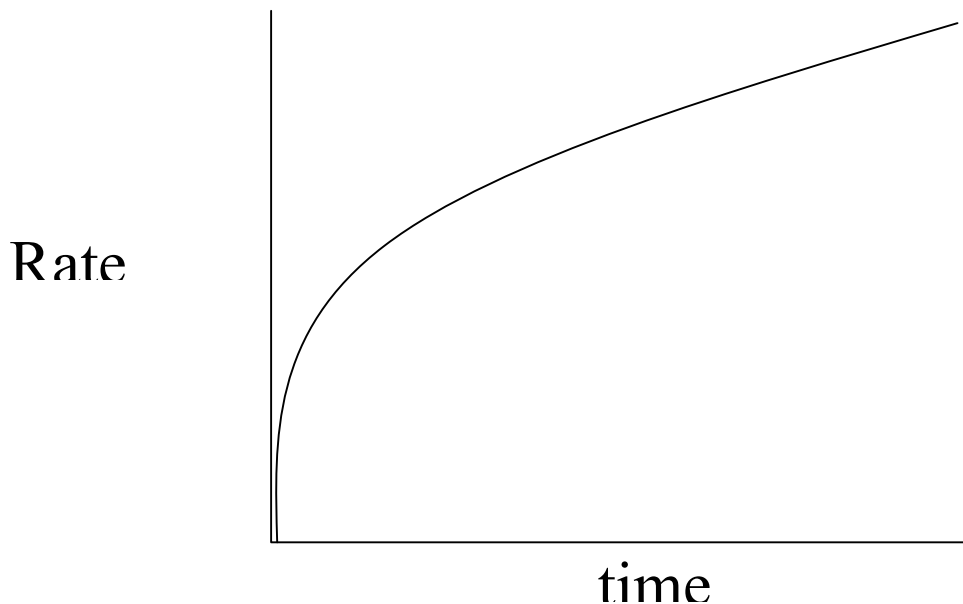


## ***OLI Tips #23***

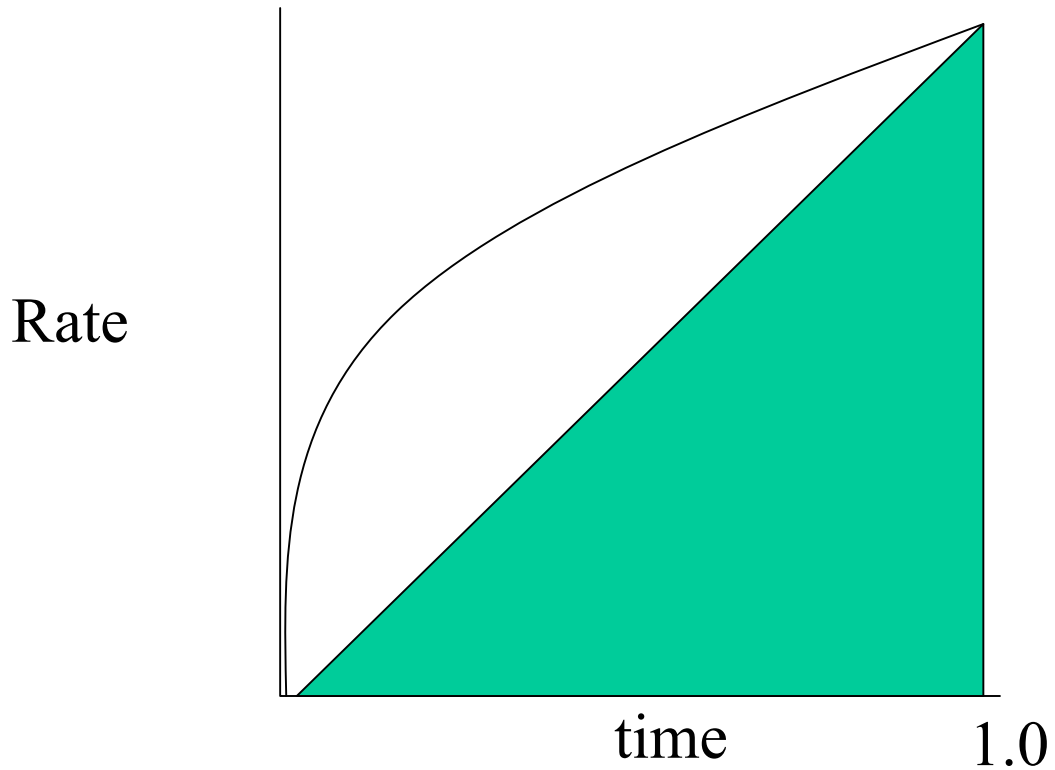
### ***CSTR v. Plug Flow Reactors***

There is a long standing confusion in the OLI/Software about the residence time and stages in the reactor. This document will help explain the confusion.

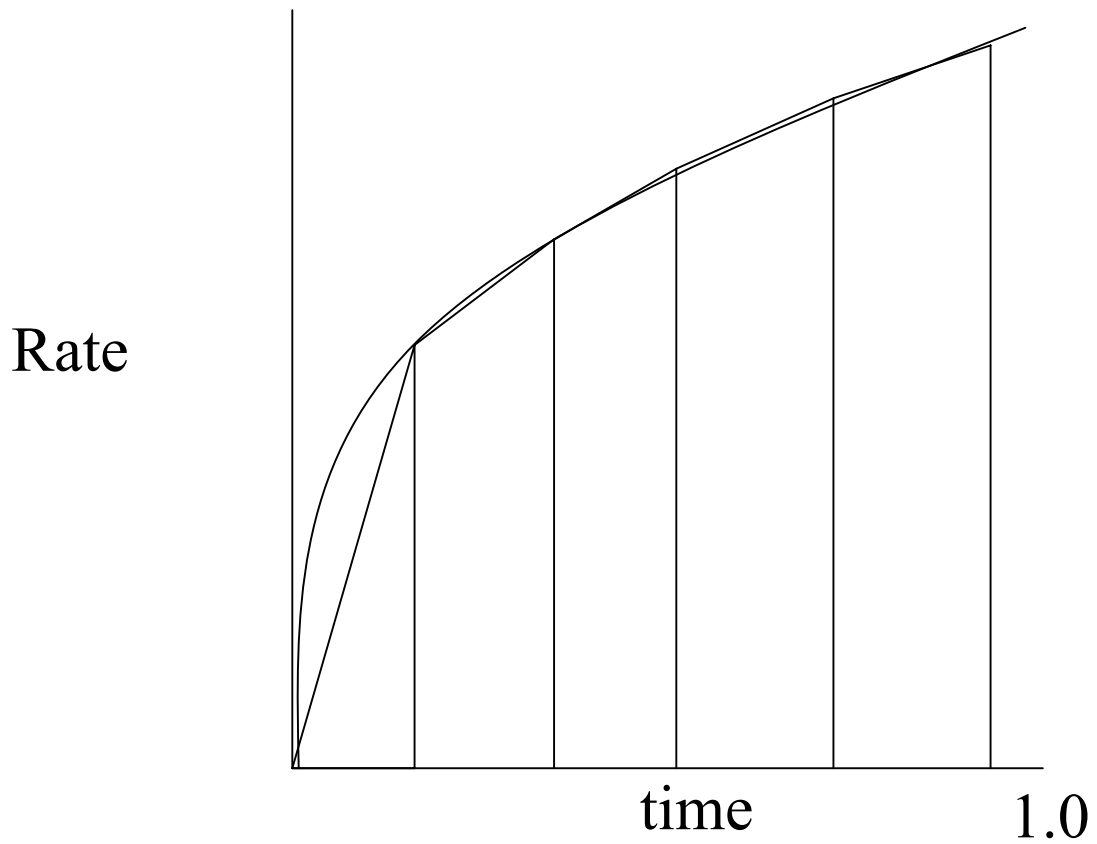
For processes that have reaction kinetics, OLI computes needs to know the change in time that occurs during a reaction. OLI first computes the equilibrium condition before the reaction occurs and then a separate equilibrium calculation after the reaction occurs. The extent of reaction, the amount of material reacted, is the area under the curve. But OLI can not directly evaluate a curve like the one below. For example, take a reaction that is fairly quick and takes one hour. The rate curve may look like this:



For a residence time of 1 hour and 1 stage we draw a line.



The shaded area represents the amount of material reacted. There is a great deal of unaccounted for material. This is the default CSTR assumption. We will now turn this into a plug flow reactor (multiple CSTR's) and see what happens.



As you can see, adding more stages decreases the error, more of the area under the curve is accounted for in this diagram. Refer to a calculus text book regarding Simpson's rule.

As you increase the number of stages, the error decreases but the computational time increases.