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Comparative Analysis of Drinking Water Mineral Composition

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Abstract. The purpose of this paper was to investigate the mineral and heavy metals concentrations in tap water, filtered water and bottled water. Minerals and heavy metals such as Ag, Be, Cd, Co, Li, Ni, Pb and Se, have not been identified (concentrations below 0.001 ppm), suggesting the absence of heavy metal contamination of drinking water in the area of the study. The samples had low concentrations for aluminum and strontium. The highest concentrations of macro-and micro-elements and toxic metals were found only in the well water samples collected from the Ramnicul Sarat and Focsani area, possibly because of higher soil pollution. For all drinking water samples, the highest mineral concentrations were found in essential macro-minerals such as sodium, potassium, calcium and magnesium. For calcium, the highest concentration was found in the well water samples from Focsani area.

Keywords: water**,** minerals, heavy metals, ICP-OES.

Introduction. Water is the most important food that can not be replaced. Water, the substance that supports life on Earth, with its beneficial qualities, is a major concern at global level. Some researchers argue that the disappearance of people on Earth could be caused by lack of water or catastrophic floods instead of other destructive factors like shortage of food (hunger) or contagious diseases (Ma et al, 2005). Practically, both in humans and animals offering a fresh, abundant supply of easily accessible drinking water at all times is essential. (Azrina et al, 2011). Also, quality drinking water should have adequate quality with low to absence of concentrations of impurities and potentially toxic metals such as heavy metals (Beede, 1991).

Aims and objectives. The aim of this paper was the identification of the main minarals and potentially toxic minerals (heavy matals) in drinking water sampled from home water systems (tap water, filtered tap water, and well water) and commercially available drinking water boteled in plastic and glass recepeints.

The objectives of this survay were: 1) to quantify of the concentration of the main minerals and potentaially toxic mineral in water samples from Râmnicu Sărat area and Focşan city; 2) to identify significat diferences between the water samples and compared to quality standards for drinking water.

The importantance of this study stems from the fact that its findings are usefull both for consumers and food industry because water is a food ingredient or it is used in food production.

Materials and methods. Samples of tap water, filtered water, bottled water and well water from Ramnicul Sarat region and Focsani city region, were collected and analyzed by ICP-OES.

The water samples collected are A1 to A14 as following: 5 samples of tap water, 5 samples of filtered water, 2 samples of bottled water, 1 sample of well water from Ramnicul

Sarat region and 1 sample of well water from Focsani city region. Each sample was acidified to 2% nitric acid with no previous concentration.

The sampled were analysed by ICP-OES. Three calibration standards were obtained by dilution from a multielement standard (Merck) which had total concentration of 1000 mg/L for each of the following minerals: Ag, Al, Ba, Be, Bi, Ca, Cd, Co, Cr, Cu, Fe, Ga, K, Li, Mg, Mn, Na, Ni, Pb, Se, Sr, Tl, and Zn. The total concentration of minerals in the calibration standards were 0.01 ppm, 0.1 ppm and 50 ppm respectively.

Results and discussions. The total concentrations of Ag, Be, Cd, Co, Li, Ni, Pb and Se were below the method detection limit (0.01 ppm) for all samples.

Table 1

Minerals concentration (ppm) in water samples (total concentration ± standard error)

Sample	Ba	Ca	Fe	K	Mg	Mn	Na	Sr	Zn
A1	0.4540 ±0.0007	39.96 ±0.41	-	2.827 ±0.017	4.800 ±0.055	-	10.87 ±0.13	17.93 ±0.0011	-
A2	0.0568 ±0.0007	39.10 ±0.81	-	2.784 ±0.058	4.732 ±0.058	0.0119 ±0.0002	11.22 ±0.26	17.40 ±0.0038	91.71 ±0.0042
A3	0.0601 ±0.0010	43.10 ±0.69	0.0210 ±0.0003	2.297 ±0.055	4.909 ±0.039	-	11.58 ±0.19	19.15 ±0.0034	49.29 ±0.0018
A4	0.0431 ±0.0009	38.50 ±0.64	-	2.694 ±0.015	4.602 ±0.057	-	10.73 ±0.18	16.91 ±0.0024	-
A5	0.0198 ±0.0004	43.05 ±0.23	0.0153 ±0.0036	3.139 ±0.004	4.830 ±0.042	-	15.02 ±0.55	17.78 ±0.0003	0.0813 ±0.0006
A6	0,0511 ±0,0007	37,22 ±0,52	0,0186 ±0,0021	2,293 ±0,047	4,258 ±0,018	0,0108 ±0,0003	13,14 ±0,26	0,1532 ±0,0025	0,8573 ±0,0089
A7	0,0530 ±0,004	41,04 ±0,33	0,0121 ±0,0010	2,710 ±0,040	4,965 ±0,063	0,0104 ±0,0001	12,78 ±0,01	0,1762 ±0,0016	0,4258 ±0,0053
A8	0,0406 ±0,0005	38,62 ±0,35	-	2,891 ±0,035	4,527 ±0,022	-	12,14 ±0,10	0,1737 ±0,0013	0,0149 ±0,0002
A9	0,0524 ±0,0011	41,43 ±0,59	-	2,623 ±0,051	4,828 ±0,071	0,0123 ±0,0001	12,78 ±0,23	0,1730 ±0,0025	0,9205 ±0,0101
A10	0,0402 ±0,0002	38,93 ±0,35	-	2,726 ±0,036	4,579 ±0,031	-	12,55 ±0,21	0,1740 ±0,0014	-
A11	0,0208 ±0,003	101,3 ±0,18	-	0,4521 ±0,0221	7,567 ±0,090	-	2,540 ±0,049	-	-
A12	0,0206 ±0,0002	104,2 ±0,13	-	0,4106 ±0,0125	7,307 ±0,122	-	2,530 ±0,053	-	-
A13	0,1262 ±0,0003	125,4 ±0,13	0,0120 ±0,0013	4,070 ±0,041	27,78 ±0,51	0,0737 ±0,0005	262,2 ±0,21	2,071 ±0,023	0,0778 ±0,0003
A14	0,2776 ±0,0020	176,5 ±0,22	0,0103 ±0,0019	5,839 ±0,033	44,49 ±0,51	0,0158 ±0,0001	28,63 ±0,21	2,306 ±0,032	0,1196 ±0,0053

It was also registered low levels of aluminium and strontium, potentially chronic toxic metals for the consumer.

Conclusions

The total concentrations of Ag, Be, Cd, Co, Li, Ni, Pb and Se in all samples were below the detection limit of the method (0.01 ppm).

The highest mineral concentrations were found in the in well water samples collected from the Ramnicul Sarat and Focsani area, possibly because of higher soil pollution in those areas.

All water samples had high concentrations of sodium, potassium, calcium and magnesium. The sample from Focsani area had the highest calcium concentration.

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