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Lab 4

BMED 430

**Introduction**

The purpose of this lab was to use python to apply Euler’s method for an initial value problem. The goal of the labs was to predict the concentration of a drug in a solution after being suspended in a spherical delivery system.

**Numerical Methods**

The numerical methods were to use the governing equation of with the initial concentration being 0 and the time being 0. That allows us to derive using scipy and numpy to apply the governing equation along with the inputs to display mass concentration and concentration over 10 minutes. That will give a final value for concentration. The equations that were used with the governing equation were and solving for km with . D0 is found using . With a being the radius of the molecule solved for using in cm.

**Pseudo Code**

* Import required packages
* Define constants and input data
  + Fluid volume
  + Number of particles
  + Particle diameter
  + Temperature
  + Fluid viscosity
  + Molecular weight of the drug
  + Drug concentration available at each particle surface
  + Initial concentration
  + Density of the drug
  + Mass of the drug
  + Avogadro’s constant
  + Boltzmann’s constant
* Use the definitions to calculate the needed values of a, km, D0 and concentration (jaf)
* Loop through each time step to give a concentration and take values for a table every thirty seconds
* Plot the final concentration and mass values
* Calculate theoretical values
* Plot theoretical values
* Display graphs and write to table
* Export table to csv

**Output**

The graph for the concentration versus time is shown in Figure 1.

A graph with a red line

Description automatically generated

**Figure 1: Concentration of the Drug in the Solution for 10 Minutes:** the graph of plotting the concentration from the iterative loop versus time.

Figure 2 shows the values of the concentration but times the volume to get the mass concentration versus time.

A graph with a red line

Description automatically generated

**Figure 3: Mass concentration of the drug versus time:** The mass concentration is in grams time is over 10 minutes.

The theoretical values were calculated using the linear equation