

ABE 580
Homework 1: SIMBAS and Modeling Exponential Growth

Objectives:

1. Understand and use SIMBAS or MATLAB to solve system of ordinary differential equations.
3. Successfully model the exponential growth of microbial cells under substrate limited conditions.

Software:

1. Microsoft Excel and MATLAB.
2. SIMBAS Runge-Kutta ODE solver (simbas.xls). This is an MS Excel spreadsheet that uses a macro written in VisualBASIC to solve systems of ODE's using the 4th order Runge-Kutta method. This spreadsheet is available online at the course Blackboard website. Make sure to enable macros in order to use the file!

Instructions:

Use the Monod equation to model the growth of microbial cells. The following constants should be used:

$$\begin{aligned}\mu_{\max} &= 0.26 \\ K_m &= 0.315 \\ Y_{sx} &= 14.3\end{aligned}$$

The following initial conditions ($t = 0$) should be used:

$$\begin{aligned}X &= 1 \\ S &= 200\end{aligned}$$

Homework (20 pts): Due January 21, 2019

Include the following:

1. Graph of the results from your model with appropriately labeled axes.
2. Printout of your SIMBAS or MATLAB code (only sections of the program you altered are needed)
3. A short report that answers the following questions:
 - a. What do the constants and variables for initial conditions mean?
 - b. What are the appropriate units for the constants and initial conditions?
 - c. How long does it take for the cells to utilize all of the substrate at the given constants and initial conditions?
 - d. Describe how the time course plot changes if μ_{\max} is changed? K_m ? Y_{sx} ? Use illustrations (graphs) if that helps to explain the relationships.