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APPENDIX

A1. Selectivity calculation

A1.1 Dynamic Adsorption: Multi-component pulse test

A schematic pulse test is shown in Figure A.1. The net retention volume of each component was measured using the index of the tracer peak as the zero origin.

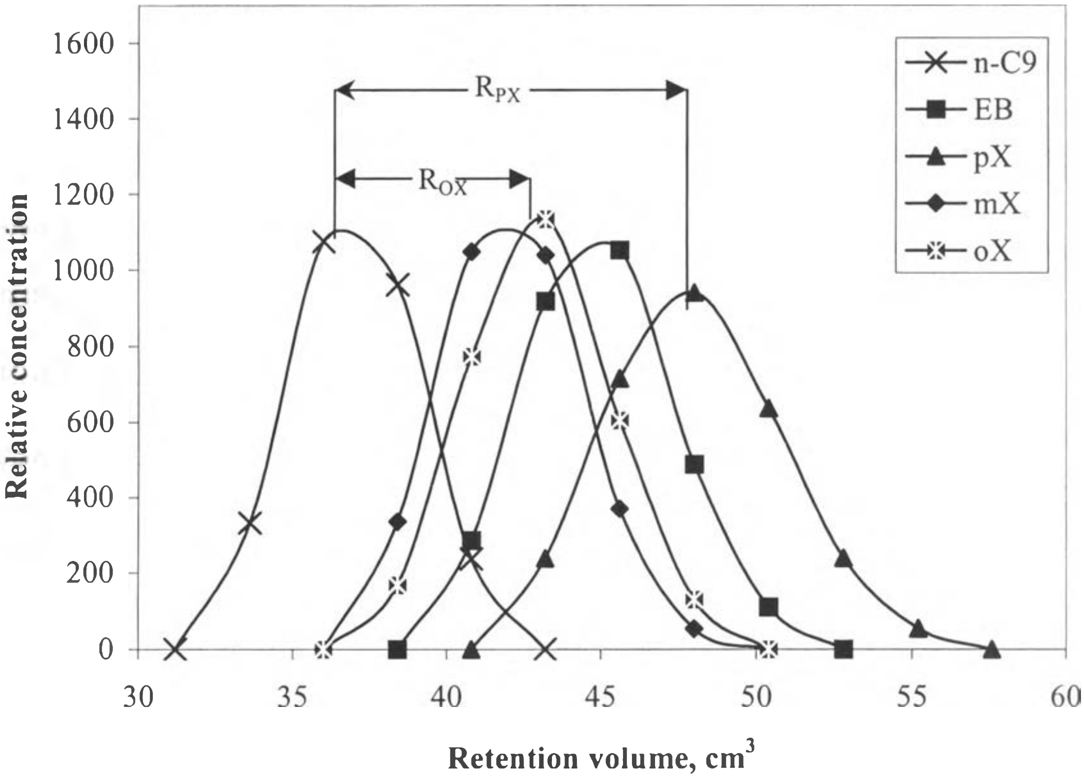

Figure A.1 A schematic of dynamic adsorption: Multi-component pulse test

From the figure, the *p*-xylene selectivity with respect *o*-xylene can be calculated from the ratio of net retention volumes of *p*-xylene, R_{PX}, to *o*-xylene, R_{OX}.

$$\alpha_{PX/OX} = \frac{R_{PX}}{R_{OX}} \tag{A1}$$

The *p*-xylene selectivity with respect to the other components, ethylbenzene and *m*-xylene, can be calculated in the same way.

Because the net retention volume of any component is ideally proportional to its distribution coefficient, i.e., its concentration in the adsorbed phase divided by its concentration in the unadsorbed phase, the calculated quantity is essentially equivalent to selectivity as defined separations carried out in a liquid system (Kulprathipanja, 2001)

A1.2 Dynamic Adsorption Isotherm: Breakthrough test on *KY*

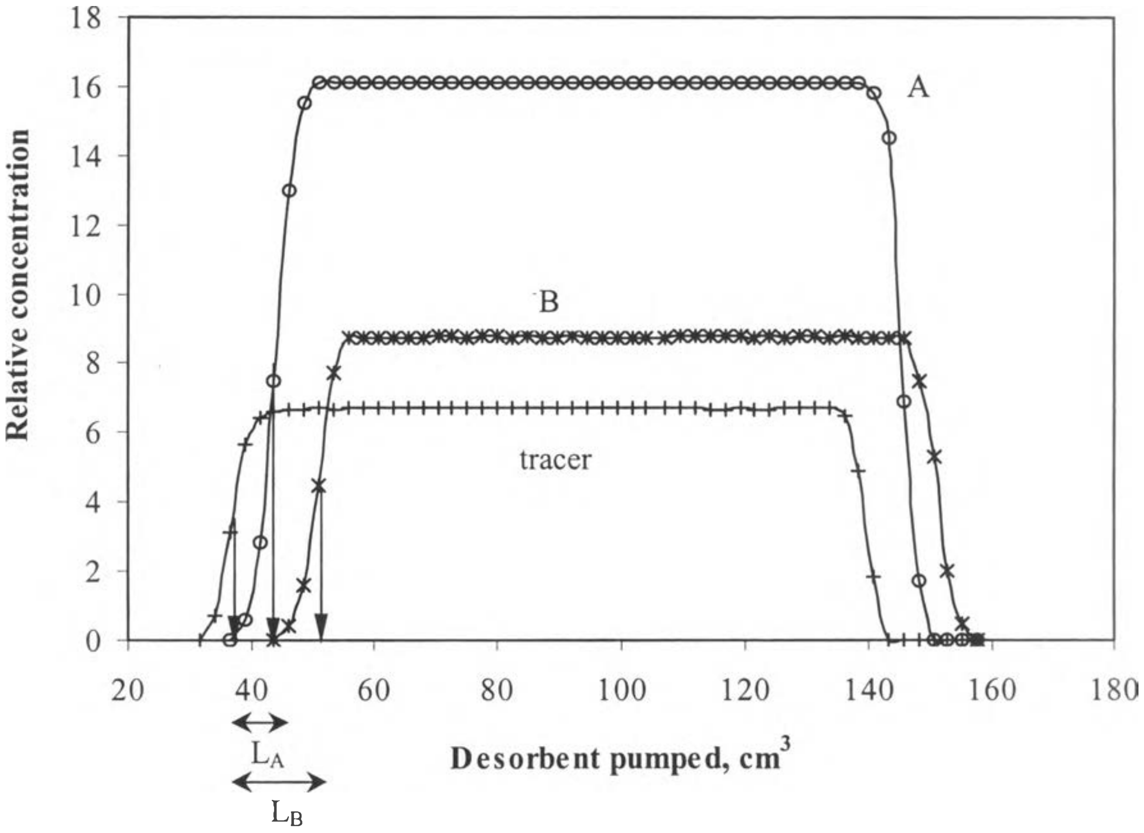

Figure A.2 A schematic of dynamic adsorption: Breakthrough curve

By as same principle as the multi-component pulse test, the net retention volume of each component was measured using the index of the tracer peak as the zero origin. The net retention volume of the component is defined at its curve half-height as seen in Figure A.2. To calculate the selectivity of component *B* with respect to component *A*, the ratio of L_B over L_A was taken.

$$\alpha_{B/A} = \frac{L_B}{L_A} \tag{A2}$$

However, frequently, the breakthrough curves are not the normal curves as shown above. The row up always occurred before reaching breakthrough region or before reaching desorption region, the areas that are circled, as seen in Figure A.3.

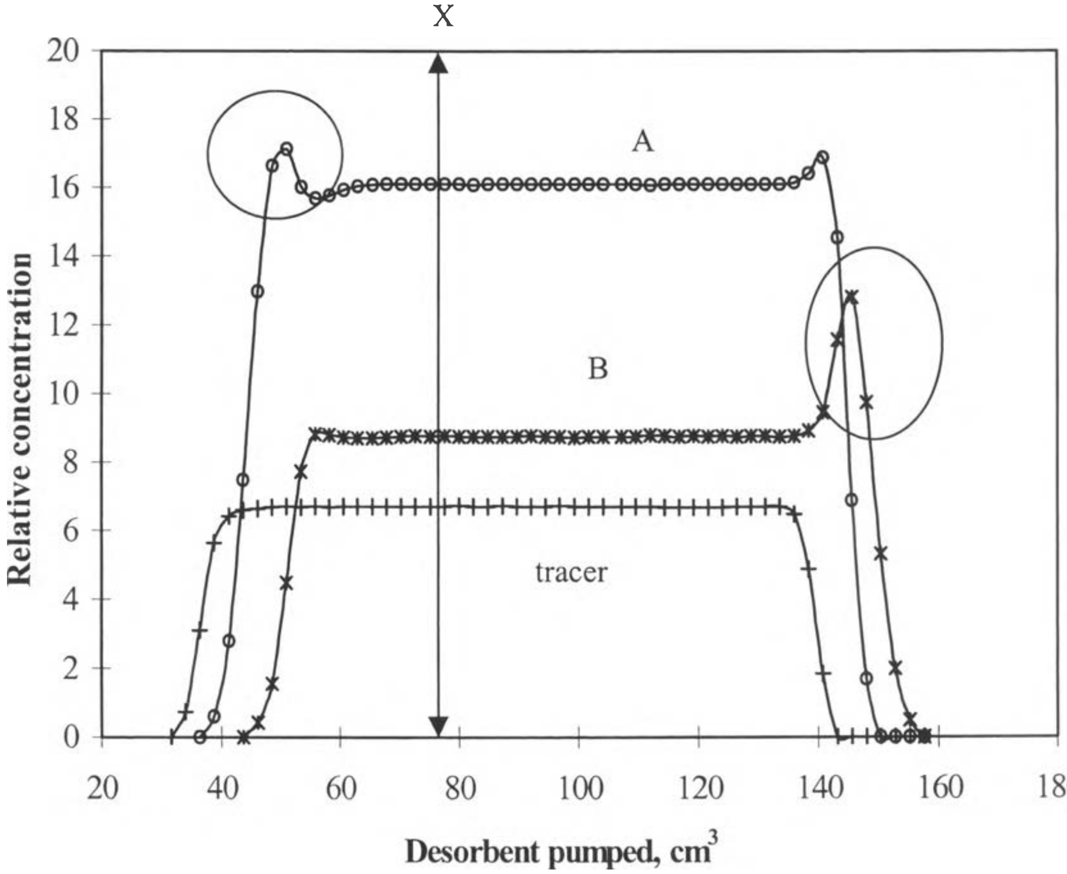

Figure A.3 A schematic of dynamic adsorption: Breakthrough curve with row up

Also in these experiments, such the phenomenon happened. Therefore, the normal calculation as explained above are no longer used because results might be deviated. To avoid an error, the following method was used in this experiment calculation. First step, a point of data in breakthrough was identified, point X. Then, the areas under the curve start from the beginning point up to point X of the components, A_{tracer}, A_A and A_B were calculated. The constant height in breakthrough region of each curve, H_{tracer}, H_A and H_B was measured. Consequently, the adsorbed volume of each component was calculated as

$$L_A = \frac{A_A}{H_A} \tag{A3}$$

But, the void volume in the column caused by zeolite packing must be concerned so L of each component was considered as the summation of viod volume and adsorbed volume. However, as a tracer was not adsorbed in the pore of zeolite so L_{tracer} can be taken as the void volume. By subtracting L_{tracer} from L of component, the adsorbed volume of each component was obtained. The selectivity of component B with respect to component A was defined as the ratio of adsorbed volume A to adsorbed volume B

$$\alpha_{B/A} = \frac{L_{tracer} - L_B}{L_{tracer} - L_A} \tag{A4}$$

By using the same method, the p-xylene selectivity with respect to the others, m-xylene, o-xylene and ethylbenzene, was calculated.

A1.3 Equilibrium Adsorption Isotherm: Autoclave

The *p*-xylene selectivity with respect to the other components can be determined as

$$\alpha_{PX/A} = \frac{X_{PX}/X_A}{Y_{PX}/Y_A} \tag{A5}$$

where X_{PX} is the mole fraction of *p*-xylene in solid phase

X_A is the mole fraction of component A in solid phase

Y_{PX} is the mole fraction of *p*-xylene in liquid phase

Y_A is the mole fraction of component A in liquid phase

A2. Sample preparation

A2.1 Dynamic Adsorption Pulse Test

Table A.1 Sample preparation for the Dynamic Adsorption Pulse Test

component	wt., g.	Density, g/cm^3	Volume, cm^3
p-xylene	20	0.8610	23.229
m-xylene	20	0.8684	23.031
o-xylene	20	0.8970	22.297
ethylbenzene	20	0.8670	23.068
n-C_9	20	0.7217	27.712

The 120 ml, approximately, of stock solution for using in the Dynamic Adsorption Multi-component Pulse Test was prepared followed Table A.1 above.

Table A.2 Zeolite used in the Dynamic Adsorption Pulse Test

Y zeolites	Amount, g.	*X* zeolites	Amount, g.
LiY	45.90	*LiX*	44.91
NaY	46.72	*NaX*	45.84
KY	45.80	*KX*	44.32
RbY	53.43	*RbX*	51.62
CsY	57.32	*CsX*	55.48

A2.2 Dynamic Adsorption Isotherm: Breakthrough

KY, 45.8 g, was packed in the column for all five blends.

Table A.3 Sample preparation for the dynamic and equilibrium adsorption

Blend	*p*-xylene, % by wt.	The other components, % by wt.
1	1.05	98.95
2	9.16	90.84
3	18.59	81.41
4	29.84	70.16
5	46.46	53.54

A2.3 Equilibrium Adsorption Isotherm: Autoclave

Table A.4 Sample preparation for the Equilibrium Adsorption Isotherm

Blend	Zeolite used, g.	Feed solution used, cm^3
1	27.32	153
2	26.98	153
3	27.79	153
4	27.68	125
5	26.82	134

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