Scientific Bulletin. Series F. Biotechnologies, Vol. XIX, 2015
ISSN 2285-1364, CD-ROM ISSN 2285-5521, ISSN Online 2285-1372, ISSN-L 2285-1364

OBSERVATIONS REGARDING THE LEVEL OF SOME MINERALS IN PARTIALLY DECARBONATED WATER

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Abstract

Water represents the essential natural resource needed for all biological processes in nature, having a particular importance for sustaining life. Nowadays drinking water has as main source, sourface waters and groundwaters that are the source of natural mineral waters. Mineral waters have a very important weight in our alimentation being intended both for daily consumption as for treating certain diseases. In order to satisfy consumers preferences, the producers resort to diversify the assortments of natural mineral water from the market, either by partially or totally degassing or by impregnating with extra carbon dioxide.

The study was performed on three assortments of partially decarbonated mineral water, aiming the level of nitrates, nitrites, chromium, copper, nickel by spectrophotometer method, using a UV-VIS SPECORD 205 spectrophotometer, respectively absorbtion spectrophotometer with graphite furnace.

After the determinations carried out, reading and interpretation of the results, it was noted that the case of assortment 3 at the studied batch, the level of nitrates (2,01 mg/l) was larger than that shown on the label, and nickel level was considerable higher (0,014 mg/l) compared with the level of other minerals determined.

All studied parameters were situated under maximum allowable limits, even if in case of assortment 3 at analyzed batch was noted a higher level of nitrates compared with the one shown on the label. In case of assortments 1 and 2 at analyzed batch the levels of nitrates, chromium, copper, nickel were situated under the values shown on the label. Even if the researched parameters are under the maximum allowable limits by the legislation in force, is needed a carefully monitoring by the competent institutions.

Key words: *heavy metals, minerals, partially decarbonated water.*

INTRODUCTION

ater represents the essential natural resource needed for all biological processes in nature, having a particular importance for sustaining life. Most of the water that exist around the world (approximately 97%) is represented by seas and oceans. In the ice caps exists more than 2% from the total water, and the stream, rivers, lakes, phreatic canvas and the atmosphere represents the rest of 1%. But unfortunately, this 1% usually represents the human supply source of water.

Data from WHO shows that, the minimum quantity of water necessary for the human body is 5 liters per day, from which approximately, 1,5 – 2 liters is represented by the consumed water. The perfomed estimations shows that at approximately 15 years the human water consumption became double, in the future being provided a global fresh water crisis.

The drinking water is a part of the water cycle in nature and has as sources surface waters and

groundwaters, from which comes the natural mineral waters (Figure 1) (Evans, Perlman, 2014). It has an important weight in alimentation being intended both for daily consumption as for treating certain diseases. Those waters comes from streams approved for these purposes, that are regularly verified (at least once a year) for the Ministry of Health bodies, and are containing in solution different minerals dissolved from the rocks through are circulating, due to which it has some specific therapeutic properties.

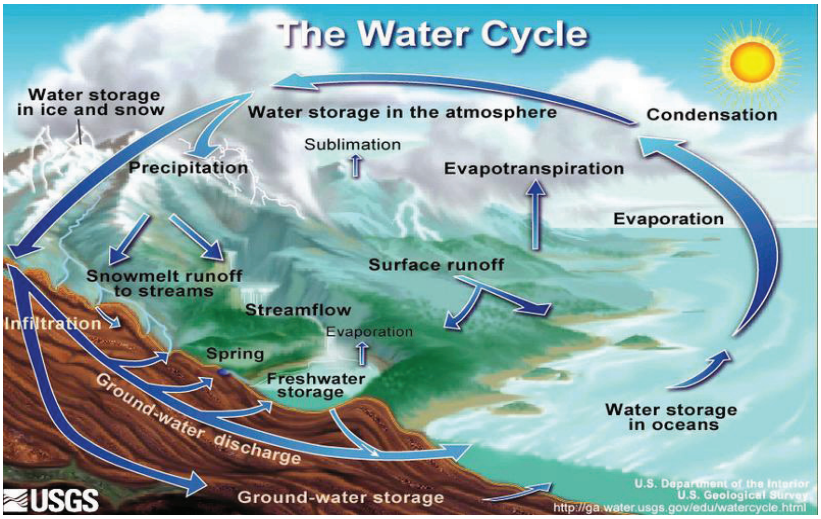

Figure 1. Water cycle in nature (by US Geological Survey, 2014)

Natural mineral water is the microbiologically pure water that comes from a phreatic canvas or from a underground aquifer deposit and comes from a source exploited by natural emerging or by drilling. It can be in a clearly way distinguished by the ordinary drinking water by its nature – characterized by the mineral components and as the case by some effects, and through its original purity that are maintained intact by the underground storage that protects against any pollution risk.

All the natural mineral water that are at one time on the market must be officially recognized by publishing in the official bulletins, at national and european level by mentioning the trade name, the extraction source and the bottling place.

In order to satisfy the consumers preferences the producers resort to diversify the assortments of natural mineral water from the market, either by partially or totally degassing or by impregnating with extra carbon dioxide (Caragea, 2010). In this way the owners of the sources of carbonated natural water are trying, using the degassing procedure (perfectly legal) to enter on the market with a product closer to plain water, while those who own sources of plain water impregnate the water with carbon dioxide (equally legal), entering in this way on the carboned water market which consumption is traditional mostly in Romania (Bărbulescu, 2003; Zamfirescu 2012).

Given the risk of pollution in the different stages of technological process - capture, degassing , packaging (Mănescu, 1991), considering human intervention on the environment (excessive soil fertilization with manure and synthetic) that led to the contamination of groundwater (especially with nitrates) (Goran, 2009; Jin 2004), regarding the necessity of being in accordance with standards , we undertook this study on the level of some minerals in partially decarbonated water.

MATERIALS AND METHODS

The study was performed on three assortments of partially decarbonated mineral water, packaged in PET, from different producers. There were used four samples (belonging to the same lot) from each assortment, collected after their purchasing from public sale units. The samples were analyzed aiming the level of nitrates, nitrites, by spectrophotometer method, using a UV-VIS SPECORD 205 spectrophotometer, and the level of chromium, copper, nickel using the absorbtion spectrophotometer with graphite furnace.

Figure 2. Spectrophotometer Specord 205

Figure 3. Spectrophotometer with graphite furnace

Determinations were performed according to ISO 7890-3 standard from 2000 that establish the method of determination of the nitrate ion and, acording to SR ISO 6777 standard from 2002 that establish the method of determination of the nitrates from the drinking water. With regard at chromium, copper and nickel, it were determined according to SR EN ISO 15586 standard from 2008 after the disaggregation with nitric acid specified in ISO 15587-2.
Were prepared standards for each analyte. Based on this standards was drawn the calibration curve of the device. After that were read the values of the concetration of substances and were reported the results for water, in micrograms per liter (µg/l). For the samples where was not obtained a detectable signal, the results were reported as being „below the detection limit".

RESULTS AND DISCUSSIONS

The determinations performed according to the methodology presented above, highlighted the following results for nitrates, nitrites, chromium, copper and nickel.

Table 1. Results obtained by analyzing water samples for nitrates

Type / Sample	Type 1 (mg/l)	Type 2 (mg/l)	Type 3 (mg/l)
S1	0,31	-	2,03
S2	0,30	-	2,07
S3	0,28	-	1,99
S4	0,35	-	1,95
Average	0,31	-	2,01

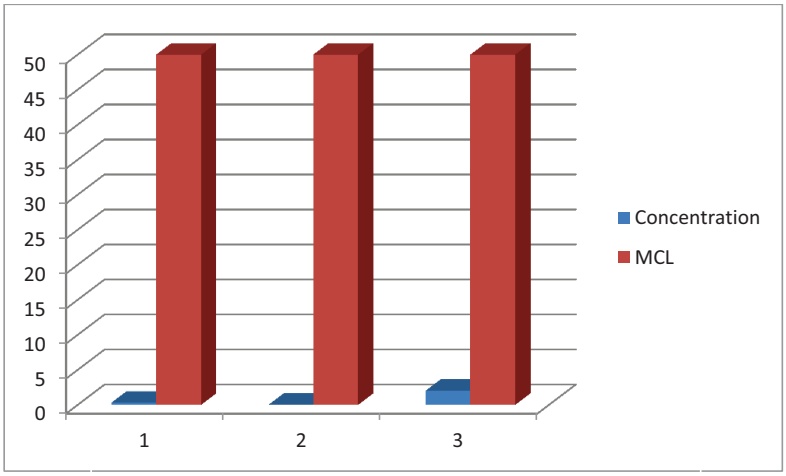

Figure 4. Nitrates concentration in the samples analyzed

It can be observed that the assortment no. 3 of partially decarbonated water is the one that has the higher content of nitrates that is a lot below the maximum limit allowed by the regulations in force (50 mg/l). Also it can be observed that in case of type no. 2 of analyzed water, the nitrate is below the detection limit of the device. Also, I could notice that in case of the type no. 3 the content of nitrates was higher than the one written on the label.

The determinations performed for nitrites and chromium shown that these two analytes were situated below the detection limit of the device.

From Table 2 results that all the three assortments of water anlayzed using the absorbtion spectophotometer with graphite furnance method to determine copper, is below the maximum allowed limits allowed by the legal norms, even if no. 3 was having a higher content (0,00464 mg/l).

It can be observed that from the three water types analyzed for the determination of nickel concentration, type no. 3 has the higher value (0,01424 mg/l) but is situated below the maximum allowed limit (0,02 mg/l).

The quantities of nitrate highlighted in the analyzed samples are corresponding to lowest limits compared to the detected values in the researches performed in Italy (1997) and India (2010).

The content of nitrites is undetectable in the case of our decarboned water samples compared to the researches performed in Italy where the content of nitrites exceeded the maximum limit allowed by the law (Montagna, 1997).

Higher concentrations were detected in our case at nickel 14,24 µg/l compared with lowest concentrations of nickel discovered in Serbia (4,00 µg/l) in 2012(Rajkovic).

Table 2. Results obtained by analyzing water samples for copper

Type / Sample	Type 1 (mg/l)	Type 2 (mg/l)	Type 3 (mg/l)
S1	0,0003	0,00107	0,00464
S2	0,0007	0,00104	0,00469
S3	0,0098	0,00109	0,00459
S4	0,0005	0,00108	0,00465
Average	0,0004	0,00107	0,00464

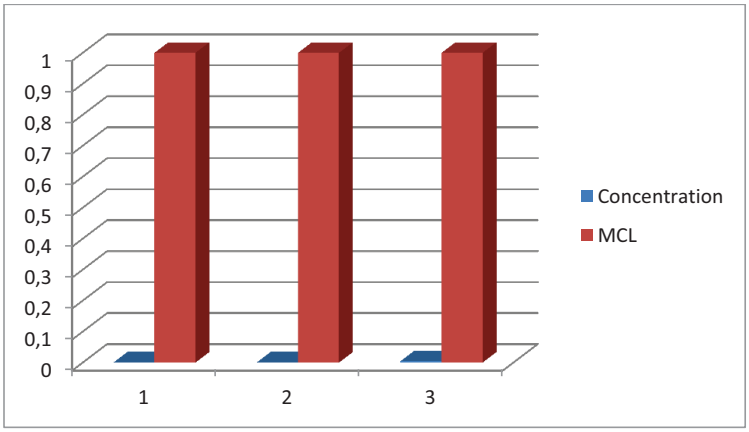

Figure 5. Copper concentration in the samples analyzed

Table 3. Results obtained by analyzing water samples for nickel

Type / Sample	Type 1 (mg/l)	Type 2 (mg/l)	Type 3 (mg/l)
S1	0,00123	0,00120	0,01429
S2	0,00125	0,00122	0,01424
S3	0,00120	0,00125	0,01418
S4	0,00124	0,00121	0,01427
Average	0,00123	0,00122	0,01424

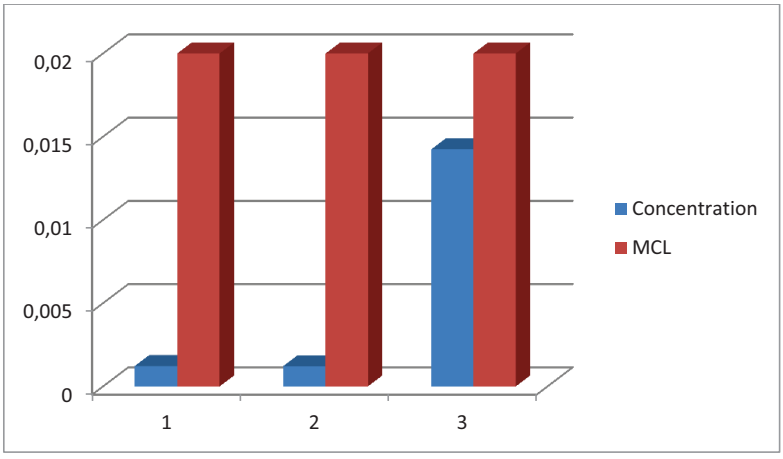

Figure 6. Nickel concentration in the samples analyzed

CONCLUSIONS

In all assortments of partially decarbonated water, all studied parameters presented values below the maximum limit allowed by the regulations in force.

The highest nitrate concentration was highlighted in the third studied type of mineral water. In this case the determined concentration was higher than the one written on the label.

In all cases nitrites and chromium were situated below the detectable limit of the device. Assortment no. 3 presented also the highest quantities of copper and nickel.

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