SNS COLLEGE OF ALLIED HEALTH SCIENCE

Affiliated to The Tamil Nadu Dr M.G.R Medical University, Chennai

DEPARTMENT OF CARDIO PULMONARY PERFUSION CARE

TECHNOLOGY

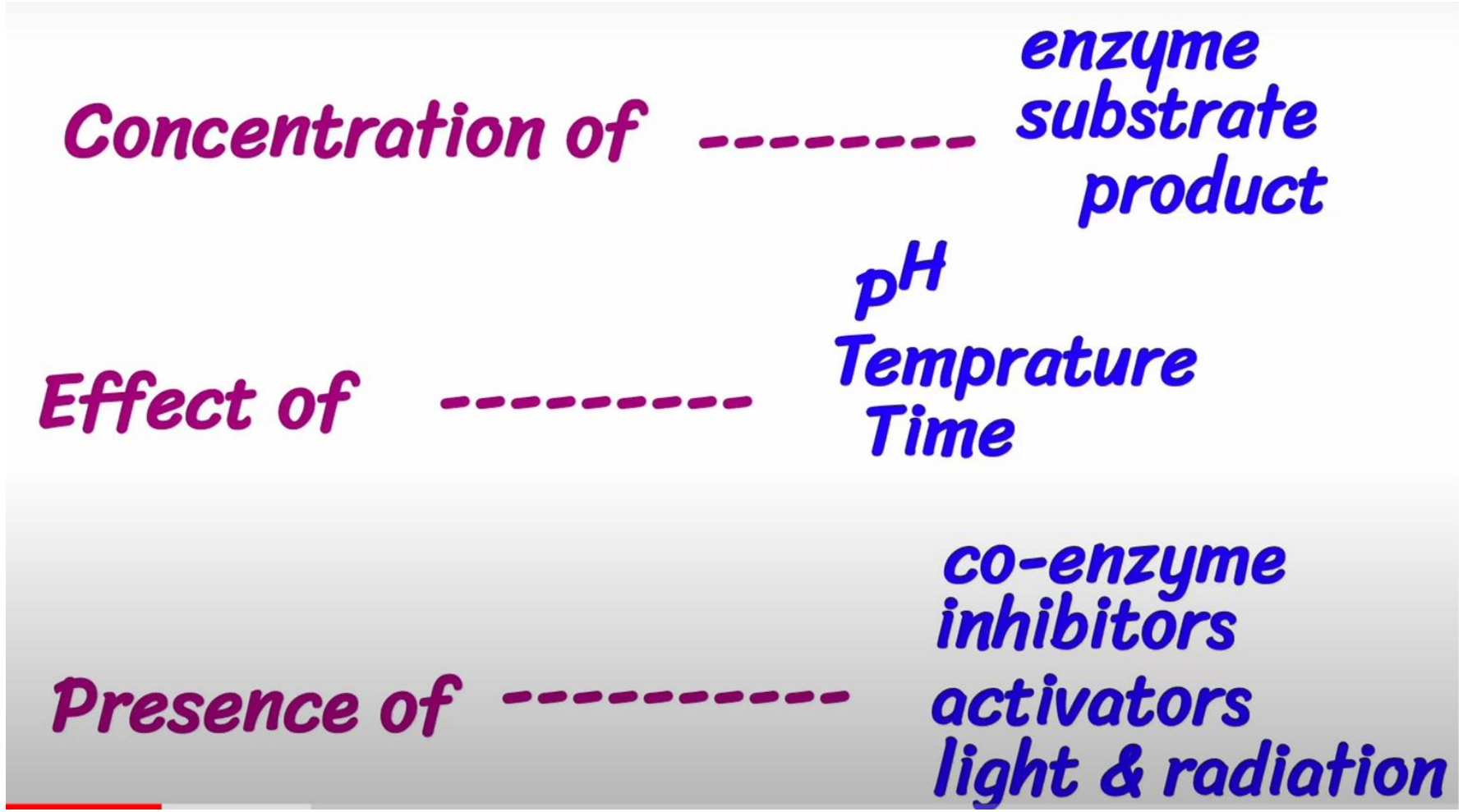
COURSE NAME: BIOCHEMISTRY

UNIT : 3

TOPIC : FACTORS AFFECTING ENZYME ACTIVITY

FACULTY NAME: MITHRA V

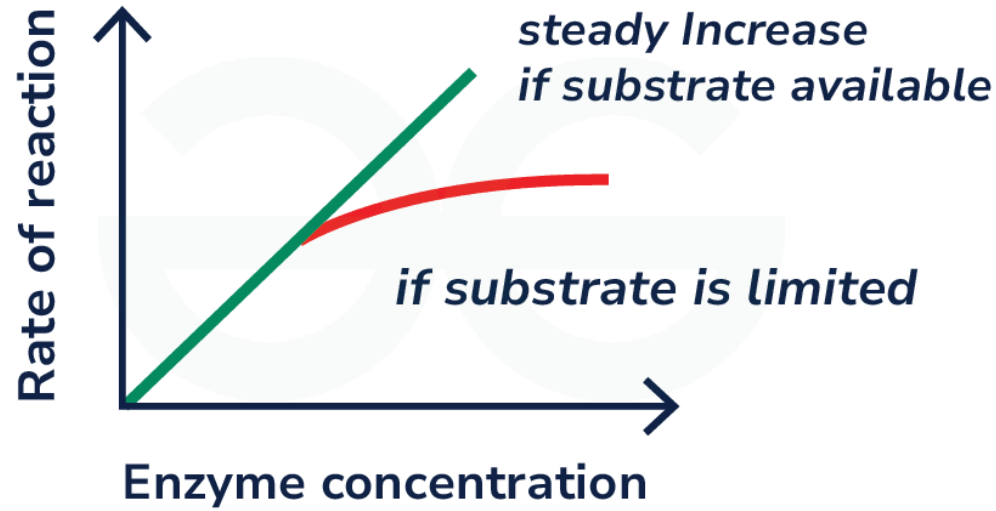
FACTORS AFFECTING ENZYME ACTIVITY



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.

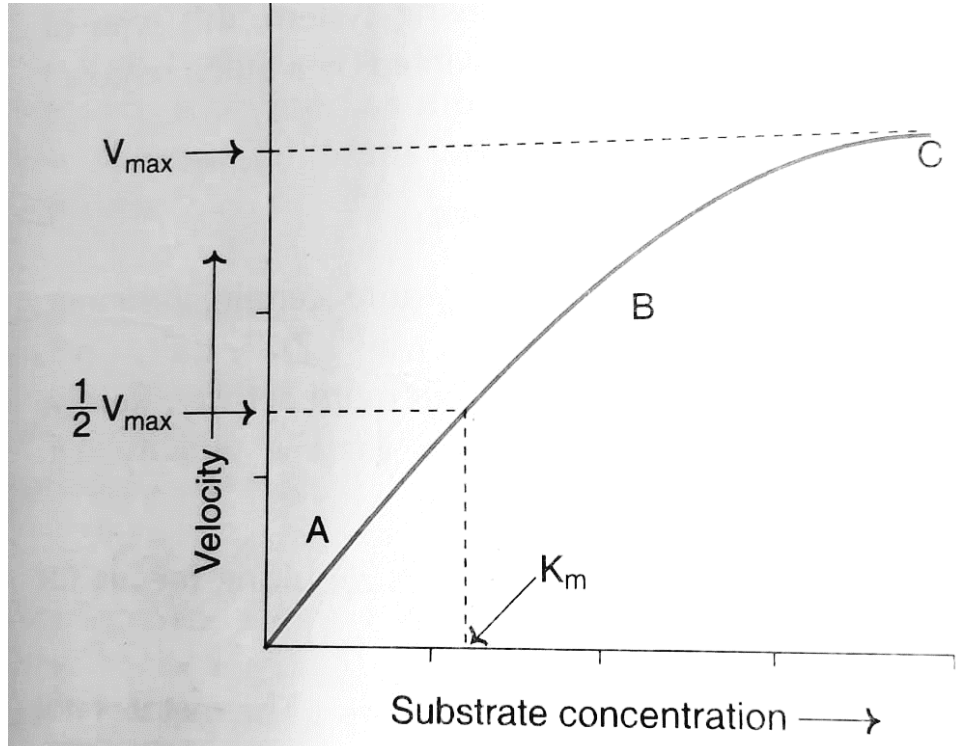
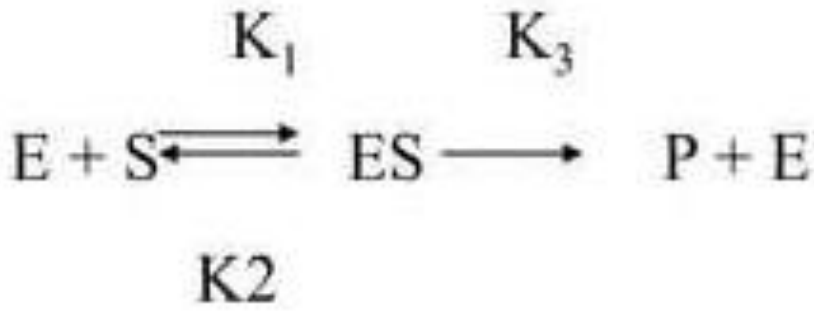


Fig.6.2 : *Effect of substrate concentration on enzyme velocity (A-linear; B-curve; C-almost unchanged).*

ENZYME KINETICS AND KM VALUE

It describes how reaction velocity varies with [S]



[K_1, K2 and K_3 are rate constants,

"S" is Substrate,

"E" is Enzyme,

"ES" is Enzyme substrate complex & "P" is Product]

Km or Michaelis Menten constant is given by the formula

$$\mathbf{Km = \frac{k2 + k3}{k1}}$$

Reaction velocity varies with substrate concentration.

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

V = Initial reaction velocity

V_{max} = Maximal Velocity

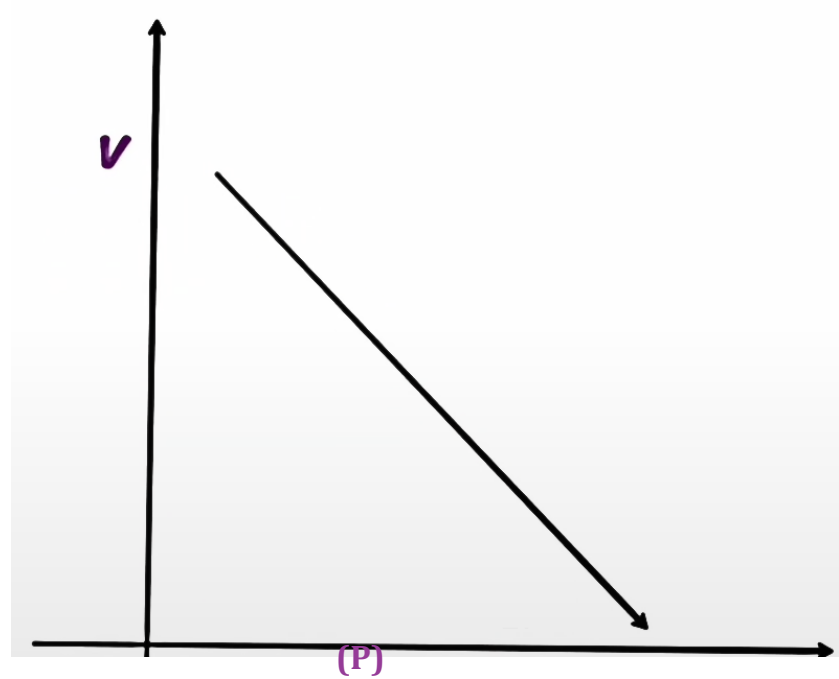
Km = Michaelis Menten constant $(K2 + K_3)/ K_1$

[S] = Substrate concentration

- **Km** 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 Km value

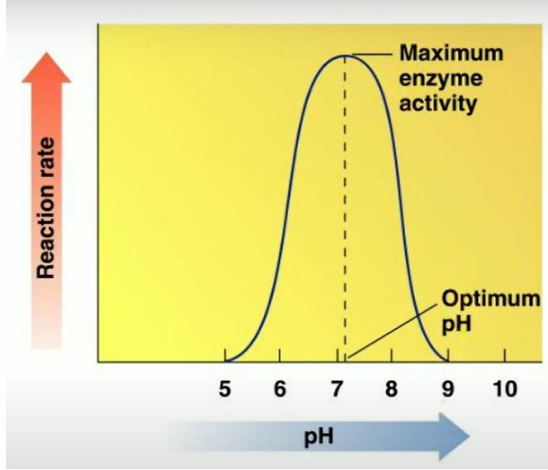
CONCENTRATION OF PRODUCT

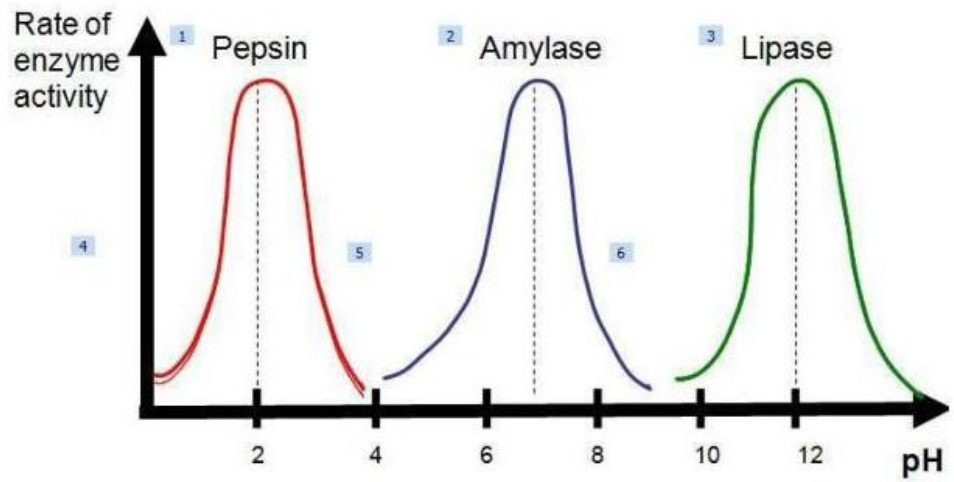
- Increasing product concentration reduces enzyme activity.
- Accumulation of reaction products generally lowers the velocity of enzyme reactions.
- For some enzymes, products bind to the active site, forming a loose complex that inhibits enzyme activity



EFFECT OF PH

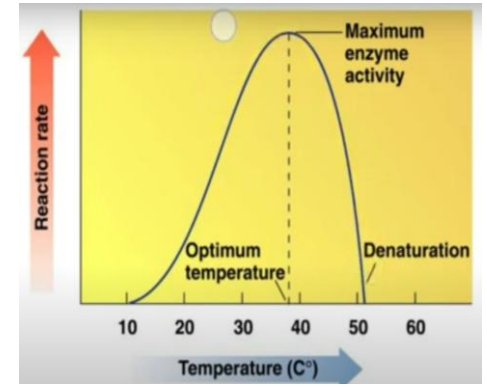
- Changes in hydrogen ion concentration (pH) significantly impact enzyme activity.
- Forms a bell-shaped curve, at an optimum pH value.
- Most enzymes in higher organisms – optimum pH (6-8).
- Certain enzymes have different optimum pH values:
- Pepsin (1-2),
- Acid phosphatase (4-5) and
- Alkaline phosphatase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

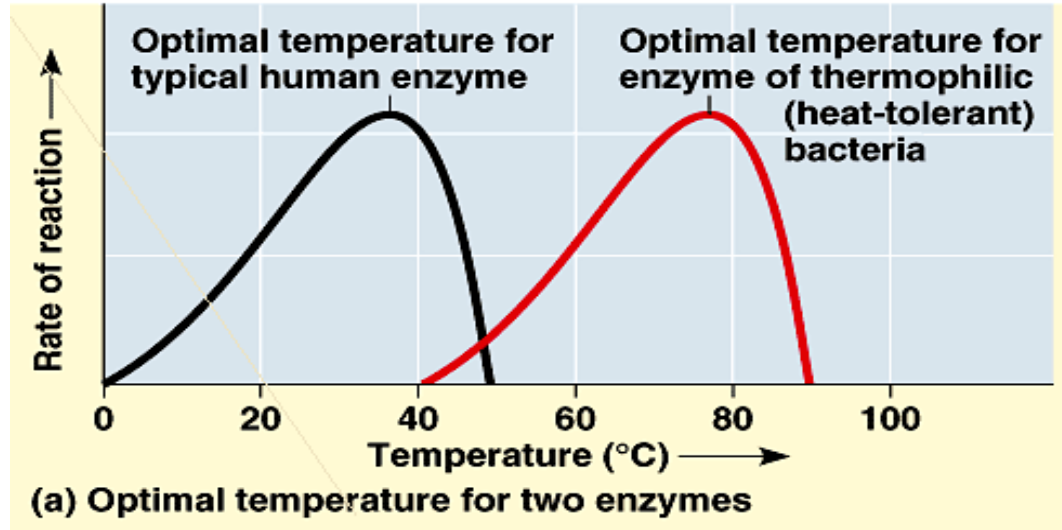




EFFECT OF TEMPERATURE

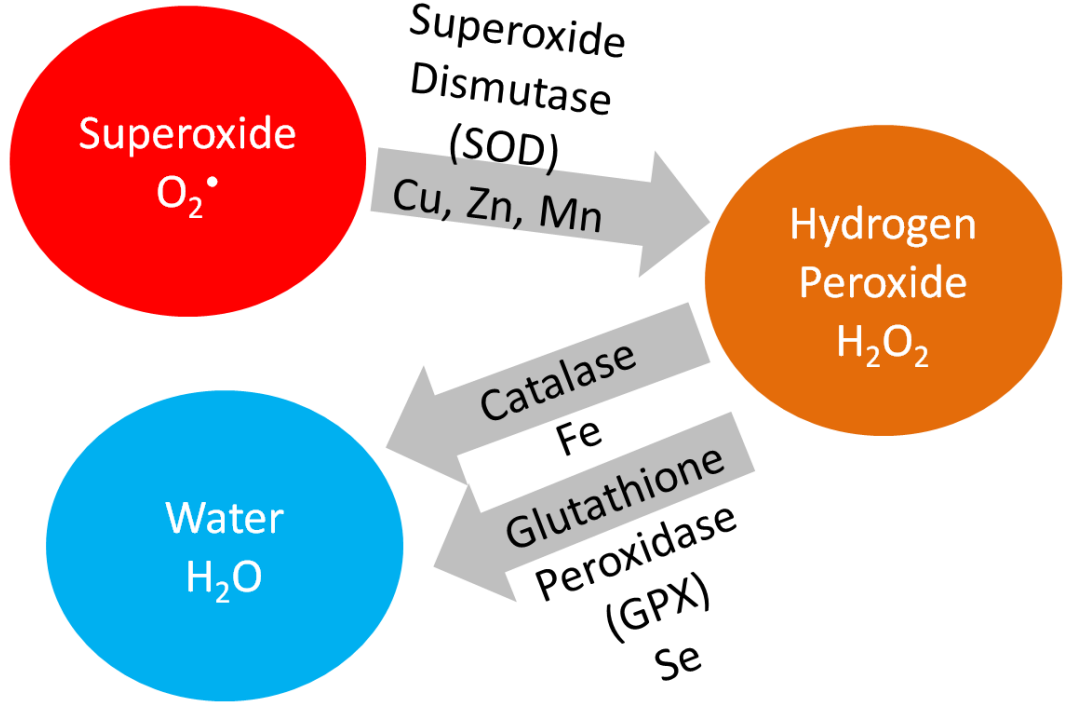
- Enzyme velocity rises with temperature upto a certain peak, then drops.
- Typically forms a bell-shaped curve.
- Most enzymes function best between 40°C and 45°C.
- Some enzymes, such as venom phosphokinases and adenylate kinase, remain active even at 100°C.
- Exposure to temperatures above 50°C often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





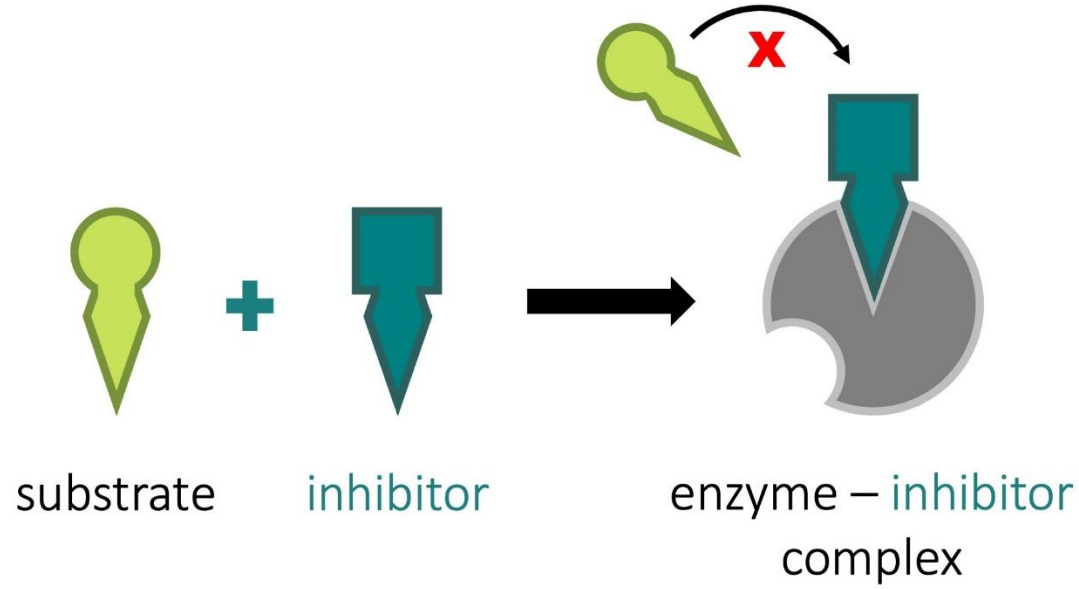
EFFECT OF ACTIVATORS

- 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


Temperature
Radiation
Water
Activators
pH
Factors Affecting Enzymatic Activity
End-products
[Substrate]
Inhibitors
[Enzyme]

REFERENCES

- Fundamentals of Enzyme Kinetics by Athel Cornish-Bowden, 4th Edition, 2012.
- Enzyme Kinetics: Catalysis and Control by Daniel L. Purich, 1st Edition, 2010.
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THANK YOU