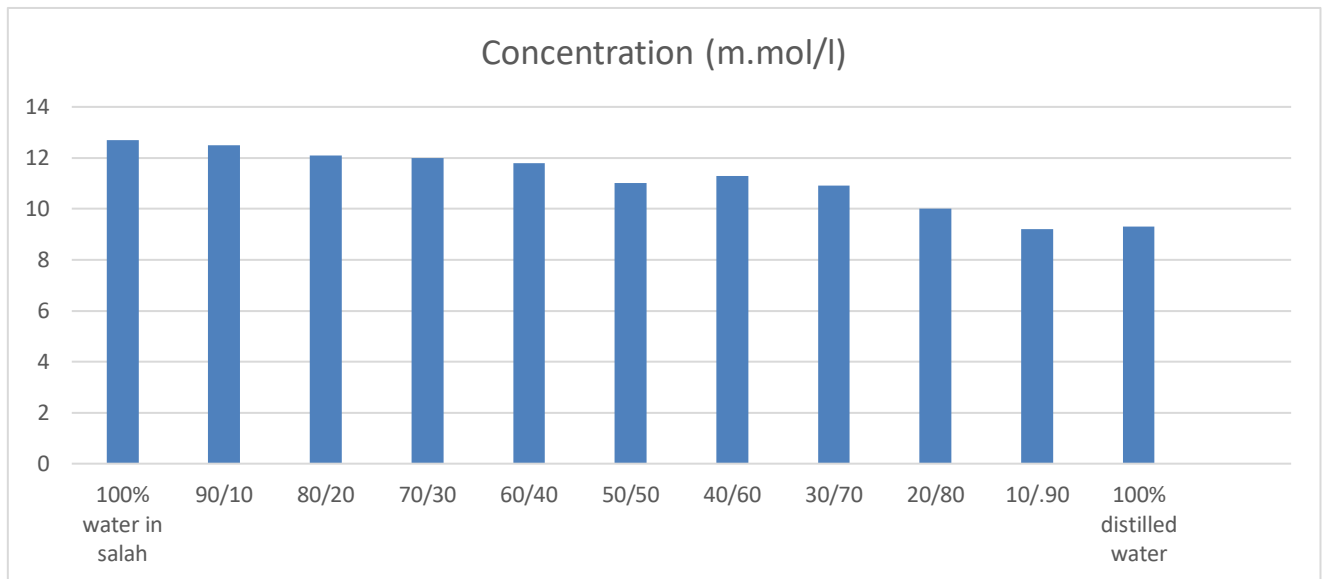


Figure 9. The concentration variation of Chloride

#### 4. Conclusion

In this work, we have studied the possibility of desalinating water withdrawing in arid and semi-arid regions to produce fresh water by solar energy as a renewable source.

The study of the analysis results of these waters carried out in the laboratory of the ADE of Tamanrasset and Laboratory of sciences and the environment (University Centre of Tamanghasset), obtained by desalination and raw water allowed to conclude that the quality of the water to prepare is of drinking quality according to Algerian standards.

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