Synthetic Materials in Industry

Chapter 7

SYNTHETIC POLYMERS

- The artificial polymers.
- Used to make a wide range of products including computers, fabrics, toys, furniture, car parts, and electronic parts.
- Manufactured by the long chain molecules consisting of repeating units of smaller molecules called monomers

- The synthetic polymers can be classified into elastomers, thermoplastics, and thermosets.
- The thermoplastics and thermosets are plastics include synthetic rubbers used to make balloons, gloves, tyres, and engine belts.
- The synthetic fibres such as nylon and polyester are used to make fabrics.
- Plastics such as PVC, polystyrene (foam), and epoxy resins are used to make toys, plastic cups, furniture, food packaging, and high-strength glue. .

PROCESS OF MAKING SYNTHETIC POLYMERS

- The synthetic polymers are produced through polymerisation process.
- Small of molecules called monomers are bound together to form longer chain of polymers.
- There are two main categories of polymerisation reaction:

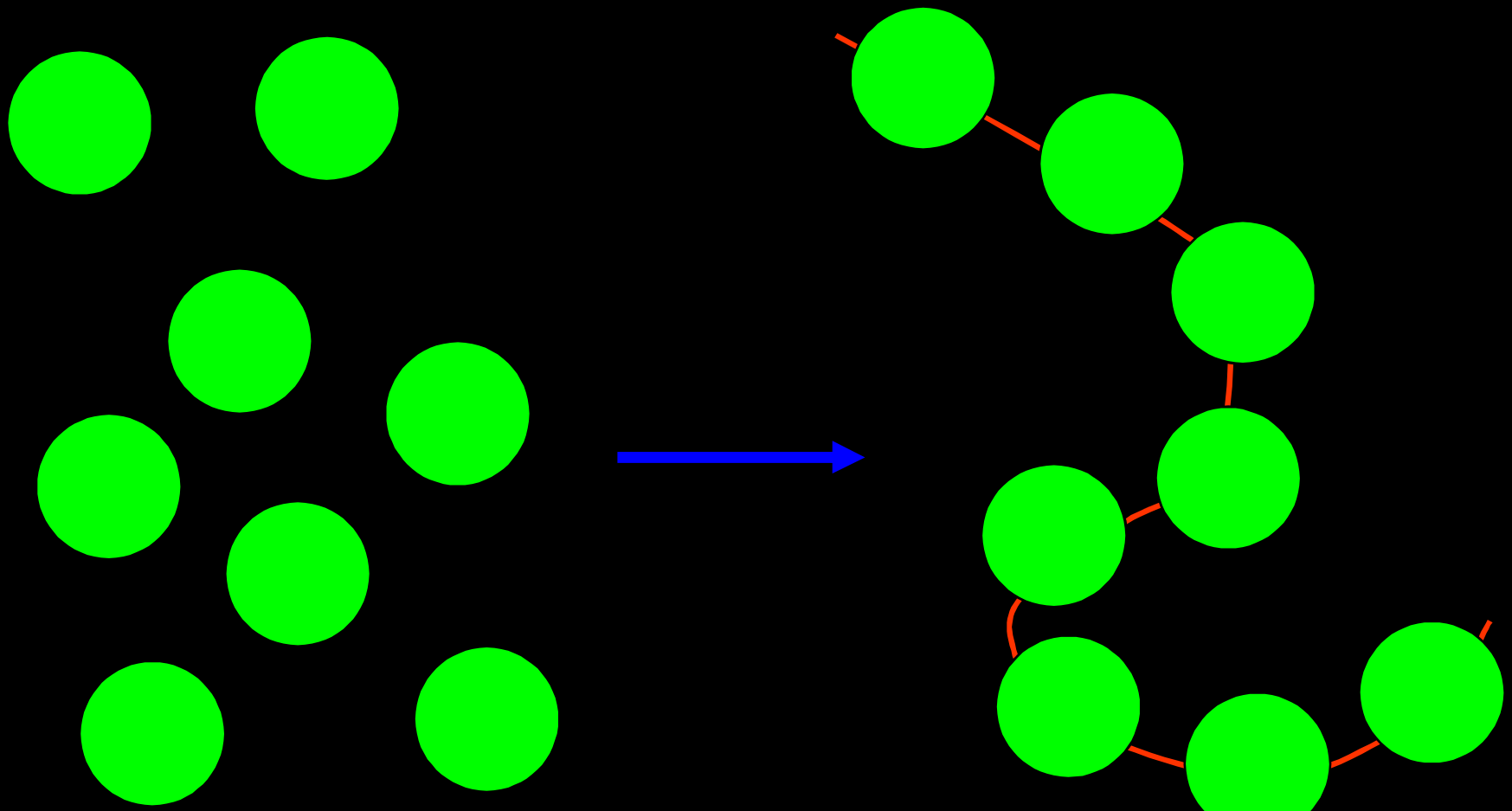
  i. addition polymerisation

  ii. condensation polymerisation.

The addition polymerisation

- A process when monomers are added to produce polymers without producing any by-products.
- Example:
  - Production of PVCs

Addition Polymerisation



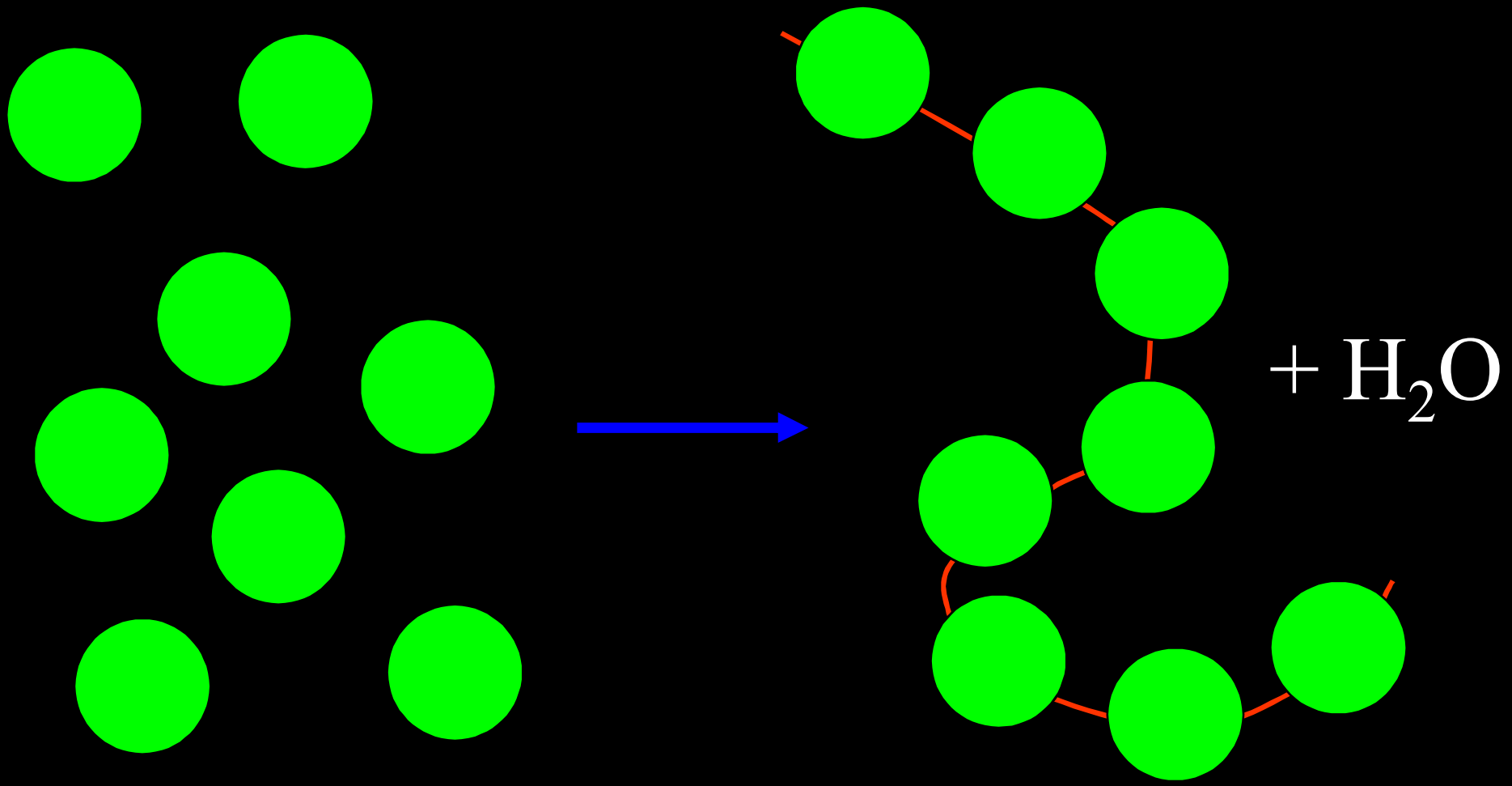
Monomers

Polimer

The condensation polymerisation

- A process that occurs when a small molecule of the by-product such as water is produced.
- Examples:
  - Production of nylon and polystyrene

Condensation Polymerisation



Monomers

Polimer + small molecule

SYNTHETIC RUBBERS

- Elastic synthetic polymers (resistant to heat, water, and oil).
- Used to make balloons, gloves, and raincoats because they are elastic and water resistant.
- Certain types of synthetic rubbers are used to make engine parts, such as fan belts, gaskets, and hoses because they are elastic, strong and resistant to oil and heat.

- This type of synthetic rubber is clear, easy to clean, odourless, and not sticky
- Some products are made of a combination of the natural and synthetic rubbers.
- Example, a foam mattress made of natural rubber is heavy and firm but deteriorates over time.
- A mattress made of synthetic rubber is lightweight, lasts longer, but is too soft.

- A mattress made of the natural and synthetic rubber is lightweight, firm and lasts longer.

Characteristics of synthetic rubber and natural rubber

Properties	Natural rubber	Synthetic rubber
Elastic	Yes	Yes
Heat resistant	No	Yes
Strong	No	Yes
Oil resistant	No	Yes
Water resistant	Yes	Yes
Chemical resistant	No	Yes
Can be oxidised	Yes	No
Can be electrical insulator	Yes	Yes

PLASTICS

- Synthetic polymers.
- There are many types of plastics:

1. PVC is polyvinylchloride (tough, flexible. cheap to produce and easy to print on).

   Example: identification card

2. Polystyrene can either be foam or rigid.

   Example:

   - The food container (it is clean, lightweight and water resistant.

   - Toys are made of the rigid polystyrene.

3. Polythene comes in two types: low density and high density.

– Container is made of high-density polythene.
– The low-density polythene is used to make plastic bags.

4. Polyamide is also known as nylon. The bristle of this toothbrush is made of polyamide. The polyamides are also used to make clothings, ropes, and carpets.

– Polyethylene terephthalate, or commonly refers to PET is a strong recyclable plastic. The bottles of carbonated drinks are made of this plastic.

– Polyurethane is strong and lightweight. The wheels of the skateboard are made of this plastic.

THERMOPLASTICS AND THERMOSETTING PLASTICS

- Plastics can be divided into two main groups:
  - thermoplastics
  - thermosetting plastics.

Thermoplastics

- Plastics that melt when heated.
- Can be reused by melting and resolidifying into new things.
- Recyclable.
- Examples:
  - plastic mineral bottles, plastic bags, and plastic wrappings

Thermosetting plastics or thermosets

- Plastics that cannot be melted or remoulded.
- When heated, the plastics will blister and burn.
- Hard, rigid, and heat resistant.
- Used to make melamine plates, mugs, and protective coverings of electrical appliances.

Comparison of thermoplastics and thermosetting plastics

Thermoplastics	Thermosetting plastics
Soft when heated	Blister when heated
Can be remoulded	Cannot be remoulded
Recyclable	Non-recyclable
Unbreakable	Brittle

DISPOSAL OF PLASTIC MATERIALS

- Everyday, people dispose tons of plastic materials.
- Plastics are non-degradable materials (take a long time to disintegrate).

- Some people dispose plastics into streams and rivers. - The plastics clog sewer system (causes flash floods during rainy season).
- Some plastics end up in the sea- contaminating the sea (creates hazards to marine life).

- Some animals were killed after they mistakenly ate the plastics (the plastics look like jellyfish when floating in the sea).
- Burning plastics produce toxic gas. People with asthma will experience breathing difficulties when exposed to the smoke produced by burning plastics.
- The remaining ashes may contaminate soils and water, thus posing hazards to wildlife and fish.

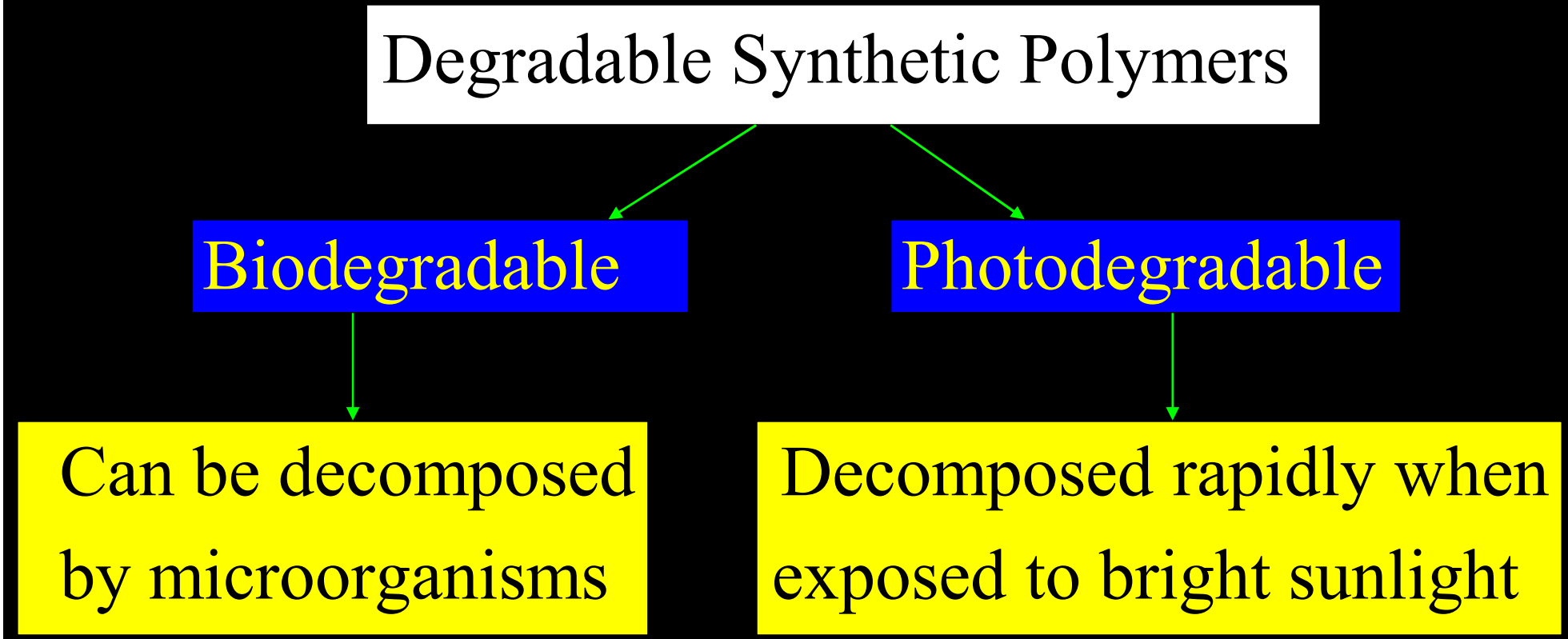
Proper Waste Disposal

- To reduce plastic wastes is by reducing its usage, recycling.
- Reusing plastic bags, food containers, and by limiting the usage of disposable plastics.
- For example, place plastics, paper, aluminium cans, and organic wastes into different bags.
- Plastic wastes can be recycled.

RESPONSIBLE ATTITUDES IN THE DISPOSAL OF SYNTHETIC POLYMERS

- The synthetic polymers are usually non-biodegradable (cannot be decomposed by living things, such as bacteria and fungi).
- This could be done by recycling or reused the materials.
- For example:
  - provides breeding space for marine lives such as fish and crabs.

- Reduce the non-biodegradable polymer wastes by using the degradable synthetic polymers.



WHAT YOU CAN DO TO HELP

- Choose products with minimal packaging
- Choose products made of recycled materials.
- Try to reduce the need to throw away plastics.
- Rather than throwing plastic toys away
- Sort garbage according to categories.
- Always remove the bottle caps when put plastic bottles into recycling bins.