On Determination Procedure of Intraparticle Diffusivity from Multi-Component Chromatogram for Non-Linear Systems

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Introduction It becomes possible to save examination time by the fact that simulation is done at the time of examining the operation method in the adsorption and desorption. Because with adsorption operation it becomes 1 cycle combining adsorption distance and removal and re-installation distance, examination of the operation method of combining becomes important. Especially you pay attention to the point, separation of the multi component blends of aqueous solution type, you express concerning the technique which does separation operation simply without using the complicated device, making use of fixed bed adsorption. In the laboratory scale, concerning the method of calculating equilibrium parameter already it is the establishment being completed, but the margin of examination is left parameter of rate of adsorption, concerning the method of calculating especially intraparticle diffusivity. Regarding single component system it is possible to seek this factor easily, making use of Batch method, but with multi component systems because due to the method of using break through curved line, many experimental times are required. Therefore, experimental time and decreasing the frequency of experiment mean industrially to have important meaning. Concerning the method finally of separating the optional one component from three component blends of the aqueous solution making use of the simulator, here you think for that because also decision of the intraparticle diffusivity which is rate parameter becomes the important element, examination is added concerning the decisive method of the intraparticle diffusivity which is made adsorption quantitative standard.

Experiment Operations In this time, the first component n-propanol, the second component n-butanol, it designated the third component as n-pentanol, experiment it did that liquid phase blend for example. Actually, selecting two components in these three components, examination it did. Furthermore, simulation calculated making use of break through curved line calculation software "Adds” drew up adsorption and desorption break through curved line. Early calculation condition was shown in Table 1.

Table 1. Initial calculation condition

Component	The first	The second	The third
Influx concentration (g/L)	1.800	1.800	1.800
K of Freundlich formula (mmol/g)	0.120	0.400	0.800
n of Freundlich formula (-)	2.100	2.570	2.650
Intraparticle diffusivity (cm^2/s)	5.016×10^{-5}	5.840×10^{-5}	6.829×10^{-5}
Film coefficient of mass transfer (cm/s)	4.104×10^{-3}	3.292×10^{-3}	3.124×10^{-3}
Molecular weight (g/mol)	60.1	74.1	88.2

Results you consider

The examination regarding influx concentration First, if experiment among two components which do, the first component and the second component if the first component, the second component and the third component by like the second component 1/3 times, 1 time and 3 times it changed the concentration of the component which is difficult to be adsorbed inspected the influence of that time. As an example at that time adsorption and desorption break through curved line of the respective component in n-propanol n-butanol two-component system was shown in Fig.1 and Fig.2. If you look at the figure, are in, to separating & to collect those which high purity these two component systems it is possible but, as for n-butanol not to receive the extent influence which it is possible speaking completely vis-à-vis the change of concentration, that to collection efficiency it is unrelated it was thought. Be able to imagine that, you can obtain this kind of result, by increasing concentration be able to obtain the similar result, regarding other two component systems fold, increasing the efficiency of separation collection due to concentration change it was thought that it is not possible.

The examination regarding k of Freundlich types Furthermore, 1/3 times, 1 time and 3 times it changed the value of k of Freundlich type, inspected the influence of that time. As an example, at that time adsorption and desorption break through curved line of the respective component in n-propanol n-butanol two component system was shown in Fig.3 and Fig.4. If you look at the figure, in order as for n-propanol as the value of k becomes small, high concentration & high purity being possible to separate to collect the thing as for n-butanol not to receive influence to change of value in these two component systems, when changing concentration, you could obtain the result that is similar. However, because k of this Freundlich system can think also that it changes with the concentration limits and the adsorption quantity, correlating with those values, examination should be advanced.

The examination regarding k of single components It changes the value of k with two component systems the occasion where, that value when being equal, the graph of each component is piled up, it is dense because with it was, k little by little with single component system change Points, the tendency was examined. The value of k of a certain component also extent and the break through curved line which get near to

other k are close the coming, the same value is piled up is taken with finally result, it is dense with you could verify. Because of this, the experiment regarding k the case where it does it becomes condition for the value to differ, was thought.

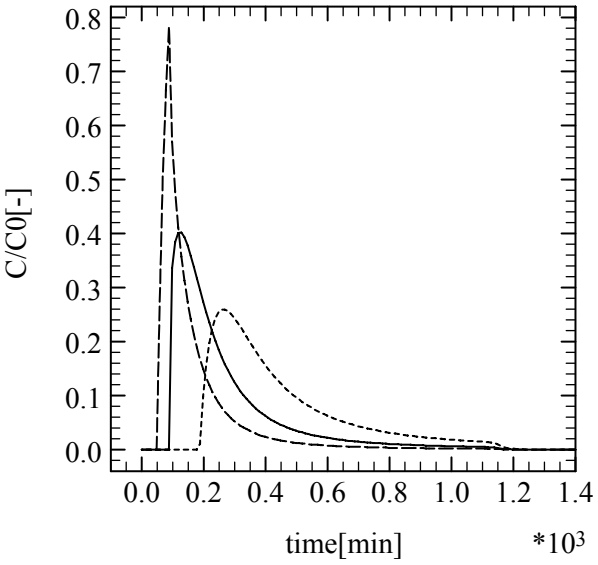

Fig.1 n-propanol adsorption and desorption break through curved line (n-propanol n-butanol two component system)

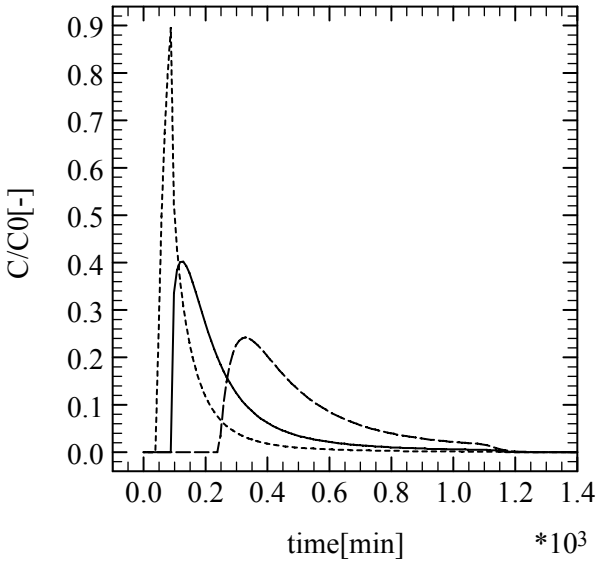

Fig.2 n-butanol adsorption and desorption break through curved line (n-propanol n-butanol two component system)

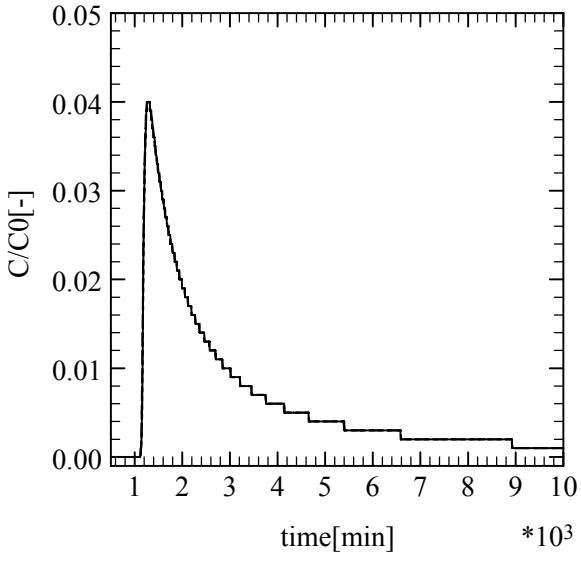

Fig.3 n-propanol adsorption and desorption break through curved line (n-propanol n-butanol two component system)

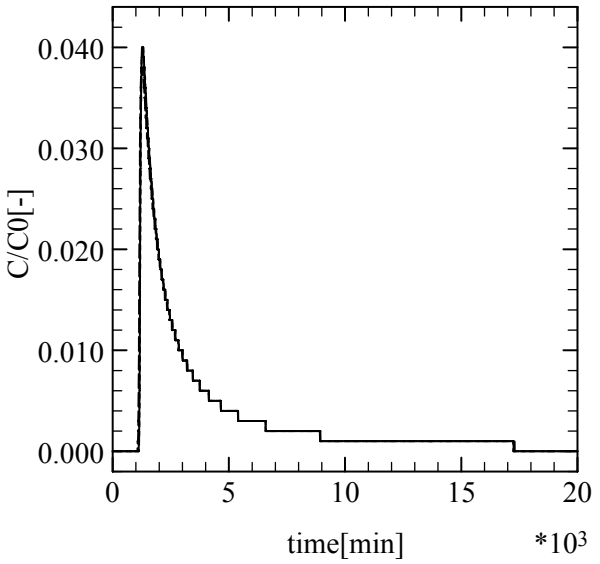

Fig.4 n-butanol adsorption and desorption break through curved line (n-propanol n-butanol two component system)

Joining Words At the time of two component type adsorption and desorption operating it was not possible to assure the improvement of efficiency of separation collection, by changing k of concentration Freundlich type of each component.

This time changing two conditions respectively, examination it did, but you do not think of that it considers also other parameter.