

CHAPTER 11

INDUSTRIAL CHEMISTRY

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Industrial chemistry is the branch of chemistry which deals with the conversion of raw materials into useful product through chemical process.

CHEMICAL INDUSTRIES

“The term chemical industries refer to all those compounds that manufacture chemicals.”

Synthetic Fertilizer	Chemical Formula	Nutrients Provided	Uses
Ammonium Nitrate	NH_4NO_3	Nitrogen	Development of roots and maintaining pH soil
Urea	$\text{CO}(\text{NH}_2)_2$	Nitrogen	Development of leaf, stem and fruits
Diammonium Phosphate (DAP)	$(\text{NH}_4)_2\text{HPO}_4$	Nitrogen, Phosphorus	Development of early stage of plants growth
Potassium Chloride (MOP)	KCl	Potassium	Help enzyme activities and photosynthesis

Synthetic Textile Products	Description	Uses
Polyester	A synthetic fiber made from petrochemicals	Clothing (shirts, pants, dresses, jackets), curtains, bedding etc.
Nylon	A strong and durable synthetic fiber	Stockings, hosiery, swimwears, ropes, parachutes, and various sportswears.
Acrylic	A soft and light weight synthetic fiber.	Sweaters, blankets, faux fur, carpets,

Paint Products	Description	Common Uses
Water-Based Paint	It is also known as latex. In this paint water is used as a carrier solvent	Interior and exterior walls, ceilings, and various surfaces.
Oil-Based Paint	It contains organic solvents as a carrier.	Woodwork, metal surfaces and surfaces that require durability.
Enamel Paint	A type of oil-based or water-based paint with a hard, glossy finish.	Metal surfaces, kitchen appliances, and surfaces that need high durability.
Epoxy Paint	A two-part paint that consists of a resin and a hardener, creating a tough and durable coating.	Industrial floors, garage floors, marine applications, and metal surfaces.

Detergent Products	Composition	Main Uses
Laundry Detergent	Surfactants, builders, enzymes, fragrance, water softeners	Cleaning clothes in washing machines
Dishwashing Detergent	Surfactants, enzymes, fragrance, water softeners	Washing dishes by hand or in dishwashers
All-Purpose Cleaner	Surfactants, solvents, fragrance, water	Cleaning various surfaces and floors
Hand Soap	Surfactants, moisturizers, fragrance, antibacterial agents	Hand hygiene and cleansing

Cement Type	Composition	Main Applications
Ordinary Portland Cement (OPC)	Clinker (mainly composed of calcium silicates), gypsum, limestone, and small amounts of other materials.	Infrastructure construction, concrete and production.
Portland Slag Cement (PSC)	Clinker, slag, gypsum and limestone.	Underground construction marine works, and sewage works.
White Cement	Clinker, limestone, and gypsum with low iron content.	Tile grout and other decorative constructions.

PHARMACEUTICAL INDUSTRY



Pharmaceutical industries refers to the companies where drugs are manufactured. Drug is a substance that is used to treat or cure a disease in human or animals. Some common drugs are described below:

1. Analgesics:

A drug that specifically targeted on central nervous system to provide pain relief is known as analgesic drug.

For example: Aspirin (chemical name: Acetyl salicylic acid)

2. Antibiotics:

It suppress the growth or kills micro organisms. "Penicillin" was the first discovered antibiotic.

3. Antipyretic medicines:

A drug which lowers the body temperature to normal is known as antipyretic. The most widely used antipyretic is "Paracetamol".

4. Anti Fungal medicine:

These drugs are used to kill fungi that cause infections on skin. The most common skin infections are ringworm and dandruff. Example of antifungal drug is "fluconazole".

5. Anti Inflammatory medicine:

These drugs help to reduce inflammation, and relieve pain. Ibuprofen (Brufen) is an example of anti-inflammatory medicine.

6. Anti Allergic medicine:

These are also called antihistamines. Histamine is a chemical produced in the body due to decarboxylation of an amino acid known as histidine. The administration of these drugs reduces the histamine level in the body.

For example: Diphenhydramine (Acefyl)

7. Anti Malarial medicine:

Anti-protozoal or anti-malarial drugs are used to treat mosquito-bite infectious disease such as malaria. Most commonly used anti-malarial drug is chloroquine.

**PESTICIDES**

"Chemical which are used to control, repel or kill pests or insects or fungus are known as pesticides".

Types of Pesticides

Pesticides are classified into three major classes named as insecticides, fungicides and herbicides.

1. Insecticides

"Chemical substances which are used to kill insects are called as insecticides". The best known insecticide is Dichlorodiphenyltrichloroethane (DDT),

2. Herbicides

Herbicides are the chemicals which either destroy or stop growing weeds.

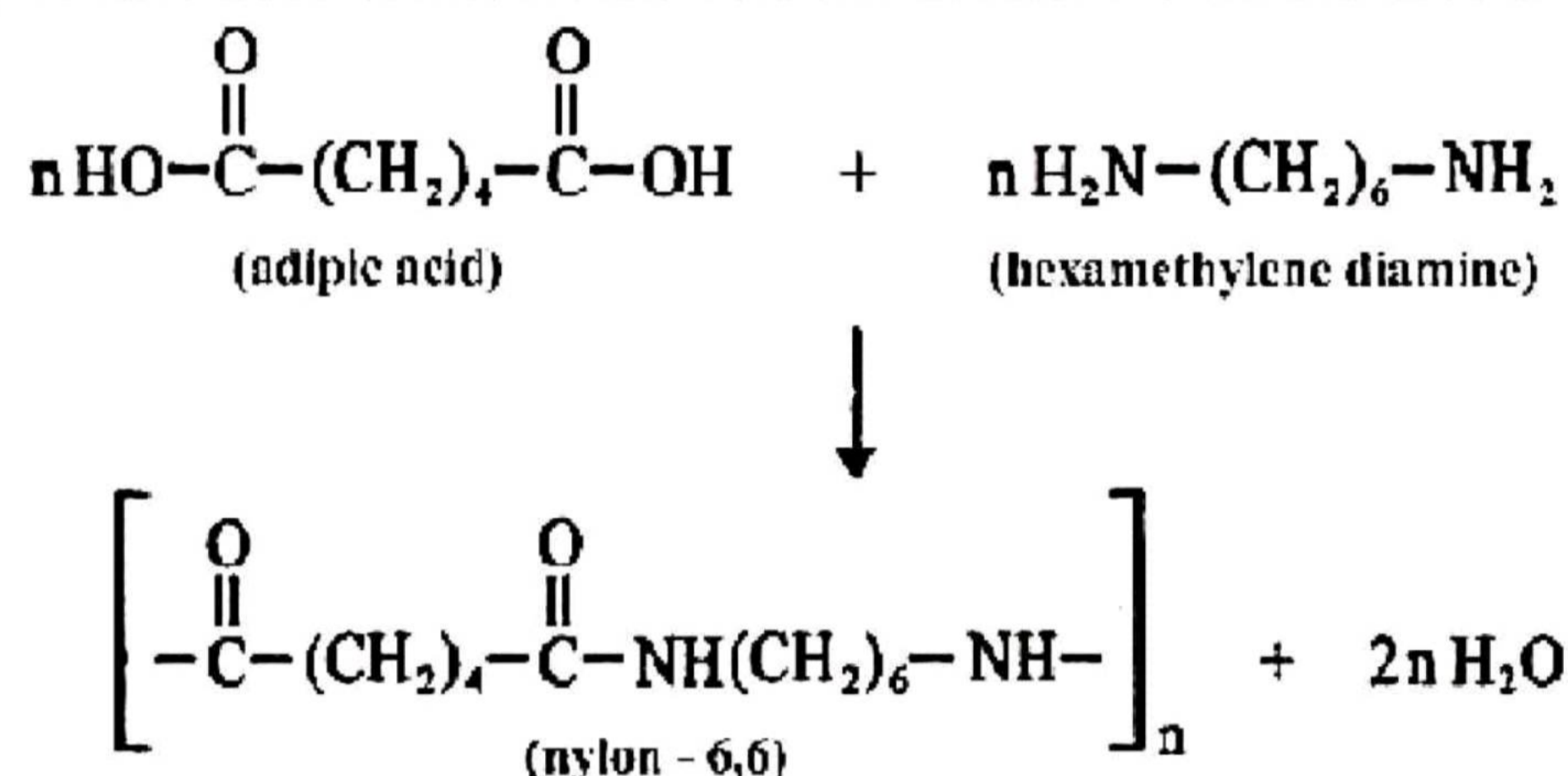
3. Fungicides

Fungicides are chemical substances employed to eliminate undesired fungi that develop within crops.

Nylon 6, 6

Nylon 6, 6 is a type of synthetic polymer. It is known due to its high strength, light weight and excellent mechanical properties.

Nylon 6, 6 is chemically a polyamide and prepared by the process of condensation polymerization between hexamethylenediamine and adipic acid (hexanedioic acid) with the elimination of water molecules.



It is used in making tents, parachutes, ropes, fish net, bristles of brushes etc.

COSMETICS

The word cosmetic is derived from the Greek word "kosmetiko" which means butification of skin.

"Cosmetics are the products that are used to enhance or alter the appearance of face, body, nails or hairs."

- (i) **Lipstick:** "Lipstick is a chemical used to colour, moisturization and protection of the lips". It is a type of makeup that usually available in a stick and is applied directly to the lips. Lipstick is typically made from a mixture of oils, waxes, pigments, fragrance and moisturizing agent.
- (ii) **Nail Polish:** It is a type of lacquer that is used to enhance the appearance of nails in women. It comes in a variety of colours including red, pink, brown and others. The basic components of nail polish include pigments, resin, plasticizers and film former.
- (iii) **Nail Polish Remover:** It is an organic solvent such as "acetone"
- (iv) **Hair Dyes:** These are chemicals that change the colour of hairs.

Hair dyes can be temporary or permanent. The permanent hair dyes contains Hydrogen Peroxide (H_2O_2) as an oxidizing agent.

- (v) **Perfumes:** These are complex mixtures of aromatic compounds

ADHESIVES

“Adhesives or glue are chemical substance that use to stick materials together”. They are liquids or semi solids. They create a bond between the two surface through either physical or chemical processes. A wide variety of adhesive are available, each possessing unique properties and appropriate applications. Some of frequently used adhesive are described below.



Starch

It is a natural adhesive and prepared by heating starch suspension in water.

It has low adhesive strength but widely used because it is easily prepared and low cost.

For example: Flour is mixed in water and then it is heated.

Epoxy Resins

These are strong synthetic adhesives and commonly used for bonding metals, plastics, glasses and ceramic items.

For example: Magic Depoxy Steel

Silicon Resins

These are known with their high strength, high thermal stability and water repellent ability. For example: UHU

Super Glue

It is chemically named as cyanoacrylate. It is fast acting adhesive that bond quickly of broken items such as jewellery, toys, automobiles etc.

For example: Elfy

Multiple Choice Questions

- (i) Super glue is chemically named as:
(a) Cyano acrylate (b) Polyvinyl acetate
(c) Epoxy resins (d) Polyurethane
- (ii) DDT is a chemical which commercially known as:
(a) Insecticide (b) Herbicide
(c) Pesticide (d) Fungicide
- (iii) Nail polish remover is mainly consists of:
(a) Pigments (b) Acetone
(c) Diethyl ether (d) Ethyl alcohol
- (iv) Antimalarial drug among the following is:
(a) Ibuprofen (b) Chloroquine
(c) Paracetamol (d) Diphenyl hndramine
- (v) Asprin is a pain reliever, its chemical name is:
(a) Ascorbic acid (b) Nicotinic acid
(c) Acetyl salisylic acid (d) Benzoic acid
- (vi) Nylon 6, 6 is a condensation polymer of hexamethylene diamine and:
(a) Benzoic acid (b) Adipic acid
(c) Pthalic acid (d) Valeric acid
- (vii) Which of the following is not a synthetic plastic:
(a) Nylon (b) Teflon
(c) Cellulose (d) Polyethene
- (viii) Drugs that lower the body temperature to normal are known as:
(a) Antibiotics (b) Antipyretic
(c) Antiallergic (d) Anti histamins
- (ix) Which of the following chemical is used as an oxidizing agent in permanent hair dyes:
(a) Acetone (b) Hydrogen peroxide
(c) Polyvinyl acetate (d) Resorcinol
- (x) An example of thermosetting plastic is:
(a) Polyethene (b) PVC
(c) Nylon (d) Bakelite

Short Questions

1. Give the scope of pharmaceutical industries in Pakistan.

Ans. There are hundreds of pharmaceutical industries operating in Pakistan. Health ministry of Government of Pakistan play important role in the availability and accessibility of drugs in public sector.

2. What is antihistamine drug? Give the symptoms in which it is used.

ALREADY DISCUSSED ABOVE

3. Write the names of two synthetic and two natural polymers.

ALREADY DISCUSSED ABOVE

4. Write the name of four main components of Nail polish?

ALREADY DISCUSSED ABOVE

Descriptive Questions

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1. How can you define Cosmetics? Describe four cosmetics which are commonly used.

ALREADY DISCUSSED ABOVE

2. What are pesticides? Explain various types of pesticides along with their specific use.

ALREADY DISCUSSED ABOVE

3. Describe the preparation, properties and uses of Nylon and polyvinyl chloride.

ALREADY DISCUSSED ABOVE

4. What are adhesives? Explain the significance of super glue and silicon resins.

ALREADY DISCUSSED ABOVE