The Water´s Quality and Socio-Economic Impact on the Population

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Abstract

An effective management system ensures the full realization of the activities that lead to the achievement of the objectives of the plain water processing companies. The efficiency criterion for a management system is represented by the level or degree of congruence that ensures the fulfilment of the objectives regarding the achievement of the parameters that define the water quality. Otherwise, this will be an ineffective or less effective system than desired. The quality control of flat mineral waters is the final link in the final chain of management that aims to achieve quality characteristics by determining the content of calcium, magnesium, manganese, iron, ammonia, nitrates, oxygen, organic substances. In the present research we aimed to determine the pH index and conductivity, compared to quality standards. The content of calcium, magnesium, manganese and iron in the water consumed daily by the population, represents the quality of water, and beneficially affects people's health. That is why these characteristics give information about the biochemical value of water.(http://www.apeleminerale.ro).

Key words: water is a vital element of life
J.E.L. classification: M54

1. Introduction

Flat and mineral natural waters have a variable content of salts, gases, mineral substances, radioactive elements, which give them therapeutic properties. In the past, the name mineral water was given to all groundwater or surface water that could be used for therapeutic purposes. In recent years, mineral waters intended for therapeutic purposes have been called curative waters. Mineral waters are the basic natural factors in the treatment of the indicated diseases. The mineral waters are salty-iodinated-brominated, salty-sulfurous and internal healing springs with weak mineralized sulfurous, bicarbonate, sulphated, sodium calcined, magnesium water. Iodinated doro-sodium waters brominated with gas emissions (light hydrocarbons, among which methane predominates) are deep waters with a high concentration, exploited by wells. Over the years there have been many hypotheses about the origin of mineral waters, but only two theories have been accepted: the meteoritic origin and the magmatic or juvenile origin.

According to the concept of meteoritic origin, mineral water would result from surface meteoritic waters infiltrated into the soil and directed underground by the network of tectonic accidents, one of which, under the rule of gravity, are often forced to penetrate the earth's crust at great depths. Throughout them, the mineral waters wash away the rocks they pass through, acquiring, by dissolution, mineral salts and free gases found in the deep zones of the water (for example CO_2).

Although more attractive, conceptual to the magmatic or juvenile origin of mineral waters, according to which mineral water would come from very deep areas of the earth's crust and those of the upper mantle, it gradually loses its supporters. It would be water from the dehydration of magma or a water of chemical synthesis based on the gases that accompany the magma. Proponents of this concept assume that magmas contain more water than the crystallized rocks they come from. A mediating solution was found between the two concepts, according to which most of the mineral waters have a muddy origin and that quantities of elements of juvenile origin can be incorporated in some deep areas of the earth's crust. (Vulpașu et al, 2006).

2. Research methodology

Hydrogen ion concentration pH-the negative decimal logarithm of hydrogen ion activity, expressed in pH units. Due to ionic interactions, the activity of hydrogen ions is significantly lower than their concentration. The test equipment and measuring means were pH-meter, indicator paper. Apparatus for measuring pH, conductivity and dissolved oxygen, pH Buffer Solutions; potassium chloride solution, distilled water.(http://aquacarpatica.com).

Sampling for analysis. The pH can change quickly due to the physical and biological processes that take place in the water sample. Take the sample in a clean container, fill it completely, remove all air bubbles from the sample by gently shaking the container, then close it tightly.

Way of working. Remove the electrode held in potassium chloride solution and place in distilled water; immerse the dry electrode to measure the pH in the test sample, open the device by pressing the ON/OFF key; select the pH measurement mode; gently shake the solution around the electrode and leave it to rest (reading is done without stirring) until a constant value remains on the device display; remove the electrode and rinse with distilled water; is introduced into the potassium chloride solution; the indicated value represents the pH value, the sample temperature is measured by pH-meter. The conductivity was performed by using the MultiLab conductivity meter, with which the concentration of the ionizable solutions present in the sample was measured depending on the ion concentration, the nature of the ions, the solution temperature, the viscosity of the solution.(SR EN 27888/1997). The concentration of oxygen in the water as well as the presence of organic substances were also measured.(SR EN ISO 5814/2013). Oxidability is the amount of oxygen equivalent to the consumption of oxidant. Organic substances are hot oxidized and may have a telluric or polluting origin, in which case their concentration varies abruptly. The organic substances are oxidized with potassium permanganate in an acid medium when boiled. Excess potassium permanganate not used in the oxidation reaction is reduced with oxalic acid, and excess oxalic acid is hot titrated with potassium permanganate until a faint pink tint persists.(SR EN ISO 6060/1995). The determination of calcium, magnesium was performed by titration method.

3. Findings

Expression of the results obtained after performing the determinations: organic substances, mg / l, pH, conductivity and oxygen are presented in table no. 1.

Table no.1 The organic substances, mg / l, pH, conductivity and oxygen concentrations

Flat water samples	**Organic substances (mg/l)**	**pH**	**Conductivitate (µS/cm)**	**O_2 (mg/l)**
Sample 1	0,85	7,82	349	8,96
Sample 2	1,16	7,97	342	9,64
Sample 3	1,92	7,88	297	8,72
Sample 4	0,70	7,02	345	10,11
Sample 5	1.46	7,54	336	9,97
Sample 6	1,76	7,47	314	11,2
Sample 7	1,31	7,79	280	8,31
Sample 8	2,37	7,23	349	10,85
Sample 9	1,61	7,88	331	9,11
Sample 10	2,07	7,99	278	11,54

Source: (*** results obtained experimentally)

Following the obtained results the pH is higher than 7.50 in all three samples, which indicates that the analyzed water has an alkaline hydrogen potential. This is a favorable one, as it is known that water with an ideal pH is the one whose value is close to 7, perfectly neutral, but also a slight overtaking towards alkalinity is beneficial, up to a maximum of 8.5.

Conductivity is an indicator that differs depending on the mineralization of the water and represents the property of conducting electric current, depending on the amount of ions present in the water. Thus, if we make a comparison between the 3 water samples in terms of conductivity, we can say that Sample 1 is the best in terms of mineralization (349 µS / cm), followed by Sample 2 which is at a very small difference and Sample 3 whose mineral content is much lower than the first - sample 2.

The table presented above highlights the results of the organic substances obtained for each sample.

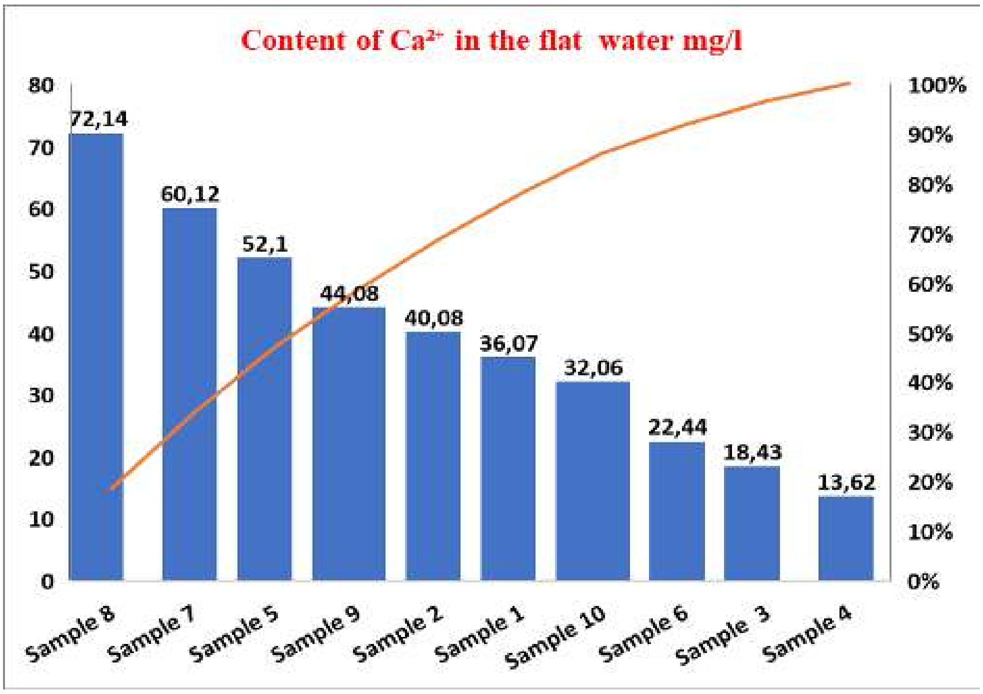
Given the fact that organic substances represent the chemical consumption of oxygen in natural flat mineral water, we can say that as long as the result obtained from the calculations is lower, the water is more qualitative in terms of organic substances.

Therefore, Sample 1 is at the top of the ranking, with a value of 0.85 mg / l, much lower than the value of the third sample, which recorded a value of 1.92 mg / l (the highest value among the three samples).

The dynamics of the calcium content in this case, water samples indicate an increasing trend from 13.62 mg/l to 72.14 mg /l Ca^{2+}. Sample 4 has the lowest calcium content, while sample 8 has the highest calcium content.

Regarding the statistical interpretation of the results obtained experimentally, it is observed that the points that define the calcium content in the 10 analysed samples, tend to be grouped around a straight line. Thus, a higher positive correlation was obtained after ordering the Ca2 + concentration values in ascending order (minimum 13.62 mg / l Ca 2+ -sample 4 and maximum 72.14 mg / l Ca 2+ - sample 8) (figure 1).

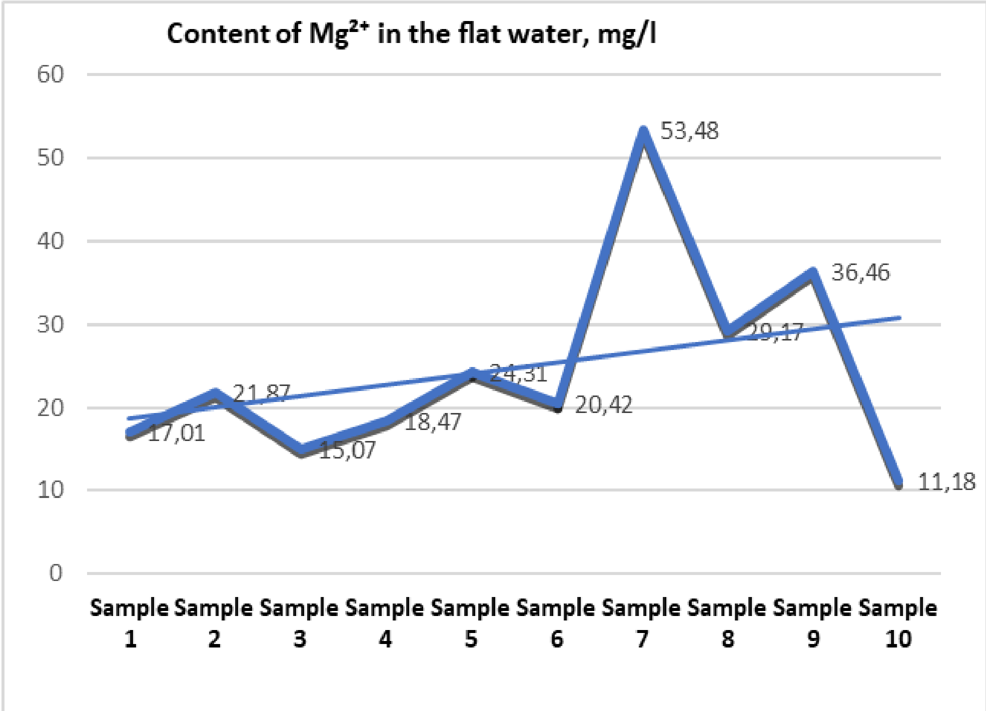
Figure no.1 Dynamic of Ca^{2+} in the flat water samples



Source: (statistical interpretation of experimentally obtained results)

Regarding the interpretation of the results obtained for the magnesium content from the analysed samples, it reaches maximum limits of 53.48 mg / l in sample 7, average limits for samples 1, 2, 3, 4, 5, 6, 8, 9, as well as minimum limits for sample 10 - 11.18 mg/l (figure no. 2).

Figure no.2 Dynamic of Mg^{2+} in the flat water samples



Source: (statistical interpretation of experimentally obtained results)

In this case several points describing the concentration of Mg^{2+} in plain water tend to group around a straight line, but there are also 3 points (the three concentrations from the samples 7, 9, 10) that have a weak tendency to group around a certain line. In this case we encounter the situation in which at a higher number of samples 7, a superior performance was achieved and at a relatively small number of samples 3 a poor superior performance was obtained. In conclusion, a weak superior correlation resulted.

From the experimental research it resulted that sample 8 has a maximum content of organic substances of 72.14 mg / l, and sample 4 reaches the lower limit of only 13.62 mg/l. Important values were also recorded in samples 2, 5, 7, 9.

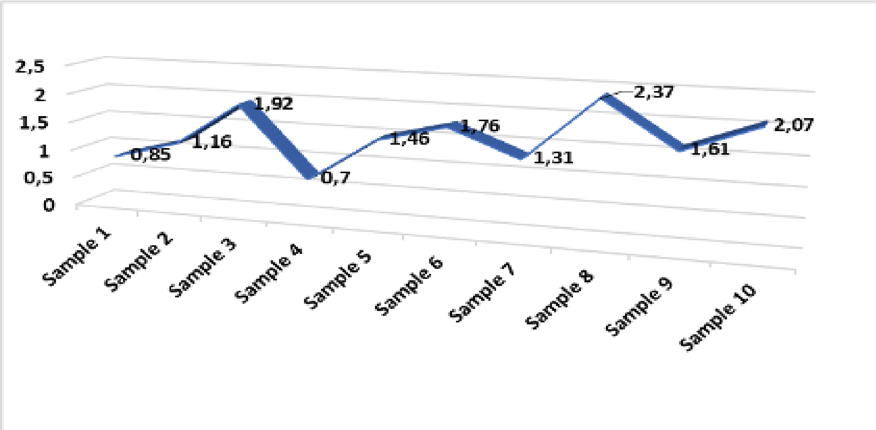
Given the fact that organic substances represent the chemical consumption of oxygen from natural flat mineral water, we can say that as long as the result obtained from the calculations is lower, the water is more qualitative in terms of organic substances.

Related to the statistical interpretation of the experimentally obtained results, it is observed that the points that define the content of organic substances in the 10 analysed samples, tend to be grouped around a line. A higher positive correlation was thus obtained (figure 3).

Following the obtained results we can observe that the pH is higher than 7.50 in seven samples, which indicates that the analysed water has an alkaline hydrogen potential. This is a favourable one, as it is known that water with an ideal pH is the one whose value is close to 7, perfectly neutral, but also a slight overcoming to alkalinity is beneficial, maximum 8.5 (figure no.4).

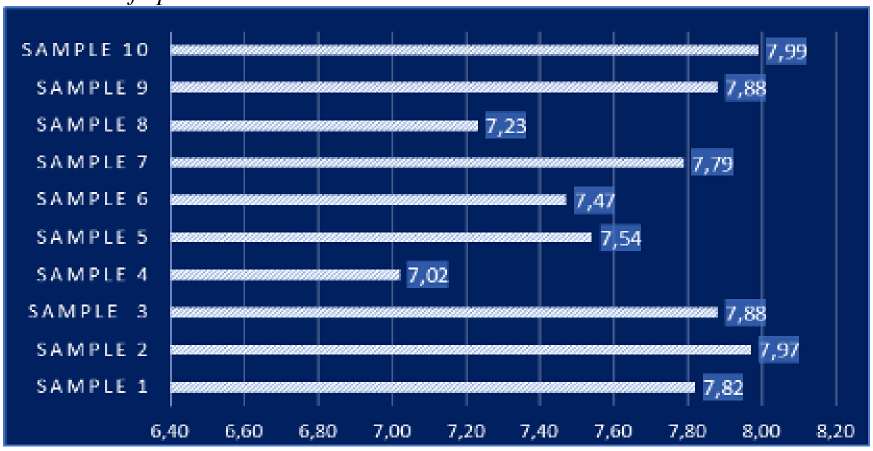
The dynamics of the oxygen content indicates an increasing variation from 11.18 mg/l to 53.48 mg/l oxygen. The highest concentrations were obtained in the samples 7,9,8 and the lowest concentrations were obtained in the samples 1,3,10. Regarding the statistical interpretation of the experimental results, it is observed that the points that define the oxygen content in the 10 analysed samples, tend to be grouped around a line. Thus, a higher positive correlation was obtained after ordering the oxygen concentration values in ascending order (minimum 11.18 mg/l O2-sample 10 and maximum 53.48 mg/l O2-sample 7) (figure 5).

Figure no.3 Dynamic of organic substances in flat water samples



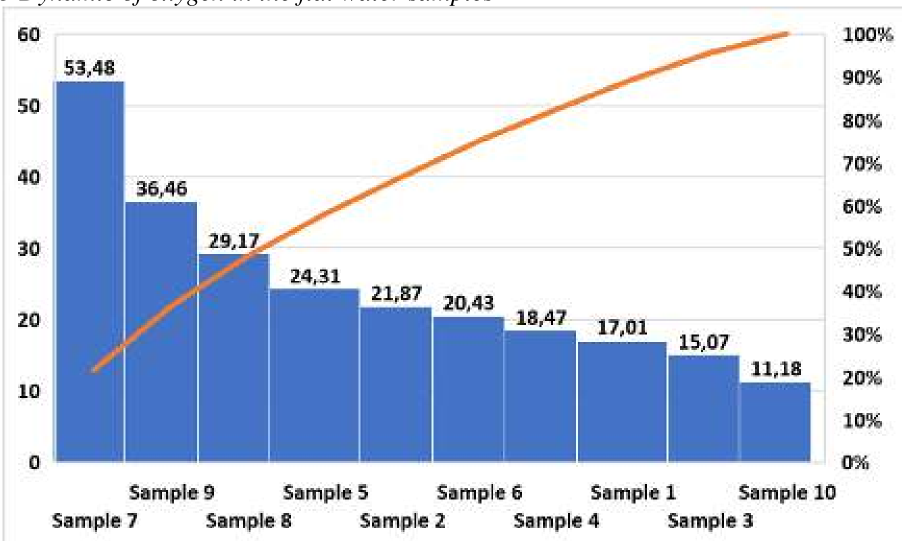
Source: (statistical interpretation of experimentally obtained results)

Figure no.4 Variation of pH index



Source: (statistical interpretation of experimentally obtained results)

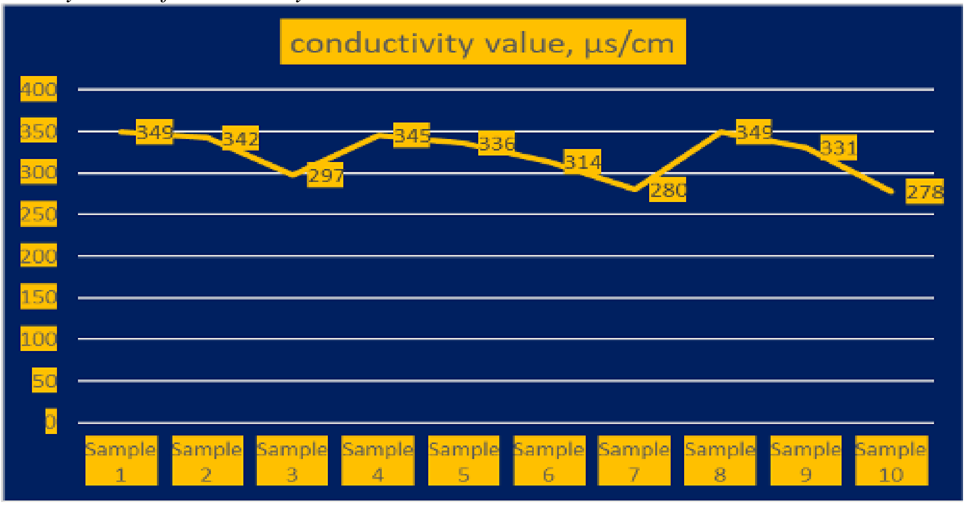
Figure no.5 Dynamic of oxygen in the flat water samples



Source: (statistical interpretation of experimentally obtained results)

Conductivity is an indicator that differs depending on the mineralization of the water and represents the property of conducting electric current, depending on the amount of ions present in the water. Thus, if we make a comparison between the analysed water samples, from the point of view of conductivity, we can say that Sample 1 is the best in terms of mineralization (349 µS/cm), followed later by Sample 2 which is at a very small difference and Sample 3 whose mineral content is much lower than the first (figure no. 6).

Figure no.6 Dynamic of conductivity



Source: (statistical interpretation of experimentally obtained results)

The experimental results that define the conductivity of the analysed samples tend to be grouped around a line. A higher positive correlation was thus obtained in this case as well.

4. Conclusions

Water quality control as a finished product is a process of monitoring performance and taking measures or actions to ensure the achievement of desired or intended results.

Water is a vital element in people's lives and the content of mineral microelements Ca, Mg, SO, O_2, make it the essence of population health. From the experiments performed, the highest Ca^{2+} content is found in the samples 8, 7, 5 and the highest Mg^{2+} content is in samples 7, 9, 10.

A pH higher than 7.50 in seven samples indicates that the water analyzed has an alkaline hydrogen potential, which is an advantage, as it is known that water with an ideal pH=7, perfectly neutral, but also a slight overtaking towards al-calinity is beneficial, maximum 8.5.

The higher the conductivity, the higher is the total mineral content. Regarding the statistical interpretation of the results obtained experimentally, it is observed that the points that define the content of calcium, magnesium, oxygen and organic substances in the 10 samples analyzed, tend to be grouped around straight lines. Thus, superior positive co-relations were obtained, which accredits the experimental research performed.

These dosages of substances that ensure the quality of flat water also determine the increase of flat water consumption on the Romanian market, which also determines an economic growth of the processing companies that ensure the management of flat water quality.

5. References

- Vulpașu, E., Sandu M., Racovițeanu G., Dinet E., 2008. Studies and researches for ensuring a drinking water with out risk for the consumer. *ROMAQUA magazine*, no.5, vol. 59;
- ***, ASRO - SR EN 27888/1997;
- ***, ASRO - SR EN ISO 5814/2013;
- ***, ASRO - SR EN ISO 6060/1995;
- http://www.apeleminerale.ro;
- http://aquacarpatica.com.