Chemistry 2740 Spring 2022 Assignment 1 Solution

1. If the data obey the Michaelis-Menten rate law, then an Eadie-Hofstee plot will be linear. The Eadie-Hofstee data are the following:

$v[\mathrm{3FGlc}]^{-1}/\mathrm{min}^{-1}$	0.0100	0.0189	0.0342	0.0547	0.0782	0.0987	0.11
$v/\mu\mathrm{mol\,L}^{-1}\mathrm{min}^{-1}$	53.6	48.5	43.1	34.6	24.5	15.4	8.4

   (You would likely have carried out these calculations in a spreadsheet.)

   My Eadie-Hofstee plot is shown in figure 1. The data fit the data reasonably well, with no obvious systematic curvature. I would conclude that these data do obey the Michaelis-Menten rate equation.

2. By linear regression, we find

$$\begin{aligned}\text{slope} &= -K_M = -442 \pm 14\,\mu\mathrm{mol\,L}^{-1}\\ \therefore K_M &= 442 \pm 14\,\mu\mathrm{mol\,L}^{-1}\\ \text{intercept} &= v_{\max} = 58.0 \pm 0.9\,\mu\mathrm{mol\,L}^{-1}\mathrm{min}^{-1}\end{aligned}$$

   (The program I used to fit data returns estimates of the errors in the parameters. Excel can do this too using the `linest` function, but that's an advanced topic.)

3. The turnover number ($k_{\mathrm{cat}} = k_{-2}$ in the Michaelis-Menten mechanism) is calculated by

$$\begin{aligned}k_{\mathrm{cat}} &= \frac{v_{\max}}{e_0}\\ &= \frac{58.0\,\mu\mathrm{mol\,L}^{-1}\mathrm{min}^{-1}}{15\,\mu\mathrm{mol\,L}^{-1}}\\ &= 3.9\,\mathrm{min}^{-1}\end{aligned}$$

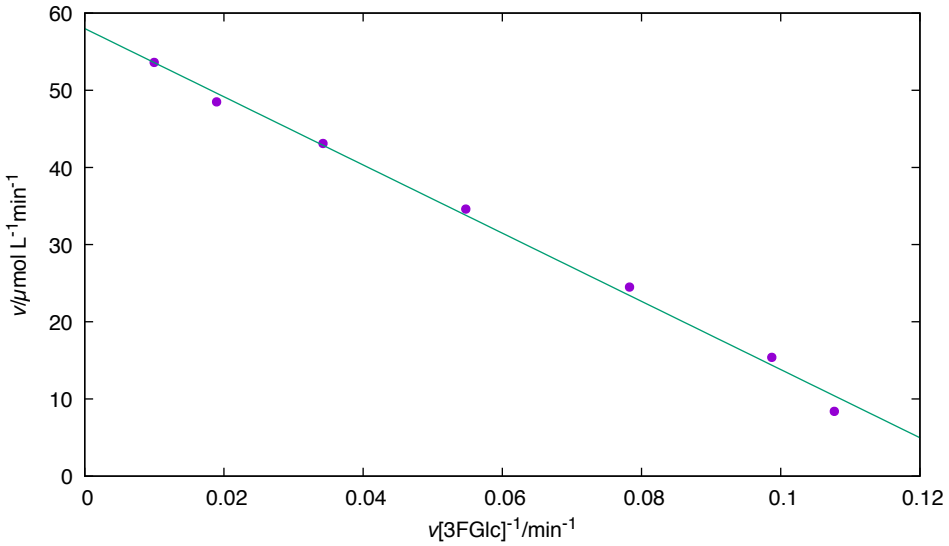

Figure 1: Eadie-Hofstee plot for the phosphorylation of 3FGlc by EII^{Glc}.