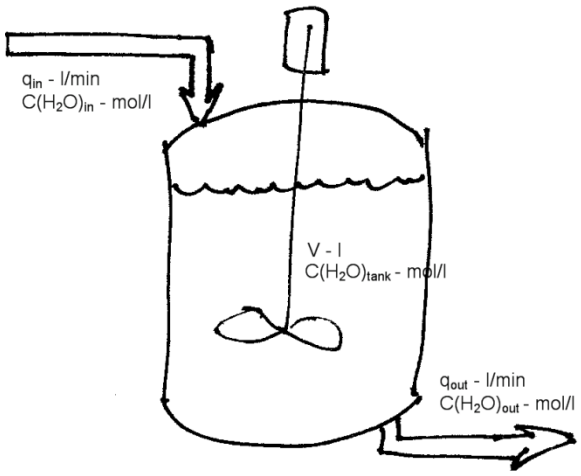
Kinetics & Reactor Design 2: Liquid Reactors

Continuing Ed workshop by Richard Skeirik,PE

Nonreacting Balance Exercise

If you see [something in square brackets] above a blank space, it's a queue for what to write underneath.

Consider a water tank, with constant level. Water flows in and flows out



Steady State

In Steady State, accumulation is zero, right?

Draw the boundary for your balance, then write the steady state mass balance around the tank. Use the variables shown on the drawing. Write your balance in mols. (This will work better when we get to adding reactions later.)

[Flow in] - [Flow out] = [Accumulation]

Check the units on each term to make sure they match.

Dynamic

Now consider the same tank, but the level is changing.

If the tank is really well mixed, the concentration coming out is the same as that within. This can be written as simple equality. Write that simple equality.

Now, by multiplying two variables, we can compute the number of mols of water in the tank. Write that product, and then using the above equality, eliminate Ctank and instead use Cout

[mols water in tank in terms of C_{tank}] [mols water in tank in terms of C_{out}]

Now, using the last form based on C_{out}, write the derivative that expresses the change in [mols water in tank] with respect to time. Remember what I showed you on the slide.

[Change in mols water in tank wrt time]

Which term in the balance is this: *flow in, flow out*, or *accumulation*?

Now you can write the dynamic mass balance in molar terms using only C_{out}.

[flow in] - [flow out] = [accumulation]