Problem

Aspartame isomer separation. Racemic amino acids can be separated using l proline attached with silanes to the surface of silica gel. In one of the experiments, aspartame isomers give the following results:

	Peak time (t0, minutes)	Peak spread (t0σ, minutes)
d aspartame	62	3
l aspartame	71	6

These results were obtained with a 25 cm column, 0.41 cm in diameter, filled with 0.62 volume fraction of 45 X 10^{-4} cm silica gel spheres. The flow in the column is 2.0 cm^3/minutes. Find the apparent rate of constant k for this separation. Compare these rate constants with those expected from the mass transfer correlation

$$\frac{k}{v} = 1.17\left(\frac{dv}{\nu}\right)^{-0.42}\left(\frac{\nu}{D}\right)^{-0.67}$$

In which d is the packing diameter, v is then solvent velocity, v is the kinematic viscosity, D is the diffusion coefficient, equal to about 0.7 X 10^{-5} cm^2/second for aspartame under these conditions.

Problem

- Fumarase chromatography. 10 g of the enzyme fumarase are being purified in an ion exchange column. At a velocity of 30 cm/hr, the peak in the concentration exists the column in 93 minutes and the standard deviation of this peak is given as 12 minutes.

(a)How long must we purify for a 90% yield?

(b)If we increase the flow to 60 cm/hr, how long must we run for this same yield if the process is controlled by diffusion and reaction?

(c)How long must we wat if the process is controlled by mass transfer?

(d)How long must we wait if Taylor dispersion controls?

(e)How long must we wait if the column actually contains equilibrium stages?

Problem

Transferrin desalting. A dilute feed in which 80% of the total solute is transferring and 20% behaves like sodium chloride is to be desalted on a dextran gel column. Operating the column at 10 cm/hr gives the following results:

	Peak time (t0, minutes)	t0σ, minutes
Void volume	27	
Transferrin	41	4
Salts	88	4

A complete separation is obtained under these conditions. To obtain more product, we plan to increase the velocity through the column. We find that the peak t0 varies inversely with velocity, but that the parameter σ varies with the square root of velocity. What is the maximum velocity and the time which will give a 99% yield of transferring which is 98% pure?