YKC Skopje, Macedonia

Zeolite and Lavender heavy metal hunters in restoring soil

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The main reason why we chose this project is because they have a bad influence on people's health and overall wellbeing, that's why we want to prevent this occurrence. One of the ways to get rid of these futile materials is by using the mineral Zeolite. ***We chose Zeolite and Lavender as ways of cleaning the soil because this method is cost-efficient****. Our goal is to prove that contaminated soil can be revitalized by this tectosilicate and after that it can be used for agricultural purposes. Formerly we took soil samples from the highly radioactive industrial area in the city of* ***Veles, Macedonia.*** *Secondarily the soil samples were examined and we confirmed that the land was corrupt. In the experimental part we used Zeolite and lavender. It took 3 months for the detoxifiers (Zeolite and Lavender) to react with the soil. Meanwhile we planted wheat in bowls with soil and foliar feeding zeolite for us to able to notice the quantity difference of heavy alloys in each pot. After three months we took samples from the soil and had them tested separately using an atomic absorber ICP OES. The atomic absorber gave us the envisioned outcome. With the utility of the zeolite, the volume of heavy metals is substantially decreased. Considering that the results are positive, our research showed that the soil is up to* ***96% cleaned****. We can use this method for improving the environment, getting cleaner soil, more refined products and an overall purer way of being.*

For this experiment It was necessary for us to do examination on different concentrations of zeolite and lavender. The weight of the soil was divided in equal concentrations (300g in each pot accordingly). In the first four pots we used 300g of soil and 10% zeolite (30g) that was thoroughly mixed. The next four pots containing the same amount were stirred with 15% zeolite (45g). The last four pots we put 20% zeolite (60g) with the same amount. In addition, there were four more pots containing 300g of soil in which we added lavender. All of the pots contained different amounts of dried lavender (2g, 4g, 6g and 8g). In total we used 20g of lavender. Meanwhile we planted seeds in the pots, 10g each.

While the wheat was growing, we continuously watered and spraying it.

After three months of watering and spraying the pots we took the soil and tested its heavy metal concentration. We got our results ready and compared the initial condition of the soil and the cleansers with the results from the samples. In the beginning it was obvious that Cd and Pb were very strong represented in the soil but after putting zeolite and lavender inside it the quantity of heavy metals is decreased.

Before mixing the soil with the zeolite and lavender:

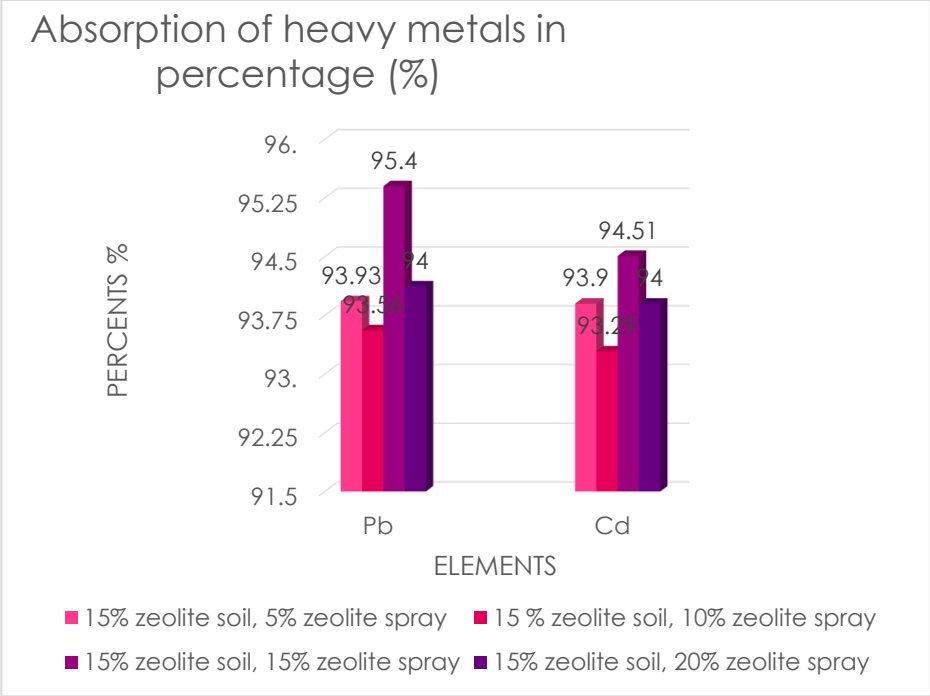
INITIAL CONDITION OF ZEOLITE AND SOIL			
Element	**Zeolite**	**Lavender**	**Soil**
Cd mg/kg	333.34	302.5	5438
Pb mg/kg	10.67	10.5	164

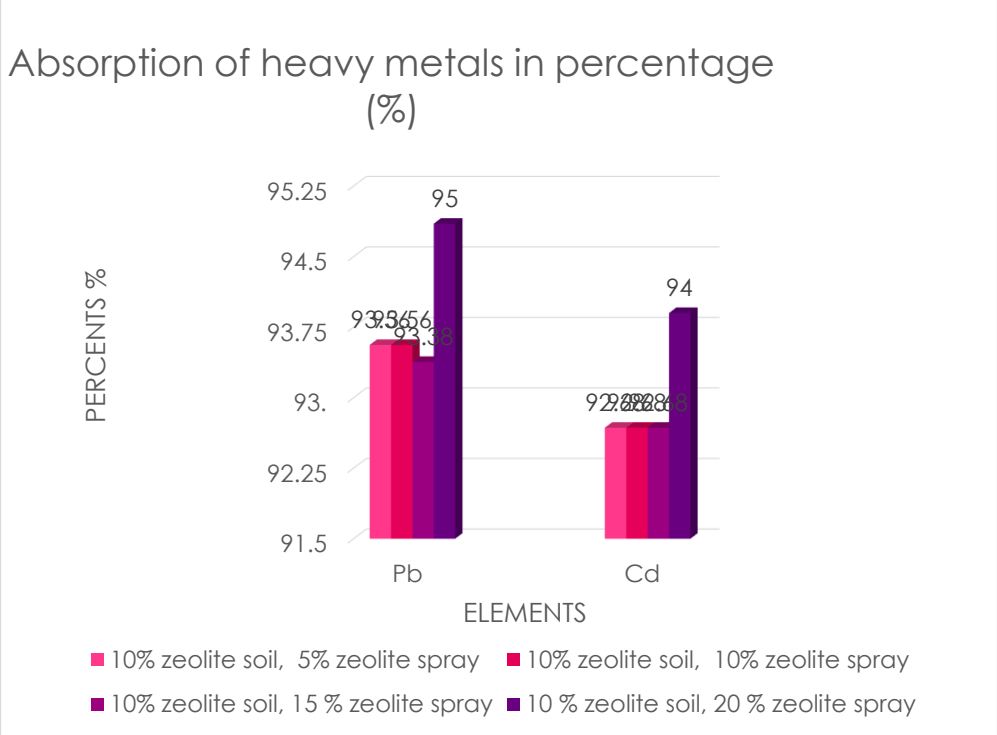
After mixing the soil with the zeolite and lavender here are the supplied results:
From this table we can notice that the transfer of cadmium and lead from the soil to the plant is different. Additionally, we can perceive that when the zeolite is powdered and the lavender is grained, they are more efficient and the main reason for that is because they cover greater specific area. The most important part is that the zeolite keeps the heavy metals (Cd and Pb) inside itself and enables them to enter the plant. The reason of this is because the specific covering of the cleansers (powdered zeolite and grained lavender) have a better ionic change on a molecular level. If we plant a seed which grows for a couple of months the efficiency of the purifiers will increase because the more, they stay in the soil the more it reacts.

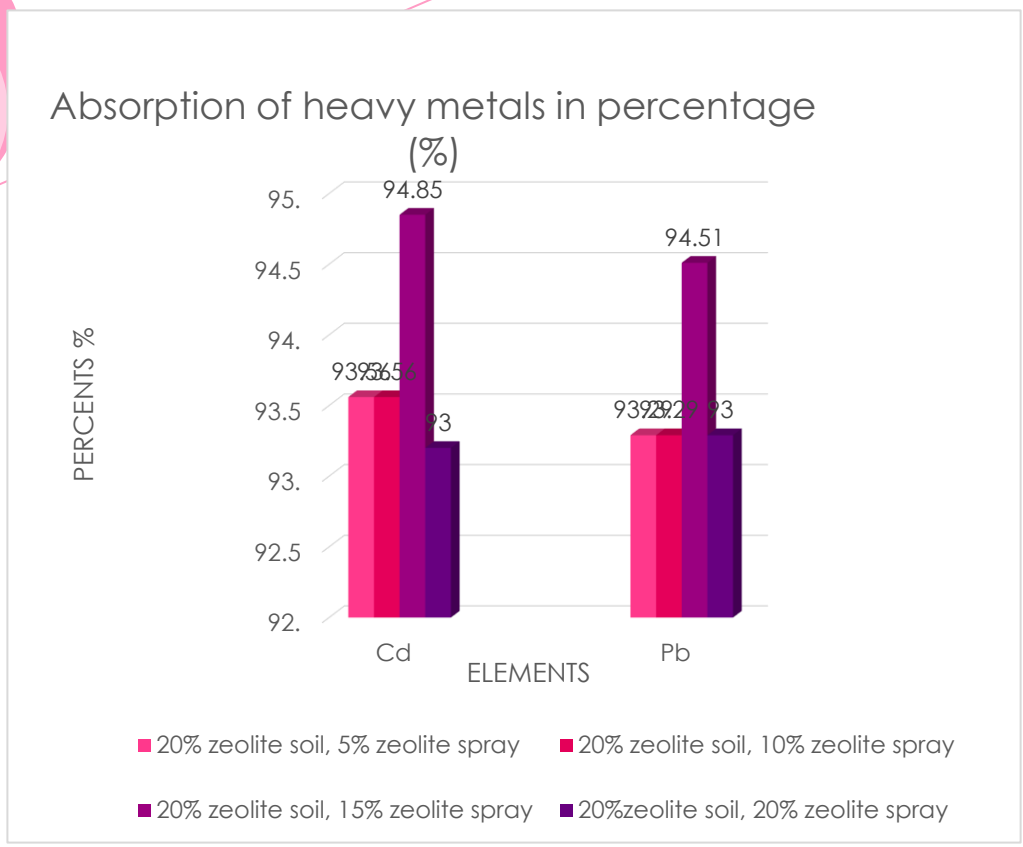
Amount of heavy metals left in the soil after the zeolite and lavender				efficiency of metal removal in %	
No	**Samples**	**Cd, mg/kg**	**Pb, mg/kg**	**Cd, mg/kg**	**Pb, mg/kg**
1	Without Zeolite	5438	164		
2	10 % zeolite soil, 5 % zeolite spray	380	12	93.68%	93.56%
3	10 % zeolite soil, 10 % zeolite spray	380	12	92.68%	93.56%
4	10 % zeolite soil, 15 % zeolite spray	360	12	92.68%	93.38%
5	10 % zeolite soil, 20 % zeolite spray	280	10	93.9%	94.85%
6	15 % zeolite soil, 5 % zeolite spray	330	10	93.9%	93.93%
7	15 % zeolite soil, 10 % zeolite spray	350	11	93.29%	93.56%
8	15 % zeolite soil, 15 % zeolite spray	250	9	94.51%	95.4%
9	15 % zeolite soil, 20 % zeolite spray	320	10	93.9%	94.12%
10	20 % zeolite soil, 5 % zeolite spray	350	11	93.29%	93.56%
11	20 % zeolite soil, 10 % zeolite spray	350	11	93.29%	93.56%
12	20 % zeolite soil, 15 % zeolite spray	280	9	94.51%	94.85%
13	20 % zeolite soil, 20 % zeolite spray	370	11	93.29%	93.2%
14	0.7% - 2g dried lavender	280	10	93.9%	94.85%
15	1.4% - 4g dried lavender	260	10	93.9%	95.21%
16	2% - 6g dried lavender	380	11	93.29%	93.56%
17	2.7% - 8g dried lavender	290	11	93.29%	94.67%

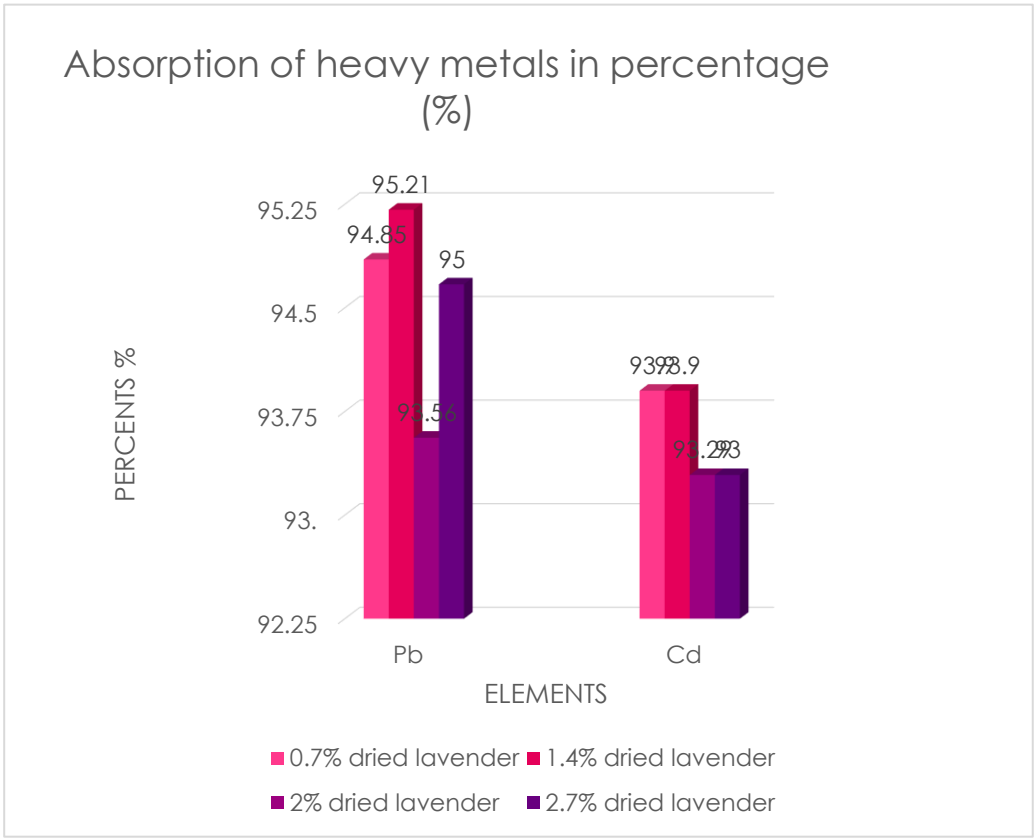
Conclusion

The high porosity of the zeolite is related to its specific opened area which enables it to make an easy and efficient cationic exchange with the soil whereupon it takes a big part of the heavy metals and exchanges them with cations from the zeolite K, Na, Ca and Mg, these cations are useful for the soil and the living organisms. Also, the zeolite stops the migration of the heavy metals that are should enter in the root of the vegetable which later are going to be consumed. With this experiment passive decontamination of the soil is done, respectively revitalization of the soil ensuring safer use as an agricultural medium. While decreasing the number of heavy metals that are entering in our, we decrease the possibility of getting ill.






Absorption of heavy metals in percentage (%)
PERCENTS %
95.
94.5
94.
93.5
93.
92.5
92.
94.85
94.51
93
Cd
Pb
ELEMENTS
20% zeolite soil, 5% zeolite spray
20% zeolite soil, 10% zeolite spray
20% zeolite soil, 15% zeolite spray
20%zeolite soil, 20% zeolite spray


Absorption of heavy metals in percentage (%)
PERCENTS %
95.25
94.5
93.75
93.
92.25
95.21
94.85
95
93.53
Pb
Cd
ELEMENTS
0.7% dried lavender
1.4% dried lavender
2% dried lavender
2.7% dried lavender