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MERCURY(II)-ADSORPTIVITY OF LIQUID POLYBUTADIENE-INORGANIC SUPPORT SYSTEM

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The liquid polybutadiene-silica gel system revealed the good adsorptivity toword mercury(II) in water, and the concentration of mercury(II) was reduced from 380 ppm to 0.3 ppm by shaking with this adsorption system in a batch process.

From a view point of environmental problems, much attention has been attracted to the recovery of metal ions from waste water, especially the collection and the removal of mercury(II).[1)] Until now, some effective adsorbents which bear functional groups have been synthesized and utilized for the adsorption of mercury(II).[2-8)] These adsorbents, however, have an economical drawback because the introduction of functional groups into the resin matrix is not easy. And for these adsorbents, solutions to be treated should be highly diluted for adsorption of mercury(II).

Now we describe here quite a new type of adsorbent for mercury(II) and its performance preliminarily. This adsorbent is prepared by a very simple procedure from silica gel and liquid polybutadiene (LPB).

Thus, silica gel (4.5 g) was added to the methylene chloride solution (30 ml) of LPB (0.5 g) and the solvent was removed by evaporation under stirring in vacuo.

The adsorbent (0.50 g or 1.0 g) was added into 20 ml of an aqueous solution containing the metal ion in a 50 ml shaker flask, and the flask was shaken at 25 °C until the system got the adsorption equilibrium in an incubator, usually within 3 h. Then, the metal ion in the supernatant liquid was determined by atomic absorption analysis (Nippon Jarrell-Ash, AA-1).

The adsorption phenomenon of LPB-inorganic support system might be influenced by some factors; out of them, the effect of amount of LPB coated on silica gel is first inspected and shown in Table 1. Although the silica gel (Merck Art. 7734) itself adsorbed mercury(II) fairly well, the adsorptivity was enhanced very much by coating with LPB. The adsorbent diminished the content of mercury(II) (380 ppm) almost perfectly within the range of 10-20 wt% of the LPB coating percentage.

The effect of the difference of polymerization pattern of LPB is also checked and shown in Table 2. There was not found any significant difference in adsorption of mercury(II) between type a (97% [1-4]-polymerized, $\overline{Mn}$=1500; Sumitomo Chemical Co., Ltd.), type b (85% [1-2]-polymerized, $\overline{Mn}$=1000; Nippon Soda Co., Ltd.), and type c (a mixture type of a and b, $\overline{Mn}$=1500; Nippon Petrochemicals Co., Ltd.).

Some other kinds of porous inorganic material were surveyed for the purpose as well (Table 2). Alumina (Woelm N, Akt. I) also exhibited the superior mercury(II)-adsorptivity by coating with LPB in the same manner as silica gel. Celite (Wako 545) as the support, however, did not reveal such a marked effect in enhancing mercury(II)-adsorptivity. Hence, it can be concluded that the synergistic effect between LPB and silica gel, or alumina, produced good results for the collection of mercury(II) from an aqueous solution.

Table 1. Effect of LPB-coating rate

LPB wt%	Adsorbed Hg^{2+} %
0	20
2.0	88
2.9	91
3.9	95
5.0	98
10	99
15	99
20	99

Original Solution: 20 ml (Hg^{2+}; 380 ppm).
Adsorbent: LPB(c)-silica gel 0.50 g.
Shaking: 3 h at 25 °C.

Table 2. Effect of polymerization pattern and the kind of inorganic support

Adsorbent		Final Hg^{2+} concn	Adsorbed Hg^{2+}
LPB	Inorganic support	ppm	%
a	silica gel	5.4	99
b	silica gel	0.29	≈100
c	silica gel	0.29	≈100
c	alumina	11	97
c	celite	270	28
none	silica gel	260	33
none	alumina	120	69
none	celite	360	4

Original Solution: 20 ml (Hg^{2+}; 380 ppm).
Adsorbent: 1.0 g (10 wt% of LPB was used when coated.).
Shaking: 3 h at 25 °C.

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