



“Heavy Metal Removal with Organic Materials”

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Purpose of the project

This study was conducted to investigate the effect ZEOHITE, BURNT EGGSHELL and its ability of heavy metal absorption.

The Heavy metals that we used were: Zinc (ZnSO₄), Copper (CuSO₄), Lead (Pb(NO₃)₂), Chromium(Na₂Cr₂O₇). We used these heavy metals altogether since we tried achieving the same level of pollution like the ones in the most polluted waters flowing in N. Macedonia (Chromium was added to test absorption/extraction efficiency).

Different parameters such as amounts and absorption of heavy metals were evaluated. Our goal is to prove that with this natural resources we can make the quality of water much better, especially the quality of polluted water, and with that we can make better conditions for living and a better environment for our lives.

For our project we chose the zeolite, burnt eggshell. The reason was that they are easily accessible, natural and cheap to people.

Extra Information

Eggshells

An eggshell is the hard, outer covering of an egg. It consists mostly of calcium carbonate, a common form of calcium. The rest is made up of protein and other minerals. Calcium is an essential mineral that is abundant in many foods, including dairy products.

Zeolite

Zeolites are microporous stones with a lot of minerals. They are well known for their absorption properties. The term “Zeolite” is introduced by Cronstedt in 1756 and comes from Greek words: ζέω (zeō), that means “boil” and λίθος (lithos), that means “stone”.

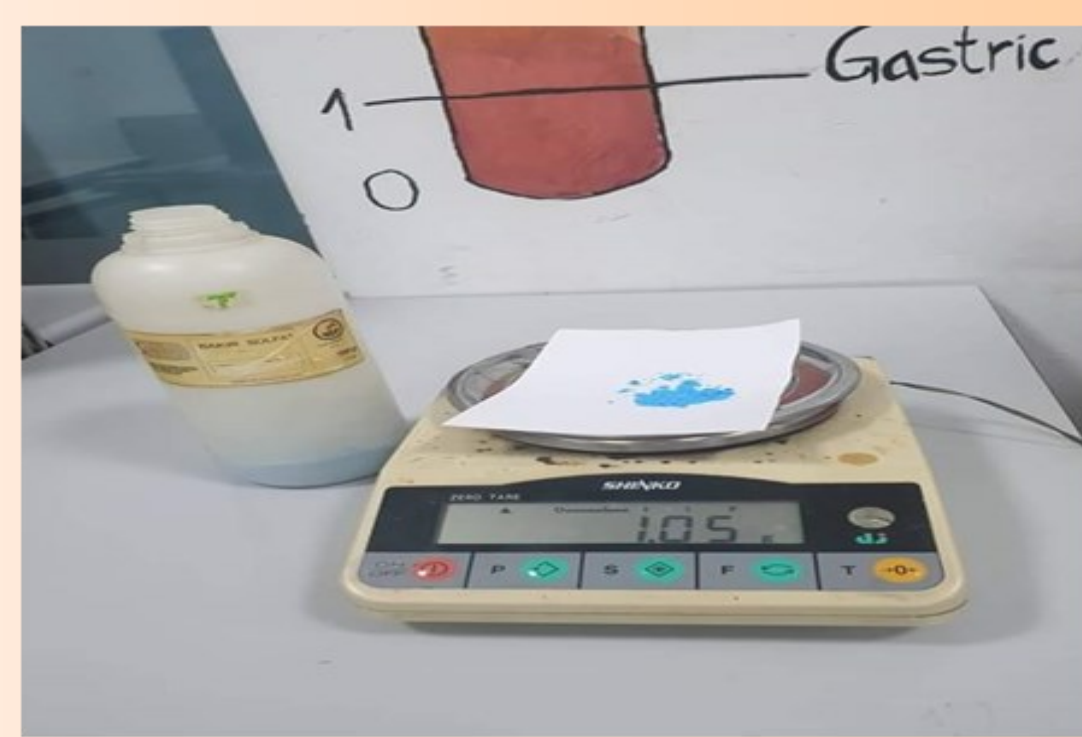
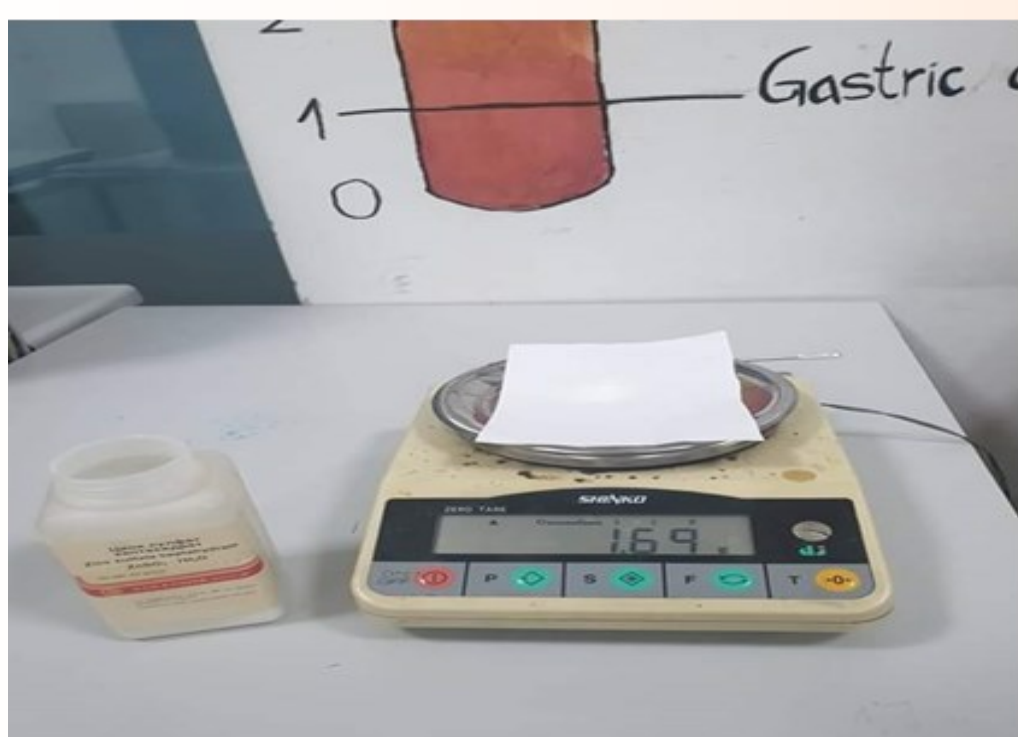
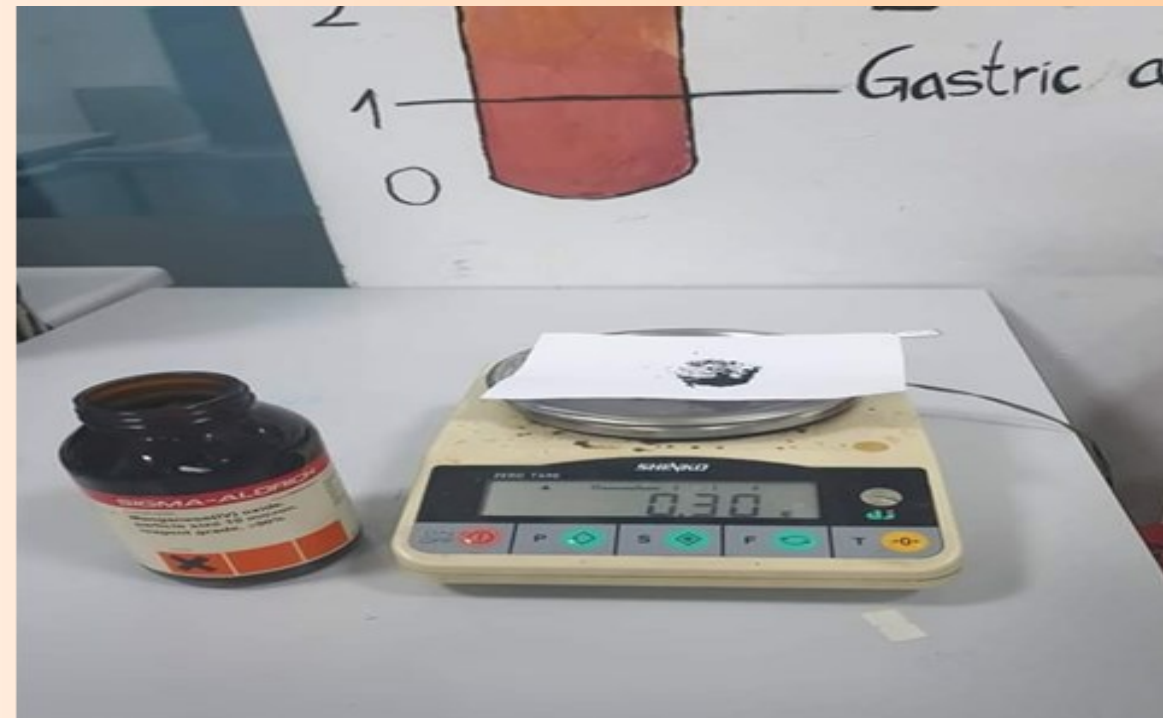


Preparing solutions

We did the solutions using:

- CuSO₄ - Copper (II) Sulphate - 0.0066 mol/l
- Pb(NO₃)₂ - Lead (II) Nitrate - 0.0059 mol/l
- Na₂Cr₂O₇ - Sodium Dichromate - 0.00388 mol/l
- ZnSO₄ - Zinc (II) Sulphate - 0.002 mol/l

Concentration is similar as heavy metals that occur in real conditions in N. Macedonia.



Making the Solution

The first step in our experiment was making the solutions. At first we put our salts on separate pieces of paper. We calculated how much salt we needed for each solution using their molar mass, then we weight the salts on a piece of paper .

Afterwards we dissolved the salts in 1l of distilled water.

Procedure

After the solutions were prepared we mixed them in to 100ml urinal cups. We used 20ml of each solution making the final solution 80ml. Then we added a specific mass of a reagent (eggshells, zeolite, bay leaf). We added magnet stirrers and closed the urine cups' lids. We stirred them for 15min. When it was done stirring we did a simple gravity filtration with a coffee filter. We packed the samples for testing

Testing

We sent the testing samples to Kiril Metodi University , Maths and Natural Sciences Faculty. In order to easily receive results regarding our experiments, we used the finest and the most certain one, the (ICP- OES) meaning inductively coupled plasma optical emission spectrometry, which is an analytical technique used for the detection of trace metals. By this machine

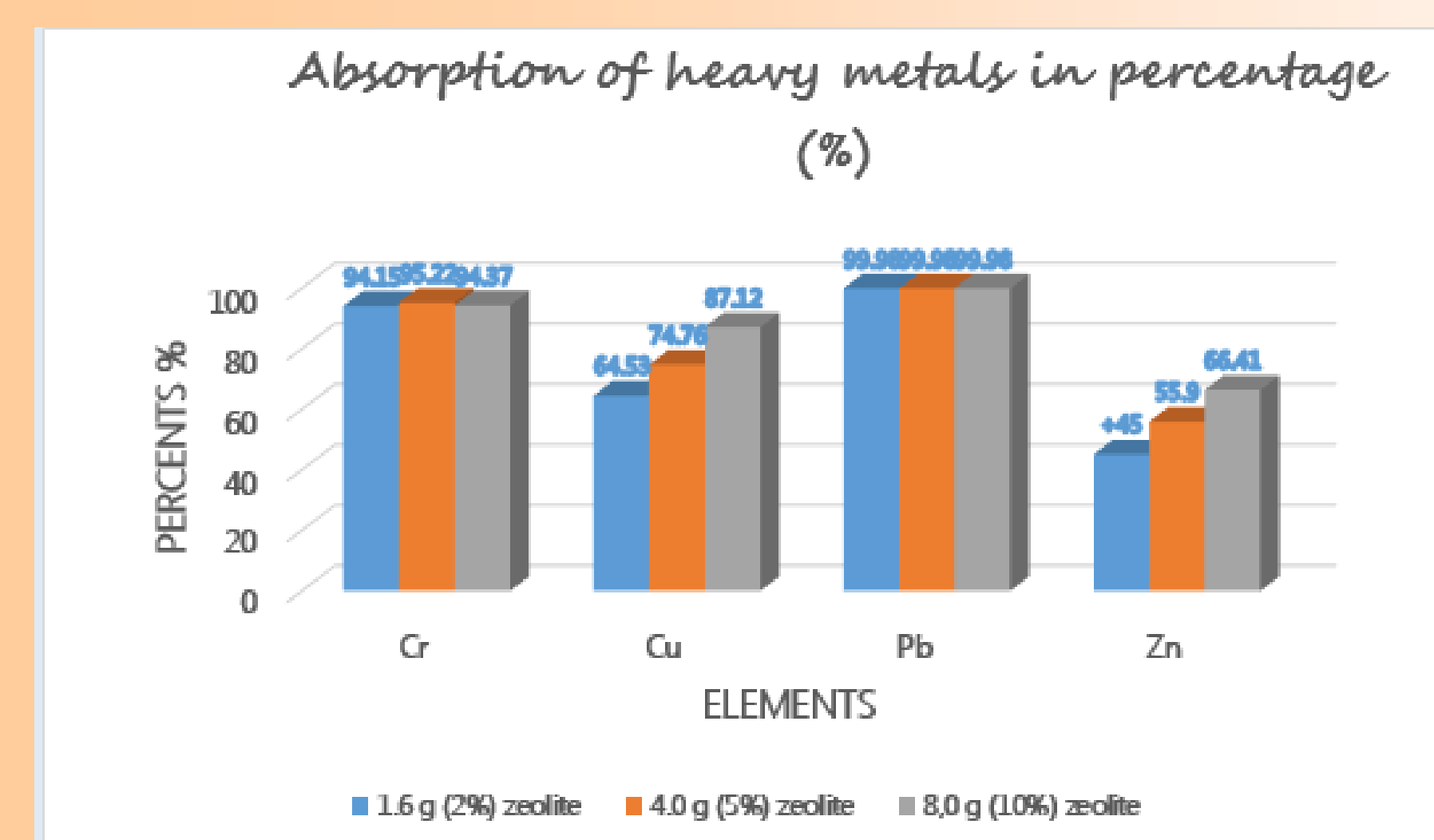
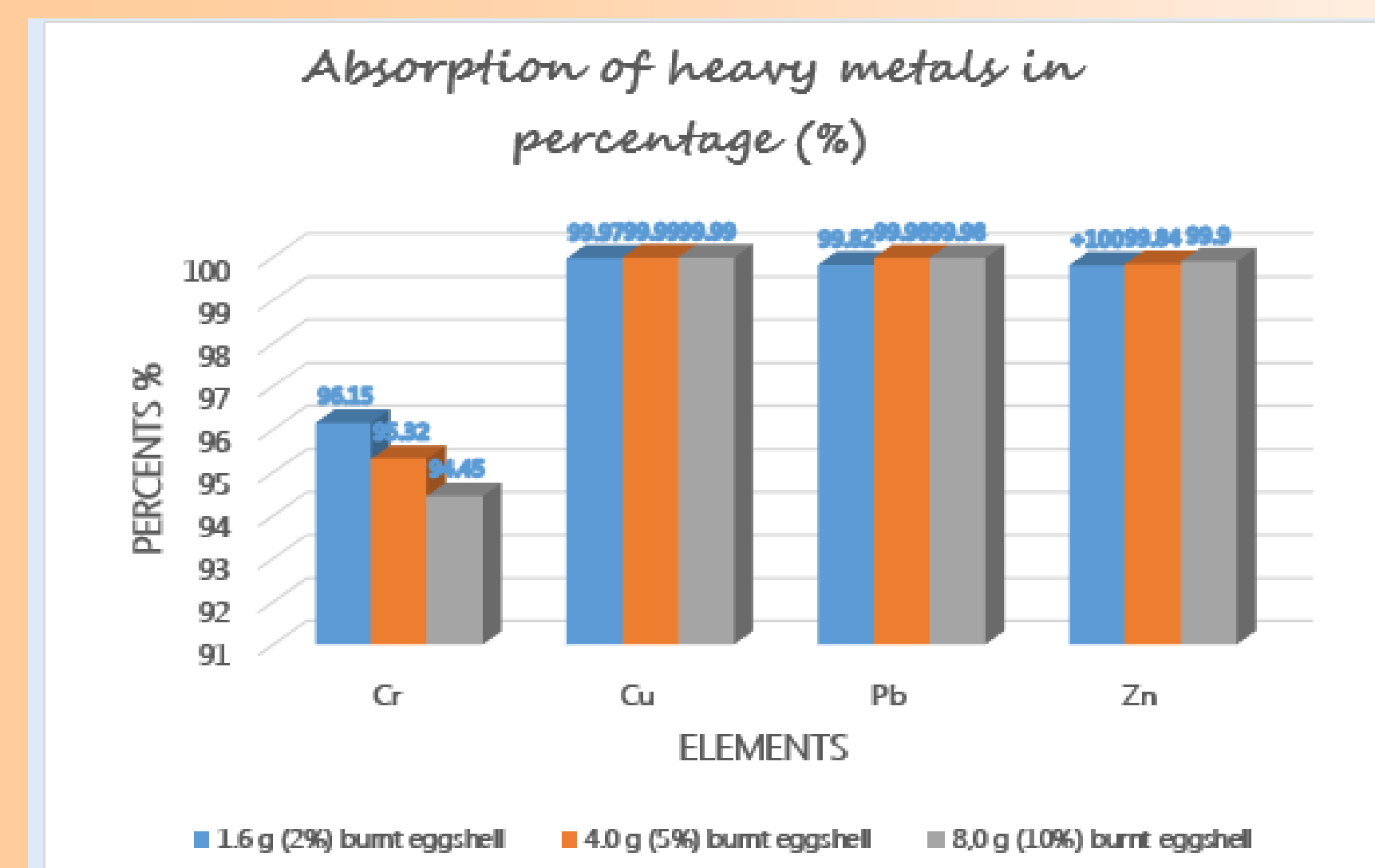
Results

Chemicals	Names of chemicals	Moles of chemicals	Molar mass of chemicals
CuSO ₄	Copper (II) Sulphate	0.0066 mol/l *4	159.609 g/mol
ZnSO ₄	Zinc (II) Sulphate	0.0059 mol/l *4	287.53 g/mol
Pb(NO ₃) ₂	Lead (II) Nitrate	0.002 mol/l *4	331.2 g/mol
Na ₂ Cr ₂ O ₇	Sodium dichromate	0.00388mol/l *4	261.97 g/mol

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types of reagents	amount of reagent	RESULTS AMOUNT OF HEAVY METALS AFTER ANALYSIS			
		Cr (µg/ml)	Cu (µg/ml)	Pb (µg/ml)	Zn (µg/ml)
Zeolite in 80ml solution	1.6 g (2%)	23.4	149	< 0.1	214
	4.0 g (5%)	19.1	106	< 0.1	172
	8.0 g (10%)	22.5	54.1	< 0.1	131
Ca(OH) ₂ in 80ml solution	1.6 g (2%)	15.4	0.12	0.74	0.74
	4.0 g (5%)	18.7	0.05	< 0.1	0.64
	8.0 g (10%)	22.2	0.02	< 0.1	0.39

types of reagents	amount of reagent	ABSORPTION OF HEAVY METALS IN PERCENTAGE (%) PERCENTAGE OF HEAVY METALS AMOUNT(%)			
		Cr (µg/ml)	Cu (µg/ml)	Pb (µg/ml)	Zn (µg/ml)
Zeolite in 80ml solution	1.6 g (2%)	94.15	64.53	99.98	45.13
	4.0 g (5%)	95.22	74.76	99.98	55.9
	8.0 g (10%)	94.37	87.12	99.98	66.41
Ca(OH) ₂ in 80ml solution	1.6 g (2%)	96.15	99.97	99.82	99.81
	4.0 g (5%)	95.32	99.99	99.98	99.84
	8.0 g (10%)	94.45	99.99	99.98	99.9



Conclusion

The results presented in the tables show the amounts of each element left in the solution. We got our results in ppm but we converted those amounts in percentages which are cleaned for better representation and also for a clearer way of showing the efficiency of our method.

This is one of the best ways to purify the water, and it's totally safe and very accessible because it's cheap and very natural.

When the heavy metals are all mixed together:

With Zinc, the best absorption percentage is achieved by the help of Ca(OH)₂ (10%): all above 99.9 %

With these types of testing the best results we got were with Lead with each one of the materials (the results varied between 99.82%-99.98%).

We were provided with the needed chemicals and equipment like the magnetic stirrer, electronic scale, chemical substances, lab equipment and the laboratory where we did the experiment, by our school, Yahya Kemal College. The other materials which were needed for the realization of the experiment were bought by us, including filtrating paper, distilled water, cups.

With this invention we can make our future and health brighter than now, it's up to us people and together we can make the first step for brighter future.