Synthesis of Porous Materials Using Discarded Acrylic Plates and Determination of Ion Exchange Volume

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Introduction

- The impact of COVID-19 has changed our lives dramatically. New coronavirus infection after the end of the disease, a large amount of incineration of acrylic plates is expected. Therefore, it is necessary to think of ways to recycle them and use them beneficially.
- In this experiment, a porous material was synthesized using a mixture of acrylic powder, water and ethanol, which was discarded.The aim of this study is to improve water quality using porous materials in.
- A porous material is a material that has many pores in its internal structure. The surface area per unit volume is large.It has high adsorptivity for molecules and ions in gases and liquids.

Method

Experiment 1〉 Synthesis of porous materials

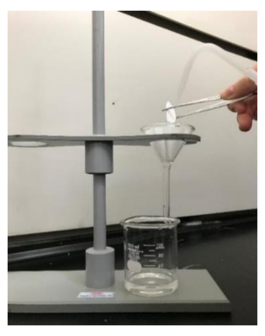
(1) The acrylic sheet was crushed into powder by the crusher.

(2) Place the acrylic powder in a mixture of ethanol and water. It was dissolved by heating and stirring for one and a half hours and allowed to coagulate and dry for 24 hours.

(3) The masses of the synthesized porous materials were compared, and the optimum conditions were determined.

Experiment 2〉 Hydrolysis experiment

(1) 20%, 30%, 40%, 50% NaOH or 20%, 30%, 40%, 50% H_2SO_4 and porous materials were placed in a triangular flask and hydrolysis was carried out for 1-3 hours at about 90° C with reflux.



(2) Wash and dry the mixture in a triangular flask with 0.1 mol/L NaOH and (1) porous material was added and the mixture was allowed to stand for 24 hours.

(3) (2) was filtered and washed with pure water. 250 ml measuring flask. Diluting in measuring flask was performed using.

(4) The amount of ion exchange was determined by using a 0.1 mol/L HCl solution.

Result

Synthesis of porous materials with different concentrations

Entry	C_2H_5OH (mL)	H_2O (mL)	Acrylic powder (g)	Weight(g)
1	55	45	2	2.12
2	60	40	2	2.19
3	65	35	2	2.34
4	70	30	2	3.91
5	75	25	2	1.86
6	80	20	2	4.51

Ion exchange capacity by each porous material (mmol/g)

(1) NaOH

Entry	Hydrolytic solution	Hydrolysis concentration (%)	Hydrolysis time (h)	Ion amount of exchange
1	NaOH	20	1	-0.16
2	NaOH	30	1	-0.13
3	NaOH	40	1	0.09
4	NaOH	50	1	0.05
5	NaOH	20	2	0.10
6	NaOH	30	2	-0.07
7	NaOH	40	2	0.14
8	NaOH	50	2	0.01
9	NaOH	20	3	-0.04
10	NaOH	30	3	-0.22
11	NaOH	40	3	0.10
12	NaOH	50	3	0.52

(2) H_2SO_4

Entry	Hydrolytic solution	Hydrolysis concentration (%)	Hydrolysis time (h)	Ion amount of exchange
1	H_2SO_4	20	1	-0.02
2	H_2SO_4	30	1	-0.06
3	H_2SO_4	40	1	0.04
4	H_2SO_4	50	1	-0.24
5	H_2SO_4	20	2	0.00
6	H_2SO_4	30	2	-0.02
7	H_2SO_4	40	2	0.18
8	H_2SO_4	50	2	-0.15
9	H_2SO_4	20	3	0.00
10	H_2SO_4	30	3	0.03
11	H_2SO_4	40	3	0.30
12	H_2SO_4	50	3	-0.05

Considerations

Experiment 1.

Only the ratio of ethanol to water was used in the experiment. In the future, we will study the detailed conditions to find the optimal conditions.

Experiment 2.

The reasons to why there was little ion exchange.

- The time required for hydrolysis was shorter than in the previous study.
- The porous material was floating in the acid or base solution during hydrolysis, so the solution soaked into the interior of the porous structure.

As a result the hydrolysis was not sufficiently carried out, we would like to.

References

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