

CATALYSIS

A catalyst is a substance that changes the rate of a chemical reaction without itself undergoing any chemical change. A catalyst plays an important role in industries and in laboratories. The phenomenon of changing the rate of a reaction by the use of a catalyst is known as **catalysis**.

Ex : Manganese dioxide is used as a catalyst in the decomposition of potassium chlorate

There are two types of catalysts, i) positive catalyst ii) negative catalyst

Positive catalyst : A catalyst which increases the rate of a chemical reaction is called as positive catalyst.

Ex : Manganese dioxide is used as a catalyst in the decomposition of potassium chlorate

Negative catalyst : A catalyst which decreases the rate of a reaction is called as a negative catalyst.

Ex : Acetanilide decreases the rate of decomposition of hydrogen peroxide.

General characteristics of catalysts :

1. A catalyst remains unchanged in mass and chemical composition at the end of the reaction. However it may undergo some physical change.

Ex : Manganese dioxide is used as a catalyst in the decomposition of potassium chlorate

2. Only a small amount of a catalyst is generally required

Ex : 1g of platinum powder can catalyse the decomposition of hydrogen peroxide.

3. A catalyst does not start any chemical reaction. It only speeds up the reaction which is already in progress slowly.

4. A catalyst does not alter the position of equilibrium or the value of equilibrium constant in a reversible reaction.

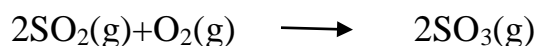
5. A catalyst is specific in its action.

6. A catalyst does not change the nature of products.

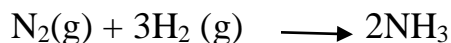
7. The activity of a catalyst is maximum at a particular temperature and this temperature is called optimum temperature of the catalyst.
8. The catalytic activity of a catalyst is increased by the presence of certain substances and these are called **catalytic promoters**.
9. . The catalytic activity of a catalyst is decreased by the presence of certain substances and these are called **catalytic poisons**.

Homogeneous and heterogeneous catalysis :

A catalytic reaction in which the catalyst and the reactants are in the same phase is called **homogeneous catalysis**.



A catalytic reaction in which the catalyst and the reactants are in different phase is called **heterogeneous catalysis**



Effect of catalyst on the rate of reaction ;

Addition of catalyst decreases the energy of activation and increases the number of active molecules .it increases the rate of the reaction.

When a catalyst is added the reaction follows a new path with a low energy of activation. This addition of a decreases the energy of activation and increases the rate of reactant by increasing the number of active centers.

Active centers : The points such as peaks, edges ,cracks and other imperfections on the surface of a solid catalyst have more number of free vacancies. They are more efficient in chemisorbing the molecules of reactants and catalyzing the reaction. These points are called active centers.

Action of catalytic promoters : The presence of catalytic promoters increases the number of active centers and hence increases the activity of catalyst.

Action of catalytic poison : The presence of catalytic poison decreases the number of active centers and hence decreases the activity of catalyst.

Efficiency of catalyst in finely divided state : When a catalyst is finely divided the surface area is increased and the number of active centers is also increased. Hence a catalyst in its finely divided state is more efficient in its activity.

Enzyme catalysis :

Certain chemical reactions in living organisms are carried out in presence of enzymes and the process is called enzyme catalysis.

An enzyme is specific in its action. It has one or more active sites where interaction takes place. The process between reactant and the enzyme takes place by lock and key arrangement. Other molecules do not occupy these sites. Urease catalyses only hydrolysis of urea.

The enzymes are prone to temperature and pH condition. The enzymes will lose their activity above 60degree Celsius.

Enzymes can be destroyed by certain substances like HCN, H₂S, mercury salts etc

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