

# Enzyme Kinetics Analysis Report

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March 2023

## 1 Introduction

Enzyme kinetics is the study of the chemical reactions that are catalyzed by enzymes. This report analyzes two sets of experimental data on enzyme kinetics, one with an inhibitor and one without an inhibitor. Calculates the  $V_{max}$ ,  $K_M$  and  $K_I$  values.

## 2 Input data

(a) Reaction without inhibitor		
[S](mmol/l)	[I](mmol/l)	V (μmol/L/min)
1	0	0.67
2	0	1.13
3	0	1.48
4	0	1.74
5	0	1.98
(b) Reaction with inhibitor		
[S](mmol/l)	[I](mmol/l)	V (μmol/L/min)
1	1	0.05
2	1	0.10
3	1	0.15
4	1	0.16
5	1	0.18

Table 1: Reaction rates with and without inhibitor

## Equations

The Michaelis-Menten equation is given by:

$$V = V_{max} \frac{[S]}{K_M + [S]} \quad (1)$$

The Lineweaver-Burk equation is given by:

$$\frac{1}{V} = \frac{1}{V_{max}} + \frac{1}{K_M} \cdot \frac{1}{[S]} \quad (2)$$

The Michaelis-Menten equation can be derived from the Lineweaver-Burk equation by multiplying both sides by  $V$  and rearranging the terms:

$$V = \frac{V_{max}}{1 + \frac{K_M}{[S]}} \quad (3)$$

The Michaelis-Menten equation can be used to calculate the  $K_I$  value, in noncompetitive inhibition, as follows:

$$V = \frac{\frac{V_{max}}{1 + \frac{[I]}{K_I}} \cdot [S]}{K_M + [S]} \quad (4)$$

## Plots

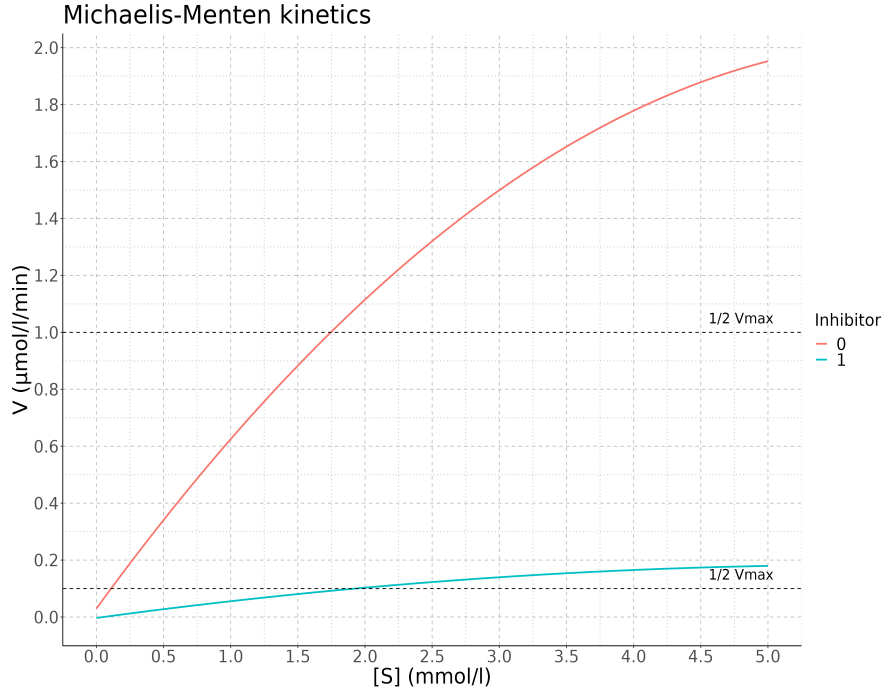


Figure 1: Michaelis-Menten kinetics plot showing the relationship between substrate concentration and reaction rate with and without inhibitor. The plot also includes fitted values and  $1/2 V_{max}$  lines for both datasets.

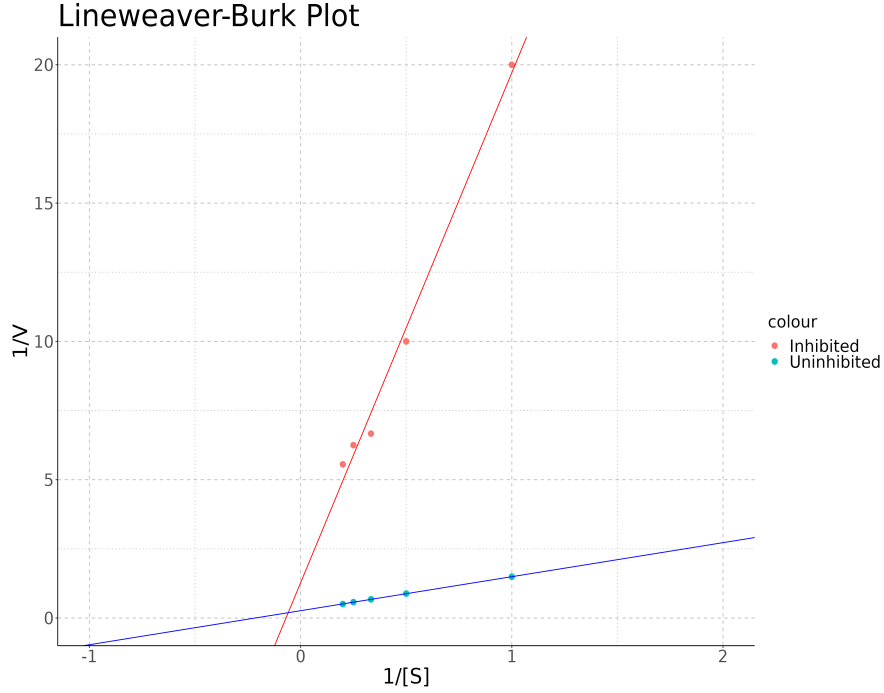


Figure 2: Lineweaver-Burk plot showing the reciprocal of substrate concentration ( $1/[S]$ ) versus the reciprocal of enzyme velocity ( $1/V$ ) for inhibited (red) and uninhibited (blue) enzyme reactions. The plot includes two linear regression lines with slopes and intercepts calculated from the data.

### 3 Uninhibited Reaction

The first set of data is from an uninhibited reaction. The data was fit to the Michaelis-Menten equation  $V = V_{max} \frac{[S]}{K_M + [S]}$ , where  $V_{max}$  is the maximum velocity of the reaction,  $[S]$  is the substrate concentration, and  $K_M$  is the Michaelis constant. The fitted parameters are as follows:

- $V_{max} = 3.89 \pm 0.08$  mmol/l
- $K_M = 4.88 \pm 0.18$   $\mu\text{mol/L/min}$

Table 2: Model summary without inhibitor

	Estimate	Std. Error	t value	Pr(>  t )
$V_{max}$	3.892276	0.0846582	45.97636	0.0000227
$K_M$	4.881717	0.1828702	26.69498	0.0001153

Table 3: Confidence interval for  $V_m$  and  $K_m$  for uninhibited reaction

	2.5%	97.5%
$V_{max}$	3.640811	4.185819
$K_M$	4.340821	5.518560

## 4 Inhibited Reaction