

Significance of Catalyst in Industrial Purpose

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DESCRIPTION

A catalyst is defined as a compound or an element that increases the rate of a chemical reaction. Some examples of catalysts are iron, which is used in the Haber process, and Nickel is a chemical compound that is used to hydrogenate palm oil to make margarine. Iron is commonly used in the manufacturing of ammonia. Some of the significant characteristic features of catalysts are:

- A catalyst does not start a chemical reaction.
- A catalyst is not consumed during the reaction.
- Catalysts react with reactants to form intermediates and to facilitate the production of the final reaction product. After the complete process, a catalyst can regenerate.

A catalyst can be liquid, solid, or gaseous. Some of the solid catalysts include metals or their oxides, including halides and sulphides. Semi-metallic elements such as silicon, boron, and aluminium are also used as catalysts. Similarly, liquid and gaseous compounds that are in a pure state are used as catalysts. Sometimes, these catalysts are also used along with suitable carriers or solvents.

The reaction that contains a catalyst in their system is identified as a catalytic reaction. In other words, catalytic action is a chemical reaction between the reactant and a catalyst. These results lead to the formation of chemical intermediates that can react with another reactant to form a product. However, when the reaction between the reactants and the chemical intermediates occurs or takes place, the catalyst is restored.

In the case of solid catalysts, the reaction modes between the catalysts and the reactants usually vary. It is more complex. Reactions can be oxidation-reduction reactions, coordination complex formation, as well as the assembly of free radicals. For solid catalysts, the reaction mechanism is acid-base reactions greatly influenced by surface properties and crystal or electronic

structures. Some types of solid catalysts are polyfunctional catalysts, which can have various reaction ways with the reactants.

Types of catalysts

Depending on the need or requirement of the chemical reaction, catalysts are classified into various types. They are as follows:

Positive catalysts: Positive catalysts are catalysts that increase the rate of a chemical reaction. It increases the rate of reaction by lowering the activation energy barriers such that a large number of reaction molecules are converted into products, thereby increasing the percentage of yield of products. Positive catalyst example is the preparation of NH_3 by Haber's process, iron oxide acts as a positive catalyst and increases the yield of ammonia in spite of less reaction of nitrogen.

Negative catalysts: Catalysts that reduce the rate of reaction are referred to as "negative catalysts." It decreases the rate of reaction by increasing the activation energy barrier, which decreases the number of reactant molecules to convert into products, and therefore the rate of reaction decreases. The examples of negative catalysts are the disintegration of hydrogen peroxide into oxygen and water is decreased by using acetanilide, which acts as a negative catalyst to reduce the rate of decomposition of hydrogen peroxide.

Promoters or accelerators: A substance that increases the rate of reaction is known as a promoter or accelerator. The examples for promoters are molybdenum or aluminium or potassium mixed together to act as promoters in Haber's process.

Catalyst poisons or inhibitors: Substances that reduce the catalyst activity are known as catalyst poisons or inhibitors. Examples of catalyst poisons are hydrogenation of an alkyne to an alkene. This catalyst is also known as Lindler's catalyst.

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