THE EVALUATION OF DRINKING WATER QUALITY IN TIRANA CITTY, ALBANIA BY THE DETERMINATION OF HEAVY METALS CONTENT USING ICP-MS METHOD.

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1.INTRODUCTION

Water contamination from trace elements (TE) is one of the most important health and environmental issues all over the world, as most of them are toxic even at low concentration levels. TEs, present in trace quantities, are essential for living bodies, but when they exceed certain limits, they may be a concern due to their toxic effects. This study was carried out to evaluate the quality of drinking water in Tirana, the capital city of Albania, by estimating the TE content of tap water.

Thirty tap water samples were collected randomly over the entire territory of Tirana. The elements Hg, Ca, Fe, K, Mg, Na, Ag, Al, As, Ba, Be, Cd, Co, Cr, Cu, Mn, Mo, Ni, Pb, Sb, Se, Th, Tl, U, V, Zn were determined by inductively coupled plasma mass spectrometry (ICP-MS), known as a very sensitive analytical technique. Statistical analysis of the data was carried out using Exceel and Minitab 17 package programs. In general, the TE content of Tirana's tap water was lower than the WHO and national permitted levels, with the following order of distribution (based on median values): Ca > Na > Mg > K > Al > Zn > Ba > Fe > Cu > Ni > Se > Mo > V > Mn > Cr > As = U > Sb > Pb > Co = Hg. The TEs of this study show low to moderate variations (CV % < 75 %), except Cr, Mn, Fe, Co, Ni, Cu, Zn, Hg, Pb and U that exhibit high CV % values (Cr: 142%, Mn: 234%, Fe: 170%, Co: 377%, Ni: 120%, Cu: 191%, Zn: 169%, Hg: 95%, Pb: 223%), indicating effects of mixed factors.

Based on the standards of the World Health Organisation (WHO) and Europian Commission , the levels of heavy metals under investigation didn't exceed the stipulated limits for drinking water by recommending it to be used as drinking water. As elevated TE content in water may pose significant health risks, continuous monitoring of the quality of drinking water in Tirana is recommended.

Keywords: *Trace elements, Drinking Water Quality, ICP-MS, Statistical Analysis*

4. METHODS

The elements Hg, Ca, Fe, K, Mg, Na, Ag, Al, As, Ba, Be, Cd, Co, Cr, Cu, Mn, Mo, Ni, Pb, Sb, Se, Th, Tl, U, V, Zn were determined in the Heavy Metals Laboratory at Food Safety and Veterinary Institute, Tirana, Albania by inductively coupled plasma mass spectrometry (ICP-MS), known as a very sensitive analytical technique.

The descriptive statistic analysis was applied to analytical data for better understanding the level and the variation on the parameters under investigation. MINTAB 17 software package was used for statistical analysis of the data.

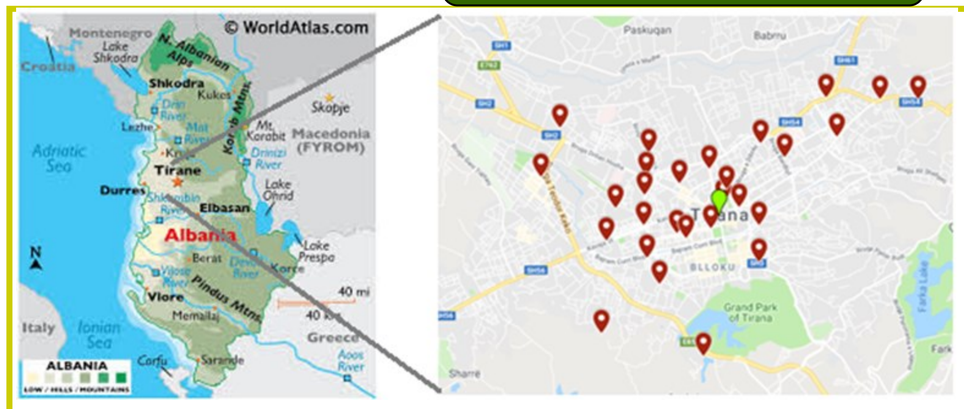
6. CONCLUSION

1. ICP / MS analysis is successful even for low content.
2. Multi-element analysis combined with statistical processing makes it possible to carry out a very complete study in terms of the level of content of the elements taken in the study and the study of factors that have influenced their levels of content.
3. From the comparison of the metal content in the samples taken in the study with the maximum allowed levels given by WHO and Council Directive 98/83/EC, it is noticed that the water cork of Tirana is suitable to be used as drining water. According to these results, Tirana drinking water is within the allowed norms in terms of metal content.
4. "Outlier" values for different elements indicate that the monitoring of these parameters must be continuous.

2.PURPOSE

The aim of this study was to estimate the quality of drinking water of Tirana city, the capital of Albania. For this purpose, the level of some trace elements (Hg, Ca, Fe, K, Mg, Na, Ag, Al, As, Ba, Be, Cd, Co, Cr, Cu, Mn, Mo, Ni, Pb, Sb, Se, Th, Tl, U, V, Zn) in tap water collected in different parts of Tirana region, were determined and compared to recommended drinking water standards set by the World Health Organisation (WHO,2008) and Council Directive 98/83/EC (Council Directive 98/83/EC, 1998).

3.SAMPLE



Tap water samples were collected randomly according to a network of 30 stations in Tirana

Sample collection, transport and conservation were done according to Standard Methods.

Figure 1. Network *of sampling points*

5.RESULTS AND DISCUSSION

Table 1. The results of factor loadings obtained from Factor analysis

Elements	Factor1	Factor2	Factor3	Factor4	Cummulative
^{78}Se [He]	0.954				0.983
^{75}As [He]	0.925				0.968
^{51}V [He]	0.921				0.906
^{121}Sb [He]	0.891				0.878
^{137}Ba [He]	0.862				0.974
^{95}Mo [He]	0.850				0.989
^{27}Al [He]	0.818	-0.472			0.943
^{24}Mg [He]	0.774	0.560			0.989
^{23}Na [He]	0.729	0.525			0.992
^{39}K [He]	0.609		0.633		0.947
^{59}Co [He]		0.941			0.920
^{55}Mn [He]		0.922			0.933
^{238}U [He]		0.896			0.997
^{52}Cr [He]		0.868			0.952
^{44}Ca [He]		0.737			0.970
^{56}Fe [He]			-0.879		0.789
^{66}Zn [He]			0.871		0.843
^{60}Ni [He]		0.500	0.806		0.917
^{63}Cu [He]			0.784		0.774
^{208}Pb [He]			0.689		0.729
^{202}Hg [He]				0.435	0.703
Variance	7.253	5.574	4.452	1.195	18.474
Variance%	0.345	0.265	0.212	0.057	0.880

From the results obtained from the factor analysis, four main factors were extracted. They represent 88% of the total variance.

Factor 1. This factor is the main factor which represents 34.5% of the total variance and high positive loadings (> 0.5) for the elements Na, Al, Mg, K, V, As, Se, Mo, Sb and Ba. The high values of these elements indicate the influence of similar factors and similar antropogenic sources of origin.

Factor 2. This is the second strong factor, which represents 26.5% of the total variance. The high loadings contribution of the elements Ca, Cr, Mn, Co, U in this factor shows that it has to do with the geogenic contribution.

Factor 3 represents 21.2% of the total variance. High loadings of elements Fe, Ni, Cu, Zn, Pb is probably related to the influence of old pipelines, atmospheric deposition, as well as emissions from traffic at source.

Factor 4. This is the weakest factor representing only 5.7% of the total variance and is accompanied by the presence of only one element, Hg, which may be associated with long range transport of the pollutants.

The maximum concentration of As, Se and Pb elements in tap water samples do not exceed the drinking water limits set by regulatory agencies such as World Health Organisation (WHO,2008) and Council Directive 98/83/EC (Council Directive 98/83/EC, 1998) (see Table 4) by indicating the tap water of Tirana is suitable to be used as drinking water.

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