Use of Ion Exchange Resin to Remove the Mercury from Contaminated Waters

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In this paper it has been done an experimental work regarding the optimal conditions of removing mercury from water using ion exchange resins namely PUROLITE S920. It were prepared water solution of $HgCl_2$ with very well determined concentrations whereat was added different amount of ion exchange resin. The system was shaking 15 min, 30 min, 45 min and 60 min. It has been found that the optimal conditions for removing of mercury from contaminated water solutions are 1,6 g/l ion exchange resin and a shaking time of 45 min.

Keywords: mercury; ion exchange resin; toxicity

Mercury is a substance, which concentrates itself more and more in our natural environment. Mercury passes easily in some organometallic mercury compounds much more toxic, such as methylmercury or tetraethyl mercury [1-3].

Mercury has a neurotoxic potential with tendency to bioaccumulation and biomagnifications in the food chain and as a result, it represents a prospective threat for human and ecological health.

The most usual sources of mercury pollution are the industry of caustic soda, chlor and chlor-alkali plant, the paper industry, industry of pharmaceutical products and of fungicides. It is necessary to remove mercury from air, soil and water because it can accumulate itself [4-6].

In this paper it has been done an experimental work regarding the optimal conditions of removing mercury from water using ion exchange resins namely PUROLITE S920. [7]. It can be considered a reaction scheme such as:

$$2R\text{-}SH + Hg^{2+} \rightarrow R-S-Hg-S-R + 2H^{+} \quad (1)$$

$$2R-SH + Hg_2^{2+} \rightarrow R-S-Hg-Hg-S-R + 2H^{+} \quad (2)$$

Experimental part

It was prepared water solution of $HgCl_2$ with very well determined concentrations: 100mg/L, 200mg/L, 300mg/L şi 500mg/L. To 25 mL from those solution were added different amount of ion exchange resin: 0.4g/L resin, 0.8g/L resin, 1.2g/L resin, 1,6g/L resin and 2.0/L g resin The system was shaken 15 , 30 , 45 and 60 min. . The resin used was PUROLITE S920. Main characteristics of the resin are presented in table 1.

Residual concentration of mercury was measured by atomic absorption spectrophotometry using Varian AA 110 spectrophotometer. The ion exchange resin was regenerated with HCl solutions. The method used for regeneration and the results are the objects of another study.

Results and discussions

The experimental results concerning the residual concentration of mercury depending on the amount of ion exchange resin, in solution with initial mercury concentration of 100mgHg/L, 200mgHg/L, 300mgHg/L and 500mgHg/L are presented in figures 1-4.

The experimental results show a general tendency of decreasing for residual concentration of mercury solution with the increasing of ion echange resin amount, and with the increasing of shaking time.

Also it shows that practically we have the same residual concentration of mercury using 1.6 g/L ion echange resin and 2,0 g/L g ion echamge resin. That is why the optimal amount of ion echange resin is 1.6 g/L.

The experimental results also shows that the time considered optimal for residual concentration of mercury obtained with 1.6g/L ion echange resin, the same with

Table 1
MAIN CHARACTERISTICS OF THE ION EXCHANGE RESIN PUROLITE S920

The structure of the polymer	Styren-divynilbenzene macroporous
The physic shape of the polymer	Spherical beads
Functional groups	Thyoronics
Ionic form	H^+
Total capacity	1,6 eq/L min
Humidity	48 – 54 %
The size of beads	0,3 – 1,2 mm
Density	700 0 730 g/L
Temperature max. of work	60°C
pH domain	1 – 9

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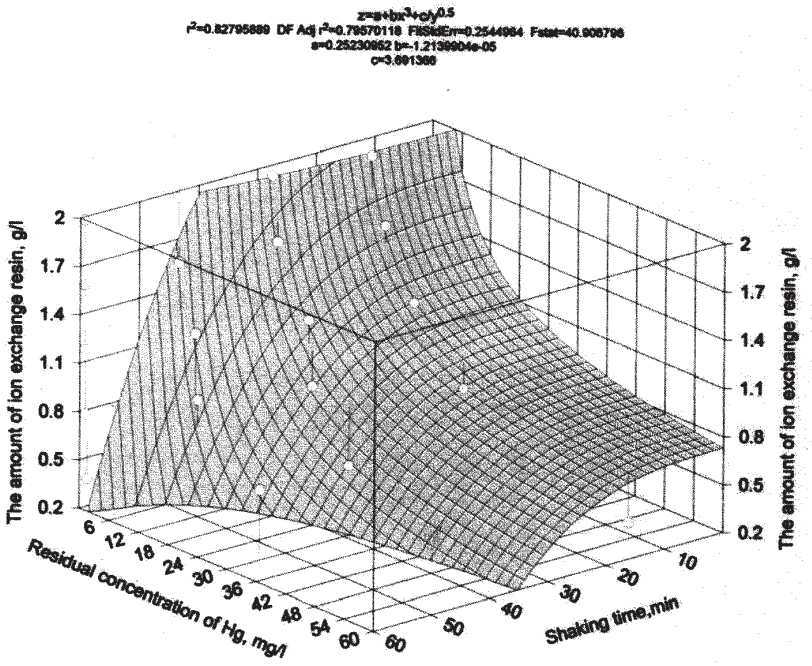

Fig.1 Dependence of residual concentration of Hg of the ion exchange resin amount and shaking time for an initial concentration of 100 mgHg/L

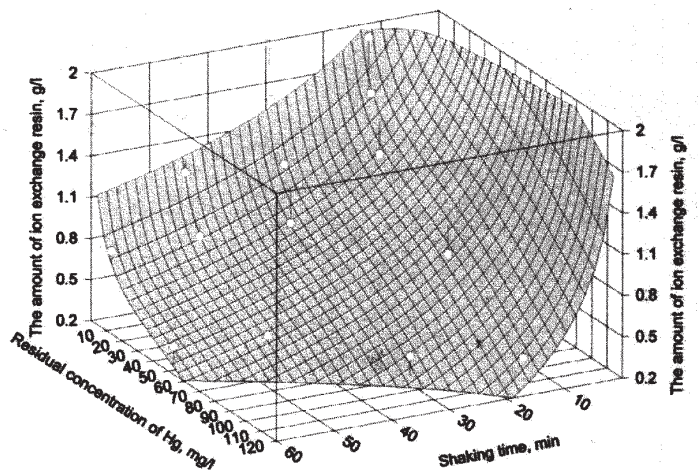

Fig.2 Dependence of residual concentration of Hg of the ion exchange resin amount and shaking time for an initial concentration of 200 mgHg/L

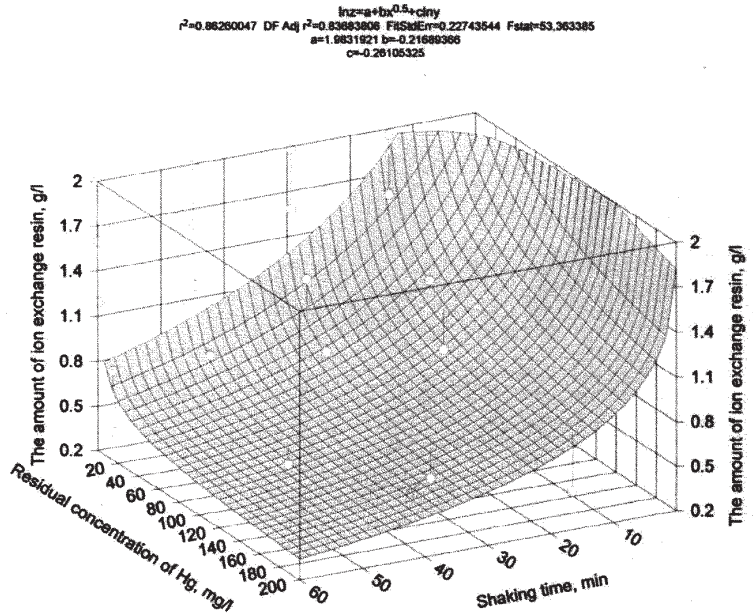

Fig.3 Dependence of residual concentration of Hg of the ion exchange resin amount and shaking time for an initial concentration of 300 mgHg/L

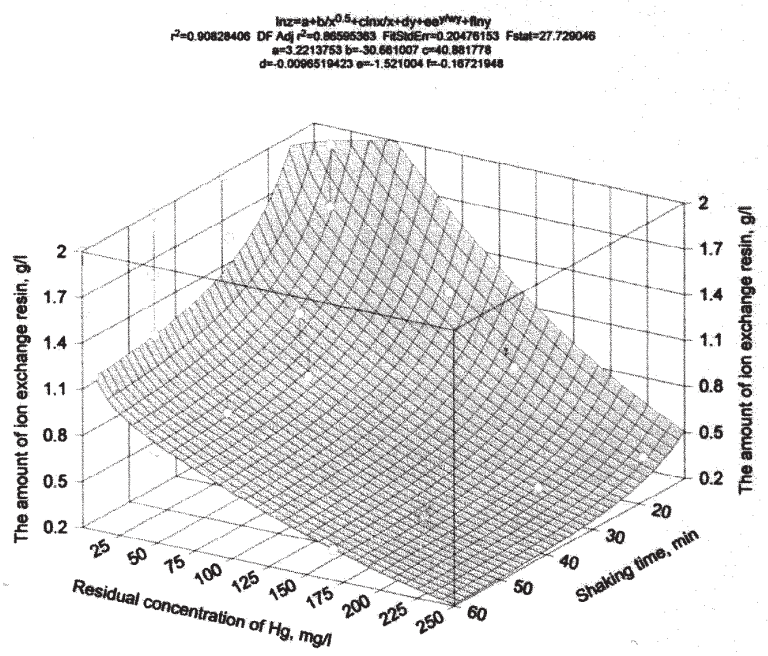

Fig.4 Dependence of residual concentration of Hg of the ion exchange resin amount and shaking time for an initial concentration of 500 mgHg/L

Table 2
THE OPTIMAL PARAMETERS OF REMOVING MERCURY FROM WATER SOLUTIONS USING THE ION EXCHANGE RESIN PUROLITE S920

Initial concentration of Hg Mg/L	The amount of ion echange resin g	Shaking time min	Residual concetration of Hg mg/L
100	1,6	45 min	2,1
200	1,6	45 min	2,0
300	1,6	45 min	0,5
500	1,6	45 min	1,6

that obtained with 2g/L, i.e. 45 min. That is why the optimal shaking time is 15 min.

In table 2 are presented the optimal parameters of removing mercury from contaminated water solutions are very well known 1.6g/L resin for the initial concentration of mercury and the shaking time 45 min using the ion exchange resin PUROLITE S920.

Conclusions

It was prepared water solution of $HgCl_2$ with very well determined concentrations whereat was added a different amount of ion exchange resin namely PUROLITE S920. The system was shaking 15 , 30 , 45 and 60 min.

It has been found the optimal parameters of removing mercury from water solutions with initial concentration of mercury very well known, using the ion exchange resin PUROLITE S920. The ion exchange resin was regenerated by HCl solutions.

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