



# Testing The Effectiveness Of Removing Toxic Elements By Clinoptilolite

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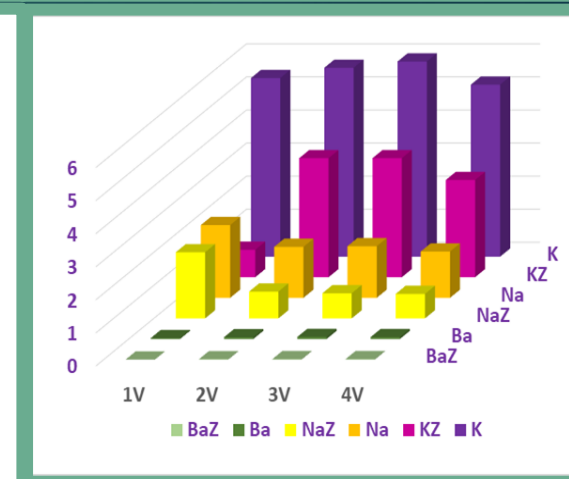
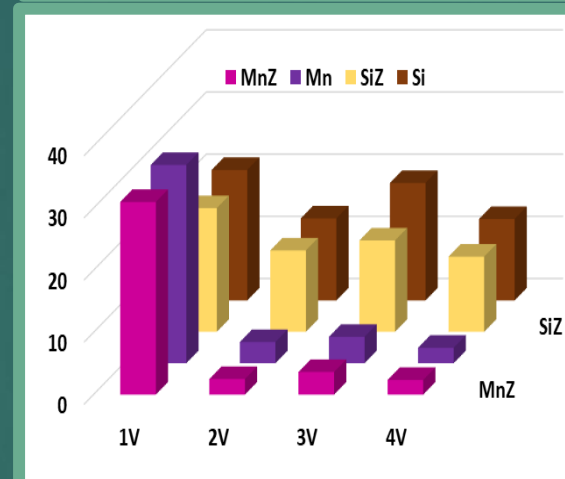
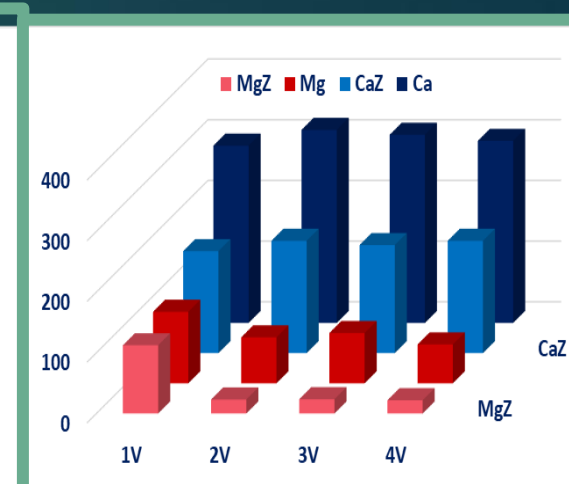
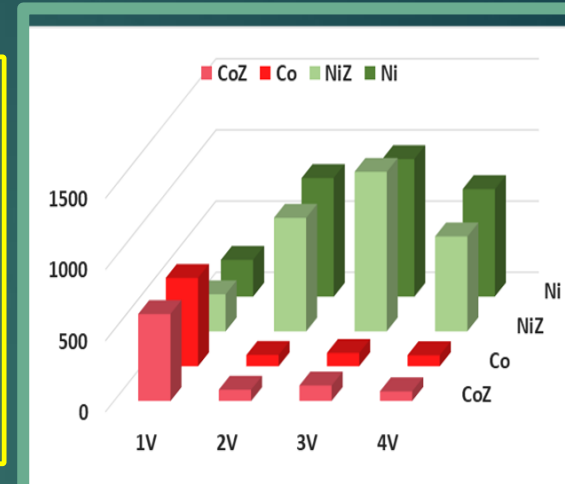
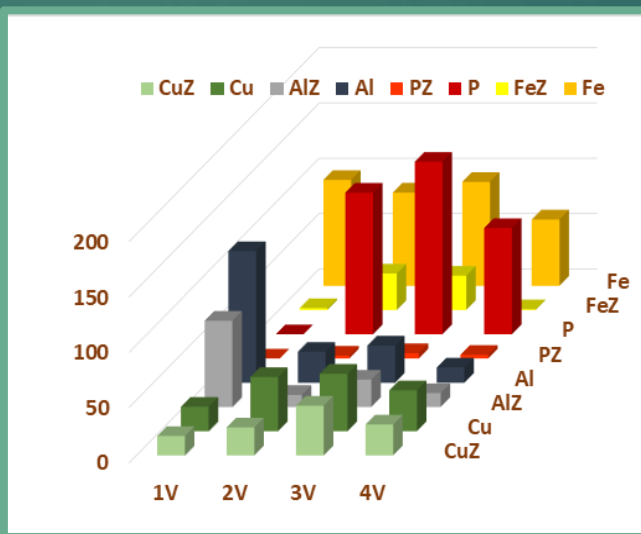
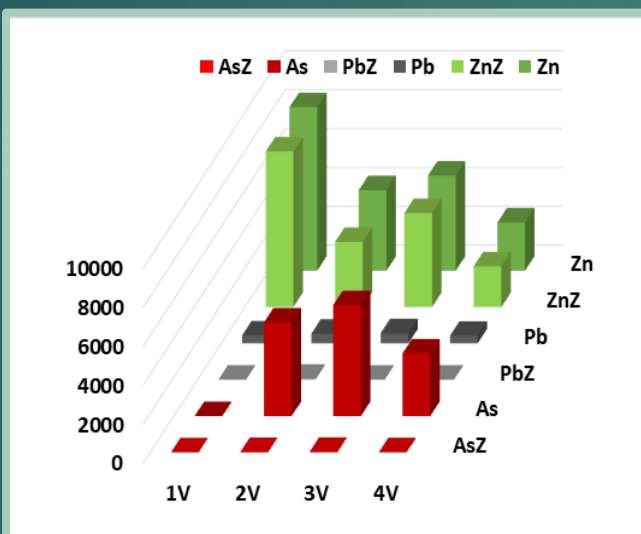
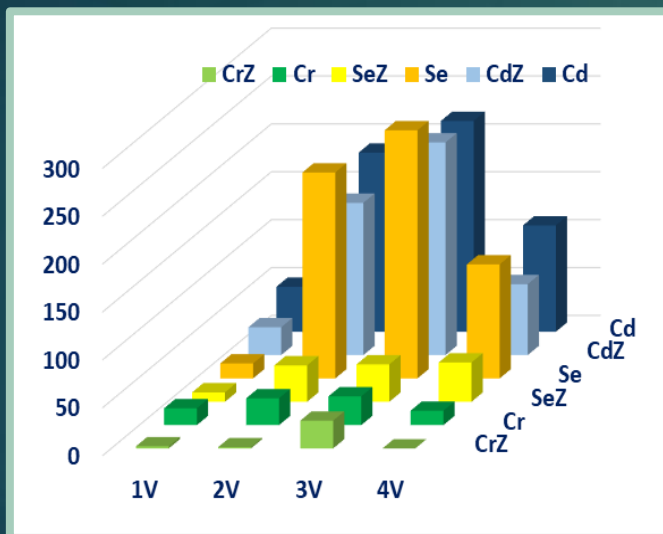
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The aim of this work was to examine the ion exchange characteristics of the dietary product zeolite-clinoptilolite on water samples from four locations of the River Borska. ICP-OES was used for the simultaneous determination of 19 elements before and after the treatment of water with zeolite (24 hours at room temperature). Based on the efficacy of the removal of ions from the solution and the balance of ions modified from zeolite, it can be concluded that from the point of view of dietary application, clinoptilolite does not release toxic elements (As, Pb, Cd, Al, Cr), and does not capture electrolytes.

**Conclusion:** The results of the experiment show that the affinity of the zeolite is the highest for Pb and the lowest is for Mn. Within each of these trends, smaller sequences of efficiency trend presented in literature are recognized: **Pb>Cd>Cu>Zn>Ni**, **Pb>Cu>Zn≈Cd≈Ni** (Panayotova and Velikov, 2002); **Fe>Al>Cu>Zn>Mg>Mn** (Cui et al., 2006), **Pb>Cr>Fe≥Cu** (Inglezakis and Grigoropoulou, 2004).



The content of Cr, Se, Cd, As, Pb, Zn, Cu, Al, P and Fe in the analyzed water samples before and after the treatment with clinoptilolite.

The content of Co, Ni, Mn, Si, Ba, Na, K, Mg and Ca in the analyzed water samples before and after the treatment with clinoptilolite.

Efficacy (%) of elements removal by clinoptilolite.													
Sample	Cr	Se	Cd	As	Pb	Zn	Cu	Al	P	Fe	Ni	Co	Mn
1V	8.4	37.2	38	/	100	4.8	20.4	34.5	/	98.2	0	1.5	0
2V	95.4	82.3	15.0	99.7	88.6	19.1	48.4	61	98	60.8	4.20	0	36*
3V	90.3	85.0	0	99.5	100	1.37	13.5	26.5	96.9	67	0	17.2*	16.8*
4V	100	65.5	33.3	99.8	100	15.5	24.3	9.4	96.5	98.8	11.7	11.7	5.53*

Element exchange trend from zeolite	
Mg, Na	3V>2V>4V>1V
Ca	3V≈1V>2V>4V
Ba	1V>3V>2V≈4V
K	1V>4V>3V>2V

Element abundance in water samples	
Ni, P, As, Cd, Cu, Se	3V>2V>4V>1V
Zn, Fe, Al, Co, Mn, Si	1V>3V>2V>4V
Pb, Cr	3V>2V>1V>4V

Trend of effectiveness of elements removing by clinoptilolite:

- 1V) **Pb>Fe>Cr>Cd>Se>Al>Cu>Zn>Co>Ni>Mn**
- 2V) **As>P>Cr>Pb>Se>Fe=Al>Cu>Zn>Cd>Ni>Co>Mn**
- 3V) **Pb>As>P>Cr>Se>Fe>Al>Cu>Zn>Cd>Ni>Co>Mn**
- 4V) **Pb=Cr>As>Fe>P>Se>Cd>Cu>Zn>Al>Ni>=Co>Mn**

**References:**  
Inglezakis V. J., Grigoropoulou H. (2004). J. Hazard. Mater. B112, 37-43  
Panayotova M., Velikov B., (2002). J. Environ. Sci. Heal. A37, 139-147.  
Cui H., Li L. Y., Grace J. R., (2006). Water Res. 40, 3359-3366.

\*Content higher after zeolite

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