# K.T.S.P. Mandal's

# Hutatma Rajguru Mahavidyalaya, Rajgurunagar

## Department of Chemistry

## T.Y.B.Sc. Sem-V

## Industrial chemistry paper-505

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As per new revised choice based credit system syllabus w.e.f. June 2021

# Modern Approach to Chemical Industry

Classification of Chemical Reactions, Batch and Continuous Operation Intellectual Property (IP), Conversion, Selectivity and Yield



## Classification of Chemical Reactions

The most general classification of chemical reactions is based on number and type of phases involved in the reaction.

Chemical Reactions.

**(A) Homogeneous Reactions**

**(B) Heterogeneous Reactions**.

**(A) Homogeneous Reactions (Reactions involving single phase):** Homogeneous reactions are further classified into catalytic and non-catalytic reactions Catalytic reactions: Here the homogeneous phase is

liquid. Examples of reactions carried out in this phase are: nitration, sulphonation, Friedel Craft reactions, condensation, esterification, enzyme reactions, hydrolysis reactions etc. (Non-catalytic reactions: Here the homogeneous phase is a gas. Examples of reactions carried out in this phase are: combustion, cracking, pyrolysis and acid base reactions.

***(*B) Heterogeneous Reactions (Reactions involving more than one phase):** Heterogeneous reactions are further classified into four types on the basis of phases.

Gas -liquid reactions: The catalytic reactions are oxidation, alkylation, polymerization, halogenation, ammonolysis and non-catalytic reactions are absorption of gases in liquid like Cl; and $CO_2$ in NaOH, or ammonia in $H_2SO$, HNO3), $H_2PO_4$, etc.

Gas-solid reactions:

The catalytic reactions are ammonia synthesis, hydrogenation, dehydrogenation, oxidation of $SO_2$, $NH_3$, hydrocarbons and non-catalytic reactions are reduction of metal oxides, burning of coal, roasting of ore etc.

Liquid-Solid reactions: The catalytic reactions are polymerization using Ziegler-Natta catalysts, enzyme catalyzed reactions and non-catalytic reactions are leaching of ore by acids, ion exchange reactions.

Gas-liquid-solid reactions: The catalytic reactions are gas liquid reactions catalyzed by solid e.g: oxidation and hydrogenation of organic compounds. oil vanaspati

## Batch and Continuous Operations

## Batch Operation

The calculated raw material is fed in one lot and the products are removed after some time

The apparatus is idle during charging and discharging

Charging and discharging operation requires more manual labor Temperature, pressure, concentration may not remain constant in all batches

The rate of reaction does not remain constant during entire process

It requires more energy due to alternate heating and cooling

Less product per man hour is obtained.

Quality control is difficult.

They require much smaller and less expensive equipment

Less Profitable

## Continuous Operation

The calculated raw material is fed continuously and the products are removed continuously

The apparatus and equipment is never idle chuting charging and discharging

Charging and discharging operations are easier and requires less manual labour

Temperature pressure, concentration remain constant, throughout the operation

Due to full automation rate of reaction remains constant

It requires less energy as waste heat is immediately used for preheating the me materials.

More product per man hour is obtained

High quality control is obtained.

They require good quality, bigger and more expensive equipment.

More profitable.

**Conversion, Selectivity and Yield**

These terms are always used in connection with the production of chemicals. These are many times uncleared by the people.

The terms conversion, efficiency and yield are used to describe the amount of reactant consumed and the amount of product formed in the process. Conversion is expressed as a percentage and is related to the amount of reactant that is chemically converted to another substance(s). The term selectivity refers to increasing the percentage of one of the products by keeping conditions favorable to the formation of that product. This generally makes use of a catalyst. Yield refers to the actual amount of product formed in the reaction.

**Intellectual Property (IP)**

It relates to creations of the mind. It includes inventions, literary and artistic works, and symbols, names, images, and designs used in commerce. It is divided into two groups as

**Industrial Property**

Patents (inventions)

Trademarks

Industrial designs

Geographic indications of sources

**Copy right**

(i) Literary works: novels, poems, plays, films,

musical works

(ii) Artistic works: drawings, paintings,

photographs, sculptures, and architectural designs

Rights related to copyright include those of performing artists actor, actress, entertainer, musician, singer, dancer etc) in their performances (presentation, show) those of broadcasters in their radio and television programmes and producers of phonograms in their recordings. The intellectual property (IP) law offers exclusionary rights to the creator or inventor against any misuse or use of work without his/her prior knowledge (previous understanding). Intellectual property law sets up an equilibrium by furnishing rights for limited period of time. The intellectual property (IP) laws vary from nation to nation. But on international level it is managed by the World Intellectual Property Organization (WIPO). Some of the Activities or work covered by IP rights are: (1) industrial designs, (ii) scientific discoveries, (iii) literary, artistic and scientific works, (iv) trademarks, service marks (business), and (v) other rights such as industrial, scientific and literary fields.

References: According to the new revised syllabus of Savitribai Phule Pune University from June 2021, Text book of Industrial chemistry for T.Y. B.Sc. course (CH- 505), Sem-V Manali Publication, Nirali Publication and google images