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CHEMICAL MONITORING FOR A NATURAL MINERAL WATER SOURCE LOCATED IN SÂNCRĂIENI

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Abstract

Using standardized analytical techniques, the chemical parameters of natural mineral originating from FH1 source located in Sâncrăieni village, Harghita county, were characterized (conductivity, pH, total hardness, fixed residue, oxidability, borates, chloride, fluoride, nitrates, nitrites, ammonia, phosphates, sulphates, CO_2, HCO^{3-}, barium, calcium, iron, magnesium and sodium). The obtained results placed this source among the oligomineral carbonated mineral waters. The obtained results proved that the monitored parameters are below the maximum allowed values specified by HG 760/ 2001; the stability tests which were also carried out proved that the analyzed water is stable.
Keywords: *mineral water, chemical analysis, parameters*

Introduction

Natural mineral water is defined as microbiologically wholesome water originating in an underground source and emerging from a spring tapped at one or more natural or bore exits, but not obtained from a public community water supply, that have undergone no chemical modification (EC Directive 80/ 777). Natural mineral waters are true ecological products and their use on regular basis may produce beneficial effects to human health. The mineral content of these waters is sometimes significantly higher than concentrations normally accepted in drinking water. Such waters are often accepted on the basis that they are considered foods rather than drinking-water. Certain mineral waters may be useful in providing essential micro-nutrients, such as calcium, magnesium, sodium, potassium, copper, zinc, manganese, etc. Mineral waters also improve the use of oxygen at tissue level, increasing the resistance of human organisms to diseases (Puddu, 1980).

Harghita county is one of the richest areas in mineral water in Romania, having more than 2000 springs of table waters, but only some of them are used and bottled as sources of drinking water and for therapeutic purposes, being known in about all countries of the world. These mineral waters are carbonated and the presence of CO_2 is due to the post-volcanic activity of the volcanic mountains Harghita. Sâncrăieni is situated in the middle of the mineral water springs zone (over than 100 carbonated mineral water springs) with waters rich in carbon dioxide, calcium, magnesium and sodium. These waters are recommended for internal cures (such as simple anemia, or diseases of the digestive system) and also for external cures such as rheumatism or neurasthenia (Pricăjan, 1985). The geographical position, as well as the unpolluted area is favorable to mineral water sources of remarkable quality.

The target of the present study is the chemical monitoring of one natural mineral water source located in Sâncrăieni village, according to the present legal requirements. Previous studies reported the content of some microelements in mineral waters from this area (Babaua, 2003; Băiulescu, 1972), but in none of them an extensive chemical characterization is presented.

Experimental

Samples were collected from the FH1 source located in Sâncrăieni village, according to SR 2852-87, this source being monitored from 10.02.2003 to 27.09.2005. The chemical analyses consisted in determining a range of indicators including conductivity, pH, total hardness, fixed residue, oxidability, borates, bicarbonate, chloride, fluoride, nitrates, nitrites, phosphates, sulphates, CO_2, ammonia, barium, calcium, iron, magnesium and sodium. Chemical analyses were performed by standardized analytical procedures (EN ISO 15586/2004, SR ISO 10523-97, SR ISO 5667/2-98, SR ISO 6777-1996, STAS 3002-85, STAS 3026 -76, STAS 3048/1-77, STAS 3049-88, STAS 3069-87, STAS 3638-76, STAS 6328-85). The following instruments were used: atomic absorption spectrophotometer Perkin Elmer AA Analyst 700, UV/VIS spectrophotometer Helios Unicam, UV/VIS spectrophotometer Jasco V-530, analytical balance Sartorius, WTW conductometer, WTW turbidimeter, Inolab 340i pH- meter and a Binder oven.

Results and Discussions

According to the data from table 1, the values of chemical parameters of the mineral water samples were all below the legal maximum allowable concentrations (HG nr.1020, 2005).

Table 1. Mean values of the monitories indicators

Parameter	10.02 2003	28.01 2004	24.03 2004	25.04 2004	22.05 2004	22.06 2004	01.02 2005	20.04 2005	27.09 2005
Conductivity (μS/cm)	717	711	708	809	713	785	724	717	693
pH	6.12	6.67	6.22	6.24	6.08	6.04	6.73	6.29	6.76
Total hardness (°G)	14.17	13.89	12.89	13.29	13.32	13.55	13.75	13.6	14.10
Dry residue at 180^0C (mg/l)	483.2	483.2	524	528	468	492	501	507.7	494
Oxidability (ppm)	2.844	0.316	-	-	0.314	0.316	0.158	0.96	0.69
Borate (ppm)	9.08	0.87	1.06	0.72	0.87	0.95	1.36	1.88	1.23
Chloride (ppm)	20	15	55	75	20	75	63	86.26	28
Fluoride (ppm)	0.15	0.006	0.31	0.26	0.39	0.27	0.15	0.2	-
HCO_3^- (ppm)	456.89	445.3	427	497.2	495	551.1	488	497.3	518.5
Nitrate (ppm)	0.01	-	0.05	0.01	0.01	0.03	0.01	0.01	0.06
Nitrite (ppm)	0.10	0.15	0.2	0.006	0.01	0.013	0.15	-	0.015
Phosphate (ppm)	0.092	0.043	0.163	0.42	0.213	0.143	0.19	0.05	0.006
Sulphates (ppm)	85	108	110	87.5	110	95.92	31.42	56.25	42.3
Ammonia (ppm)	0.15	0.2	0.21	0.14	0.09	0.08	0.09	0.19	0.17
CO_2 (mg/l)	329.56	321.2	308	358.6	330	365.4	352	374	324.6
Barium (ppm)	0.067	0.052	0.053	2.002	0.055	0.065	0.061	0.048	0.042
Calcium (ppm)	50	49.28	48.27	45.27	40.78	40.07	47.6	44.8	47.93
Iron (ppm)	0.15	0.19	0.56	4.38	6.63	7.09	7.46	6.59	7.31
Magnesium (ppm)	22.58	24	23.41	28.75	23.1	21.78	20.5	20.2	21.3
Sodium (ppm)	65.2	60.6	44.7	45.6	52.8	93.2	81.3	95.7	93.4

Lead, copper, zinc and cadmium were also analyzed during the above-mentioned period, but all their concentrations were under the detection limits (0.02 ppm for lead and for copper, 0.04 ppm for zinc and for cadmium) and for this reason they were not included in table 1.

The analyzed samples presented values for the dry residue at 180^0C ranging from 468 – 528 mg/ l, which placed this water source among oligomineral water sources according to EC Directive 80/ 777. As a function of CO_2 content of the water samples (308 – 374) mg/ l, these waters belongs to the category of carbonated mineral waters.

Statistical analysis of the data based on calculation of Kendall's tau correlation coefficients proved a strong correlation between the variation of

sodium and magnesium (0.722), followed by those for borates and magnesium (0.648), Cl^- and CO_2 (0,629), HCO_3^- and CO_2 (0.611), calcium and iron (0.556), calcium and CO_2 (0.556), sodium and sulphates (0.553), fluoride and sulphates (0.519), calcium and chloride (0.514).

Conclusions

The obtained results proved that the monitored parameters are below the maximum allowed values specified by HG 760/ 2001; the stability tests which were also carried out proved that the analyzed water is stable.

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