Studies Regarding the Removing of Mercury from Soil Using Na-EDTA, Na$_2$S$_2$O$_3$ and KI Solutions

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Mercury is one of the most toxic heavy metals. Mercury is outstanding among the global environmental pollutants of continuing concern. Mercury has a neurotoxic potential with tendency to bioaccumulation and biomagnification in the food chain and as a result, it represents a prospective threat for human and ecological health [1-3]. We can find mercury in air, in water and in soil.

In this paper it has been done an experimental work regarding the optimal condition of removing mercury from soil using 0.1M solution of Na-EDTA, Na$_2$S$_2$O$_3$ and KI. A soil sample contaminated by mercury was sieved and classified into three fraction of different particle size. A soil sample of each fraction were treated with very well determined volumes of extraction solutions into a liquid : solid ratio (L : S) of: 5:1, 6:1, 7:1, 8:1 and 10:1. They were shaken in a shaker for different period of time (15 min., 30 min., 1h, 2h and 5h). After that, the soil sample were filtered, and the resulted solution was analysed. The extracted mercury concentration was determined by atomic absorption spectrophotometry. To determine the optimal condition of removing mercury from soil sample it was determined the dependence between the extracted mercury concentration and the L : S ratio, shaking time, soil particle size and the type of extraction solutions.

Results and discussions

Soil sample analyses

The experimental results concerning the initial concentration of mercury from the soil samples classified in three fractions are showed in table 1.

<table>
<thead>
<tr>
<th>Table 1</th>
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<tr>
<td><strong>THE INITIAL CONCENTRATION OF MERCURY FROM THE SOIL SAMPLES CLASSIFIED IN THREE FRACTIONS</strong></td>
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<table>
<thead>
<tr>
<th>Soil fraction</th>
<th>Initial concentration of Hg mgHg/g dry soil</th>
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<tbody>
<tr>
<td>I</td>
<td>3.88</td>
</tr>
<tr>
<td>II</td>
<td>2.63</td>
</tr>
<tr>
<td>III</td>
<td>2.46</td>
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</tbody>
</table>

The experimental results concerning the dependence between concentration of extracted mercury and time and L : S ratio when a Na-EDTA solution was used for extraction, are showed in figures 1-3.

The experimental results show that for all the three particle size, the extracted mercury concentration increases with the increasing of shaking time. It shows that for a shaking time longer that 2h, the increasing of mercury concentration is not significant. That is why we considered that the optimal shaking time is 2h.

Also it shows that up to L : S ratio 7:1 the concentration of extracted mercury increase for all the three particle size.
After that decrease slowly. That is why we considered that the optimal L: S ratio is 7: 1.

Extraction with Na$_2$S$_2$O$_3$

The experimental results concerning the dependence between concentration of extracted mercury and time and L : S ratio when a Na$_2$S$_2$O$_3$ solution was used for extraction, are showed in figures 4-6.

The experimental results show that for all the three particle size, the extracted mercury concentration increases with the increasing of shaking time up to 2h. After that it slowly decreases. That is why we considered that the optimal shaking time is 2h.

Also it shows that up to L: S ratio 7: 1 the concentration of extracted mercury increase for all the three particle size. After that decrease slowly. That is why we considered that the optimal L: S ratio is 7: 1.
The experimental results concerning the dependence between concentration of extracted mercury and time and L : S ratio when a KI solution was used for extraction, are showed in figures 7-9.

The experimental results show that for all the three particle size, the extracted mercury concentration increases with the increasing of shaking time up to 1h. After that it slowly decreases. That is why we considered that the optimal shaking time is 1h.

Also it shows that up to L : S ratio 7:1 the concentration of extracted mercury increases for all the three particle size. After that decrease slowly. That is why we considered that the optimal L : S ratio is 7:1.

Comparing the results for the three solution used (Na-EDTA, Na2S2O3 and KI) it can be established the optimal condition for mercury extraction. Those condition are showed in table 2.

According to the experimental results presented in table 2 it can be observed that the biggest amount of extracted mercury is in all cases for fraction I. Here are the smallest particle sizes but the biggest contact surface. The biggest values for the amount of extracted mercury are similar for all the three solutions. Also the optimal L : S ratio is the same for all the three solutions and soil particle size. Only the shaking time is shorter for KI solution (1h unlike 2h for the other solutions).

Considering all those facts we can conclude that the KI solution can be successfully used to remove mercury from the contaminated soil, the amount of extracted mercury is similar with that for Na2S2O3 and bigger than for Na-EDTA and the shaking time is shorter. So, an KI solution can be an alternative for removing mercury from soil.

Conclusions

The mercury was extracted from an soil sample of different particle size using Na-EDTA, Na2S2O3 and KI. The best option is KI because it has an optimal L : S ratio and an shaking time smaller than Na2S2O3 and Na-EDTA and the amount of extracted mercury is similar with Na2S2O3 and bigger than Na-EDTA.

References

1. BOENING, D. V., Chemosphere, 40, 2000, p. 1335

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