FACTORS AFFECTING ENZYME ACTION

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1. Enzyme Concentration: As long as other factors are at their optimum level, the rate of reaction enhances with enhancement in enzyme concentration. A limiting effect is arrived in biological systems.

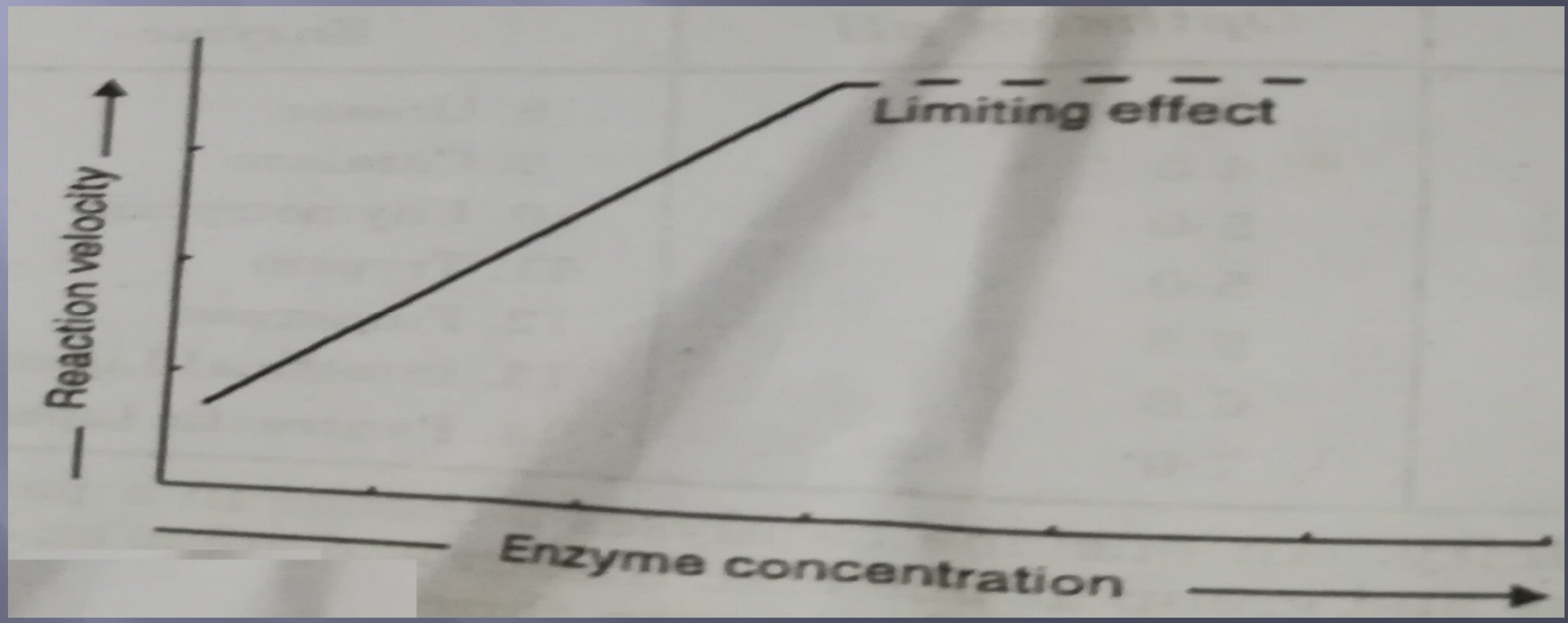

Fig. 1. Relationship amongst enzyme concentration and reaction velocity **(Bhatti 2015)**.

2. Product Concentration: Enhancement in concentration of products has an adverse effect on the rate of reaction. The latter slows down, many turn out to be zero causing start of reverse reaction.

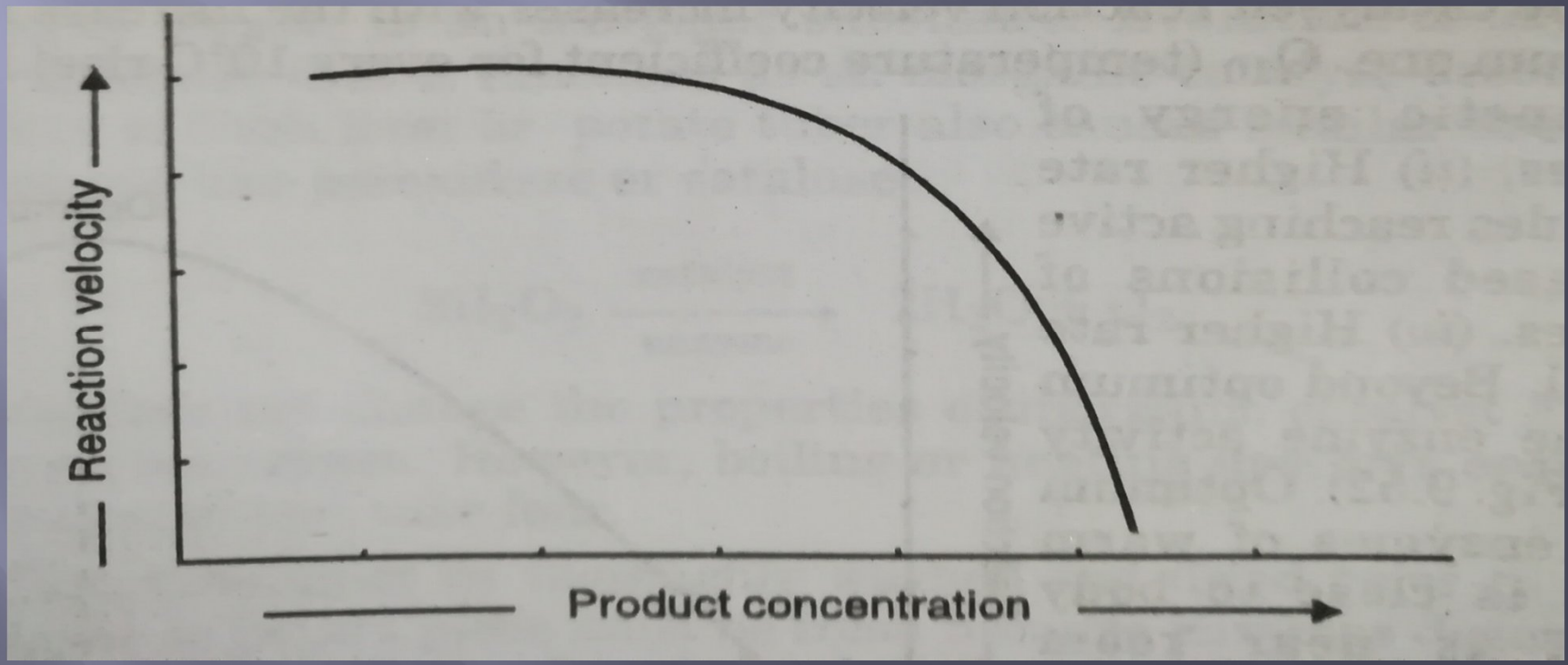

Fig. 2. Relationship amongst product concentration and reaction velocity (Bhatti 2015).

3. Substrate Concentration: In any enzyme reaction, the enhancement in substrate concentration (S) causes the reaction velocity (V) to enhance at first. However, the increase in "V" reduces gradually with the enhancement in "S".

- The reaction finally attains a maximum velocity, where it doesn't enhance any further with enhancing the concentration of the substrate. This happens as enzymatic molecules are lesser over substrate molecules.
- Further enhancement towards the concentration of the substrate will saturate all the enzyme molecules, thereby no enzyme is available free for binding with surplus substrate molecules.
- Thus, the velocity of enzymatic reaction can not be enhanced beyond a limit by adding more substrate.

4. Michaelis Constant (K_m): It was derived mathematically independently by Michaelis (1913) and Menten (1913).

- K_m of an enzyme defined as that substrate concentration in which the reaction achieves half its maximum velocity (1/2 V_{max}).
- K_m of an enzyme is represented in moles of substrate per litre.
- K_m values usually lies in the range of 10^{-1} to 10^{-6} .
- The lower the vale of K_m, the greater is the affinity of the enzyme towards the substrate and *vice versa.*
- An enzyme acting on more than one substrate have different affinities with different substrates, i.e., have separate K_m value for each. For instance, protease act on a variety of proteins and, therefore the K_m value of protease varies with the type of proteins.

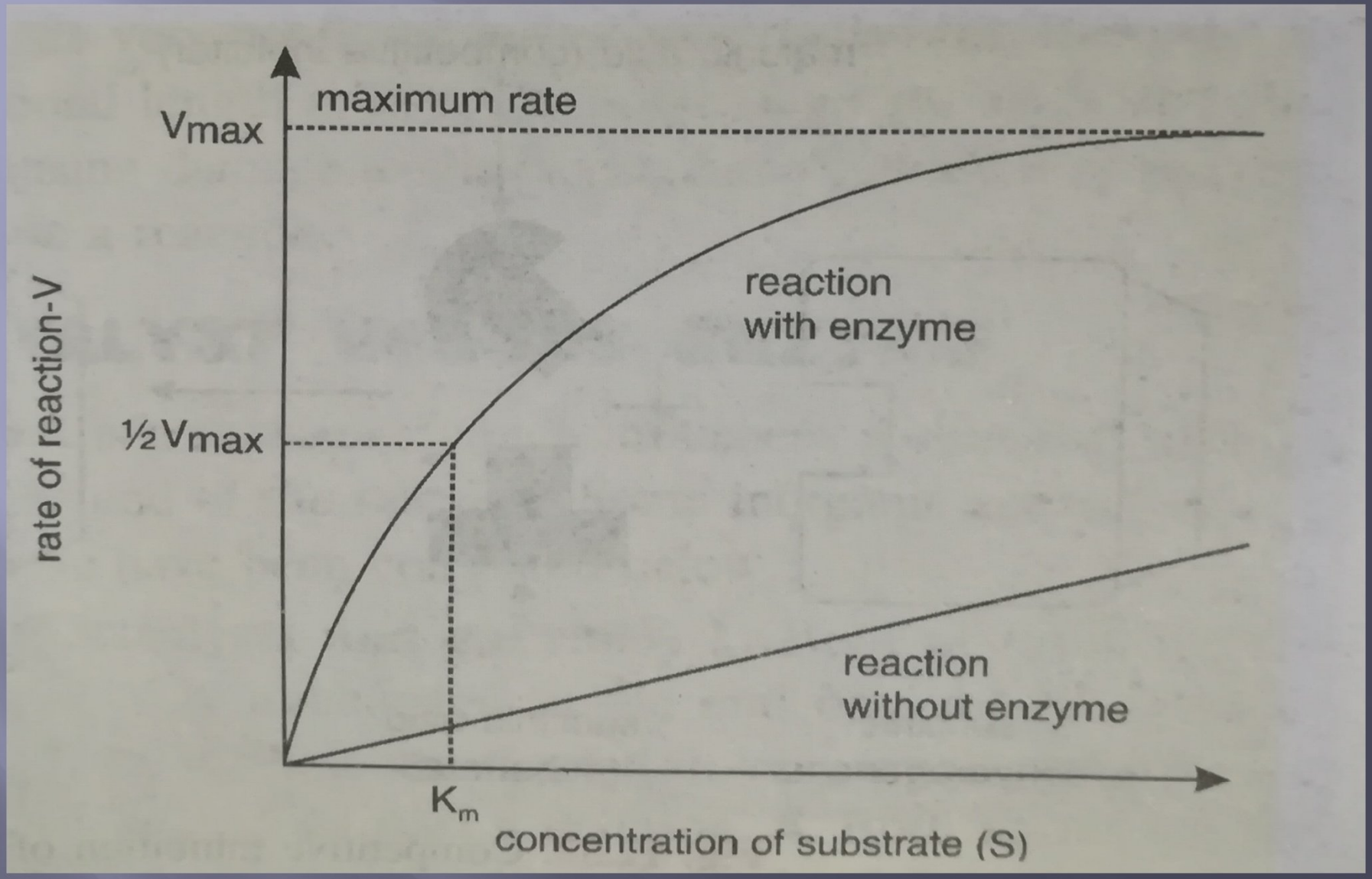

Fig. 3. Relationship amongst substrate concentration and reaction velocity as well as calculation of K_m (Verma and Pandey 2006; Bhatti 2015)

5. Activators: These are needed for:

- Transforming proenzymes to active enzymes. For instance, HCl (hydrochloric acid) is required for transforming inactive pepsinogen into active pepsin.

- Enhancing functioning activities of some enzymes. For example, chloride ion for salivary amylase.

- Function as inorganic cofactors. For instance, Copper, Iron, Magnesium, Nickel, etc.

6. Inhibitors: These are those substances that cause temporary or permanent stoppage of enzymatic activity such as:

- High energy radiations
- Salts of heavy metals
- Cyanide
- Formaldehyde (Formalin)
- Dinitrophenol, etc.

7. Temperature: An enzyme found to be active within a narrow range of temperature.

- There is minimum temperature below which the enzyme turn out to be inactive, maximum temperature beyond which the enzyme becomes denatured and an optimum temperature at which an enzyme depicts maximum activity.

- The enzyme catalyzed reaction velocity enhances with the enhancement of temperature from minimum to optimum one. Temperature coefficient (Q_{10}) for every 10 ^{0}C rise is 2-3 owing to: (a) increased kinetic energy of substrate molecules, (b) increased collisions of substrate molecules, (b) Higher rate of substrate molecules reaching active site.

- High temperature above 45 ^{0}C causes denaturation of enzyme owing to the disruption of various forces/ linkages maintaining the enzymatic tertiary structure.

8. pH Sensitivity: The activity of enzyme is significantly affected by change in optimum pH value of surroundings owing to:

- Alteration in degree of ionization of $–NH_2$, -COOH and other ionizable residues of enzymatic molecules.
- Alteration in non-ionic linkages needed for maintaining conformation of protein and its active site.
- Change in ionic as well as other bonds of the substrate

References

- Verma, P.S.; Pandey, B.P. (2006) Biology, S. Chand & Company Ltd., New Delhi, India, pp. 681-683.
- Bhatti, K. (2015) Companion Biology, S. Dinesh & Co., India, pp. 1328-1345.
- Bugg, T. D.H. (2012) Introduction to Enzyme and Coenzyme Chemistry, Blackwell Publishing Ltd, UK.