Graph of MT (measures ratio of intrinsic reaction rate vs. mass transport) tells the concentration changes over the pores of the reactant.

Going up the y axis, the MT decreases

What is a strong vs. weak pore?

* Reaction constant
* Size of pore
* Diffusion rate

MT < 0.4, CA ~= CAs, ξ = 1

MT > 4, ξ ~= 1/MT

CA/CAs = (em(L-x) + e-m(L-x))/(emL+ e-mL)

m = sqrt(k/D)

MT = mL

ξ = CA,avg / CAs = ∫CA/L dx / CAx = tanh(mL)/mL

L size for geometries

Flat plate: L = thickness/2

Cylinder: L = radius/2

Sphere: L = radius/3

Use L to determine MT

Use MT to determine ξ (effectiveness factor)

ξ = Actual Rxn Rate/Full Rxn Rate (range = [0,1])

ξ for different geometries

Flat plate: tanh(MT)/MT

Cylinder: use chart/graph to find value

Sphere: 1/MT \* 1/tanh(3\*MT) \* 1/3\*MT

Bessel Function: x2 d2y/dx2 + x dy/dx + (x2 - a2)y = 0

BRING YOUR OWN GRAPH SO YOU DON’T HAVE TO DO THIS BS (figure 18.6)

MT < 0.4: resistance-free regime, ξ = 1

MT > 4, strong pore diffusion resistance regime, ξ = R2/R1

MW = ξ \* MT2

Reaction Rates(First Order) shows how to convert k to k’ to k’’ to k’’’

PFR model with packed bed catalytic reactor

Impact of diffusion

Packing of solid inside reactor

τP = fV/q = ∫dC/-ξkC

fV/q = 1/-ξk \* ln(1-X)

X = 1 - e-ξkfV/q

MFR model with packed bed catalytic reactor

τM = C0-C/-r = C0-C/kC

X = kτM/1+kτM

X = (ξkfV/q) / (1 + ξkfV/q)

1 - X = ∫(1-X)Edt = ∫e-kTEdt

Cout = ∫CEdt