

SNS COLLEGE OF ALLIED HEALTH SCIENCE
Affiliated to The Tamil Nadu Dr M.G.R Medical University, Chennai



DEPARTMENT OF OPERATION THEATRE AND ANAESTHESIA

TECHNOLOGY

COURSE NAME: BIOCHEMISTRY

UNIT : 1

TOPIC : FACTORS AFFECTING ENZYME ACTIVITY

FACULTY NAME: MITHRA V

FACTORS AFFECTING ENZYME ACTIVITY

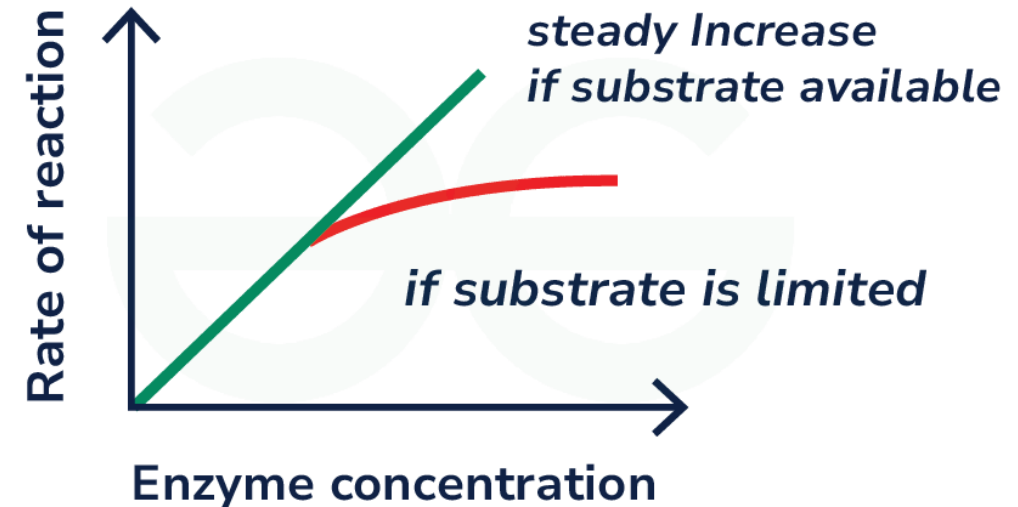
Concentration of ----- *enzyme
substrate
product*

Effect of ----- *pH
Temperature
Time*

Presence of ----- *co-enzyme
inhibitors
activators
light & radiation*

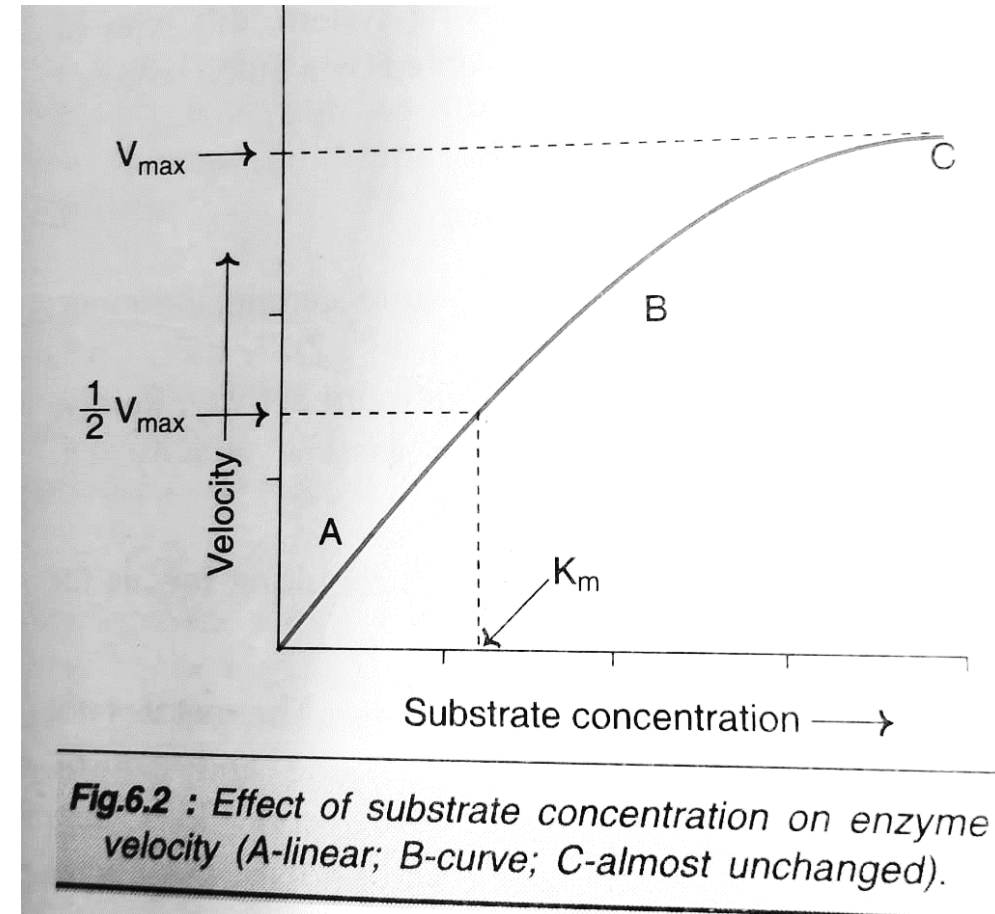
CONCENTRATION OF ENZYME

- As the concentration of enzyme is increased, the enzyme action & velocity of the reaction proportionately increases.
- The property of enzyme is made use in determining the serum enzymes for the diagnosis of diseases.



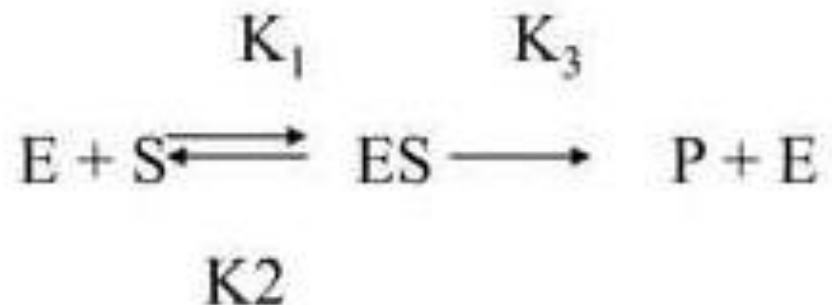
CONCENTRATION OF SUBSTRATE

- Increase in $[S]$, gradually increases the velocity of enzyme reaction, within the limited range of substrate levels.
- A rectangular hyperbola is obtained, when velocity is plotted against the substrate concentration.



ENZYME KINETICS AND K_m VALUE

It describes how reaction velocity varies with $[S]$



[K_1 , K_2 and K_3 are rate constants,

“S” is Substrate,

“E” is Enzyme,

“ES” is Enzyme substrate complex & “P” is Product]

K_m or Michaelis Menten constant
is given by the formula

$$K_m = \frac{k_2 + k_3}{k_1}$$

Reaction velocity varies with substrate concentration.

$$V = \frac{V_{\max} [S]}{K_m + [S]}$$

V = Initial reaction velocity

$V_{\max}$ = Maximal Velocity

K_m = Michaelis Menten constant $(K_2 + K_3)/ K_1$

$[S]$ = Substrate concentration

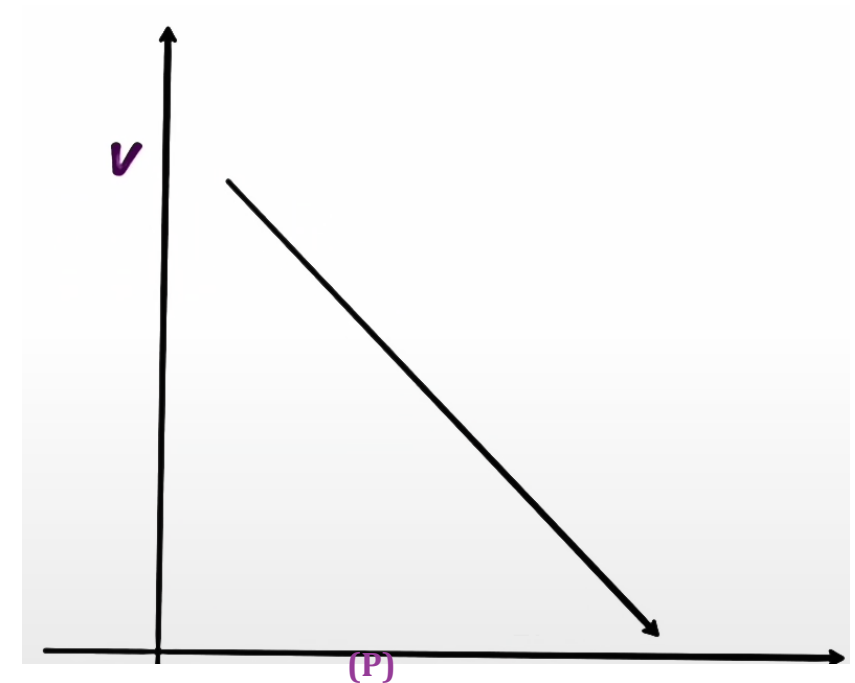
- **K_m** or the **Michaelis – Menten constant** is defined as the **substrate concentration** to **produce half – maximum velocity** in an enzyme catalyzed reaction.
- It indicates the enzyme molecules (50%) are bound with substrate molecules when the substrate concentration equals the K_m value

CONCENTRATION OF PRODUCT

■ Increasing product concentration reduces enzyme activity.

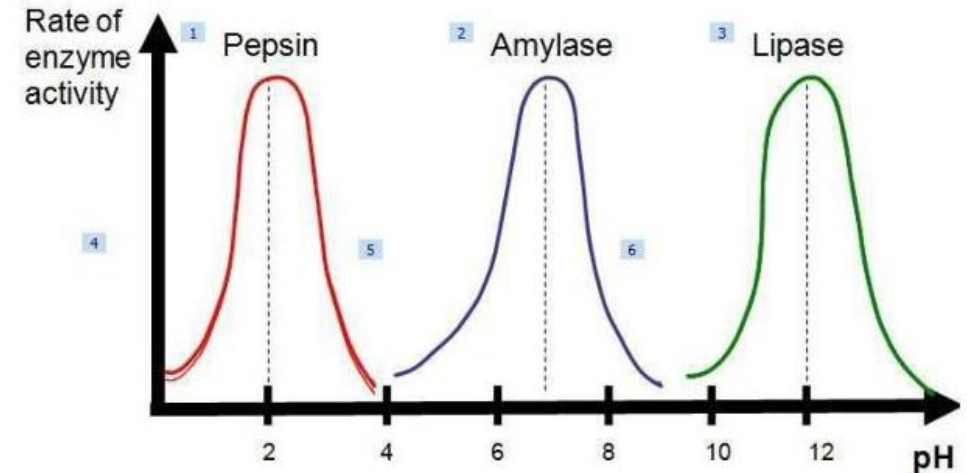
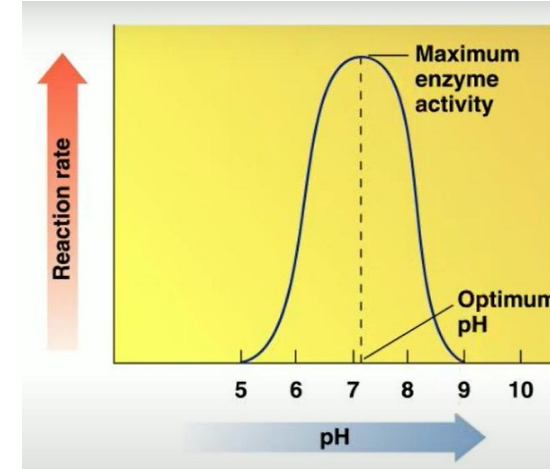
■ Accumulation of reaction products generally lowers the velocity of enzyme reactions.

■ For some enzymes, products bind to the active site, forming a loose complex that inhibits enzyme activity



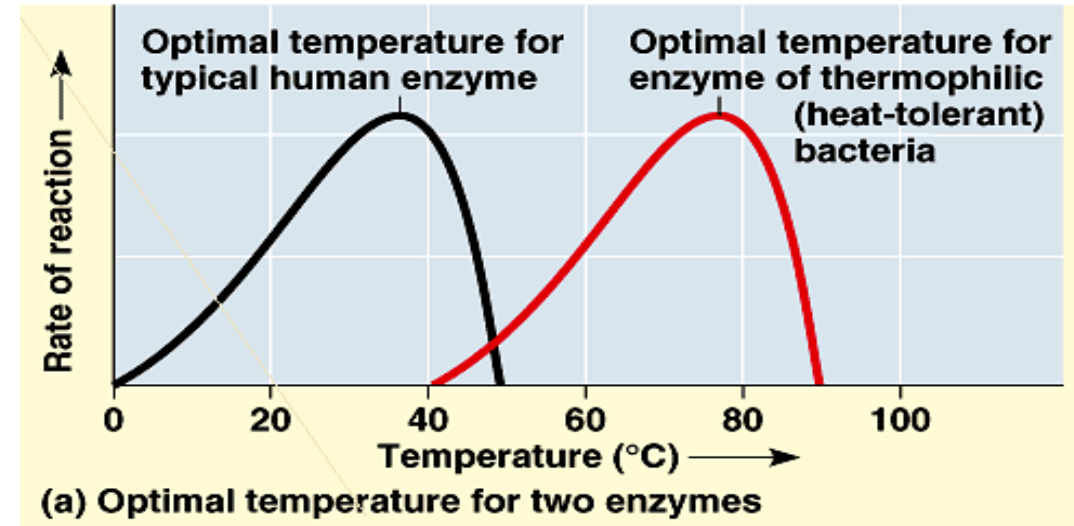
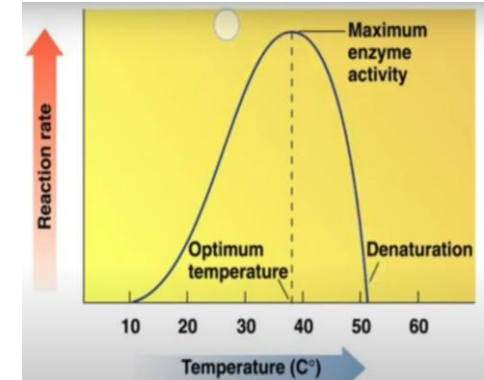
EFFECT OF PH

- Changes in hydrogen ion concentration (pH) significantly impact enzyme activity.
- Forms a bell-shaped curve, at an optimum pH value.
- Most enzymes in higher organisms – optimum pH (6-8).
- Certain enzymes have different optimum pH values:
- Pepsin (1-2),
- Acid phosphatase (4-5) and
- Alkaline phosphatase (10-11).



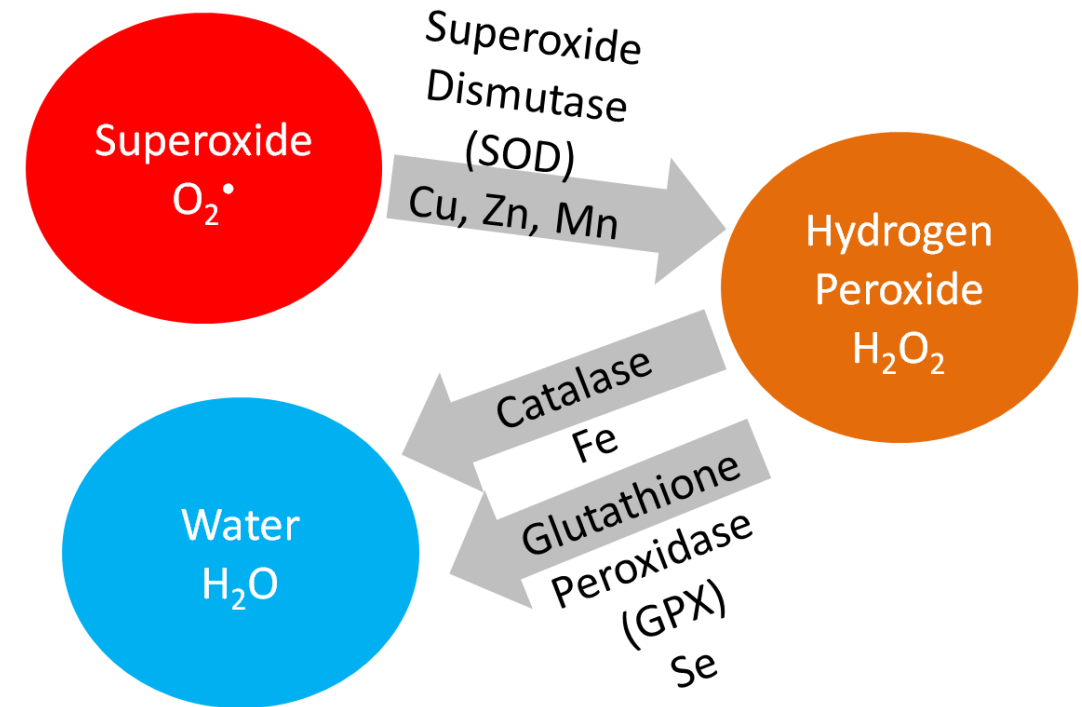
EFFECT OF TEMPERATURE

- Enzyme velocity rises with temperature upto a certain peak, then drops.
- Typically forms a bell-shaped curve.
- Most enzymes function best between 40°C and 45°C.
- Some enzymes, such as venom phosphokinases and adenylate kinase, remain active even at 100°C.
- Exposure to temperatures above 50°C often leads to denaturation and loss of enzyme tertiary structure.



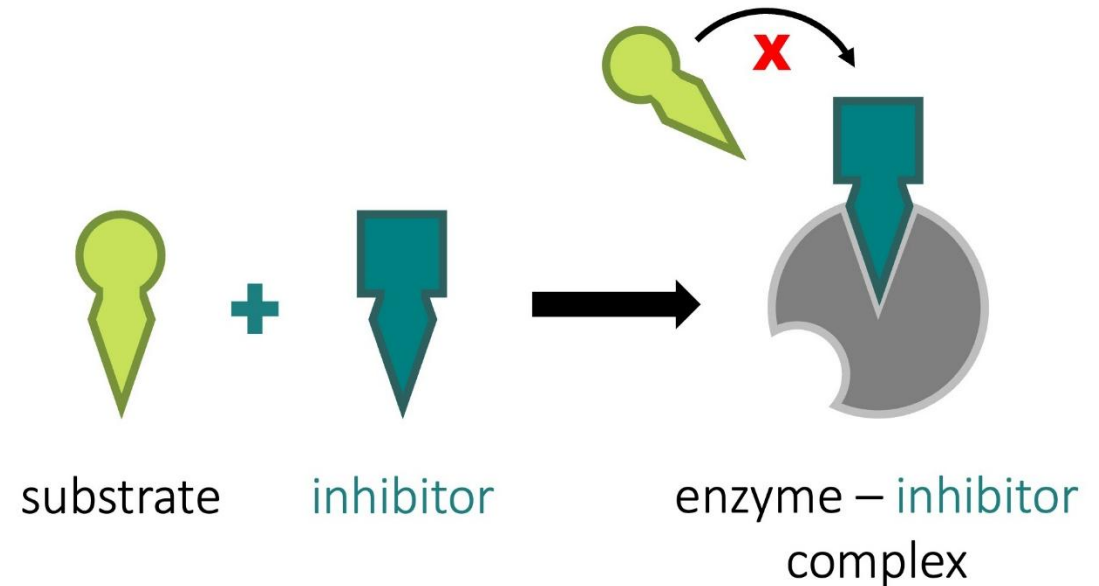
EFFECT OF ACTIVATORS

- Some enzymes require metal ions (e.g., Mg^{2+} , Zn^{2+} , Ca^{2+} , Cl^-) for optimal activity.
- **Metal-activated enzymes:**
 - Bind metal ions loosely
 - Metals can be easily exchanged
 - **Examples:** ATPase, superoxide dismutase
- **Metalloenzymes:**
 - Bind metal ions tightly (usually covalently)
 - Metals are not easily removed/exchanged
 - **Examples:** Cytochrome oxidase, pyruvate oxidase



EFFECT OF INHIBITORS

- **Inhibitors:** Compounds that **slow down or stop** **enzyme**-catalyzed reactions.
- **Effect depends on:** Type of inhibitor and its concentration.
- **Higher concentration** → **Greater decrease** in enzyme activity rate.
- Eg: Methotrexate and Penicillin – **Competitive inhibitor**



SUMMARY



REFERENCES

- Fundamentals of Enzyme Kinetics by Athel Cornish-Bowden, 4th Edition, 2012.
- Enzyme Kinetics: Catalysis and Control by Daniel L. Purich, 1st Edition, 2010.
- <https://dept.harpercollege.edu/chemistry/chm/100/dgodambe/thedisk/enzyme/4back2.htm>
- https://www.creative-enzymes.com/resource/enzyme-kinetics_45.html

THANK YOU