

Chapter – 3: Synthetic Materials

- Your clothes – made of different materials – fabric – made of fibres
- Fibres from plant and animals – natural fibres – cotton, jute, flax, sheep, silkworms
- Other fibres – artificial methods – synthetic fibres – made in labs – with chemicals – synthetic polymers

Polymers

- Synthetic fibre – chain of small units – monomers – joined together – polymer
- Process – joining monomers – polymerization
- Poly – many – mer – repeating units
- Polythene (polyethylene) – polymer – make carry bags
- This polymer – made of ethene (ethylene)
- Polymers – 2 types –
 - Natural –
 - Occur in nature
 - Cotton – polymer of cellulose (wood pulp)
 - Silk, wool, proteins, etc
 - Synthetic –
 - Prepared artificially
 - Rayon, nylon, polythene, Teflon
- Synthetic polymers – strong, light weight, durable – very useful – make fabric, pipes, buckets, glasses, etc

Synthetic Fibres

- Most clothes – synthetic materials – OR – blend (mixture) of natural and synthetic materials
- Most popular synthetic materials – nylon, rayon, polyester, acrylic

Nylon

- 1st complete synthetic material – invented in New York (NY) – 1931 – 1st sold in London (LON) – named this way – NYLON
- Prepared chemically – no natural material used
- Combining – coal (carbon), water (hydrogen oxide), and air – polymer of polyamide
- Properties –
 - High tensile strength – elastic or flexible
 - Durable – resist wear and tear
 - Absorb less water – dries up very fast
 - Wrinkle free – easy to maintain
 - Shiny, long lasting colour – good to look at
- Uses –
 - Textile industries – produce yarn – make dress materials, sarees, shirts, etc
 - Making parachutes, ropes, fishing nets, badminton rackets, etc
 - Toothbrush bristles, combs, etc

- Several machine parts – pulleys, washers

Rayon

- Also called – artificial silk – reason – smooth quality
- Similar to silk – feel, texture
- Cheaper than silk – woven just like silk
- Obtained from pure cotton – natural source – processed chemically – called regenerated fibre
- Properties –
 - Soft, smooth, cool, comfortable
 - Do not trap heat – ideal – hot, humid climate
 - Comfortable as natural fibres
- Uses –
 - Dress materials, clothes
 - Home furnishing – blankets, bedsheets, curtains, etc
 - Waterproof bandages – cover wounds – do not stick

Polyester

- Synthetic fibre – made from petroleum products – mainly esters
- Terylene, Dacron, Terene – examples
- Terylene – mixed (blend) with cotton – form terycot – mixed with wool – form berywool
- Blended fibres – more comfortable – easier to maintain
- Properties –
 - Strong, durable fibre
 - Easy to maintain – wrinkle free, resist water
 - Light weight, elastic
- Uses –
 - Shirts, trousers, sarees, other dresses, etc
 - Sails – sailing boats – light weight
 - Trap heat – jackets, sleeping bags
 - Bottles, jars, utensils, other useful products
 - PET (Polyethylene Terephthalate) – jars, bottles – store food items

Acrylic

- Synthetic polymer – looks like wool
- Blended with – cotton, polyester, other polymers
- Properties –
 - Warm, soft – like wool
 - Lighter than wool – do not absorb water
 - Winter wear – lighter, durable
 - Wrinkle free – chemical resistant
 - No effect of sunlight
- Uses –
 - Sweaters, winter wear, etc
 - Linings – boots, gloves – socks, sportswear, fake fur
 - Carpet, craft yarn, upholstery fabrics (chair covers, etc)

Properties of Synthetic Fibres

- Strength –
 - Most imp. property – nylon, polyester, etc
 - Resist lot of force – without breaking
 - Natural fibres – cotton, wool, silk – break easily
 - High tensile strength
- Elasticity –
 - Highly elastic – stretched – great lengths
 - Release – retain original shape
 - Nylon – make socks
- Water absorption –
 - Absorb – less water – dries up very fast
 - Natural fibres – absorb lots of water – very long to dry
- Wrinkle resistance –
 - Wrinkle free – easier to maintain
 - Natural fibres – wrinkle easily – regular ironing
- Moth resistance –
 - Not attacked by moths – chemically inert (not active)
 - Natural fibres – easily attacked by insects
- Inflammability –
 - Synthetic fibres – inflammable – burn easily
 - Not to be used – kitchens or near fires

Disadvantages of Synthetic Materials

- Non-biodegradable –
 - Do not decompose naturally
 - Cause water pollution – choke drainage
- Do not absorb water –
 - Summer season – uncomfortable – do not absorb sweat
 - Overcome this problem – blend with natural fibres
 - Terycot – make shirts, towels, etc – blend of terylene and cotton
- Burn easily –
 - Melt – low temperatures
 - Near fires – dangerous – synthetic fibres – melt – stick to skin – deep burns
 - Skin problems – rashes, allergies

Plastics

- Lots of things – made of plastic – buckets, mugs, glasses, toothbrushes, etc
- Synthetic polymers – 2 types –
 - Thermoplastics –
 - Heat again and again – make different shapes
 - Heating – gets soft – cooling – gets hard
 - Thermosetting –

- Can be moulded – only once – cannot change shape
 - Retain shape – even at high temperatures
- All plastics – common property – made of polymers
- Source – petroleum – crude oil – found naturally
- Mixture – carbon compounds – separated – fractional distillation
- These fractions – compounds – benzene, ethene, propene, etc

Properties of Plastics

- Poor conductors –
 - Do not conduct – heat, electricity
 - Electric wires – covered with plastics
 - Tumblers – contains hot food items – do not melt
 - Cooking utensils – handles – made of plastic – do not heat
- Light weight –
 - Easier to carry – light weight
 - Other materials – wood, metals – very heavy
- Durability –
 - More durable – tensile strength, toughness
 - Handle – great force, pressure – do not break
- Corrosion resistance –
 - Not affected – air, moisture, etc
 - Do not corrode – retain colour – longer time
 - Buckets, etc – made of plastic
- Chemical resistance –
 - Strong chemicals – acids, bases – do not harm plastics
 - Store chemicals

Uses of Plastics

- Plastics – part of daily lives – more economical
- 2 types of plastic – thermoplastics, thermosetting

Thermoplastic

- These plastics – gets soft – on heating – recycled, reused, coloured, melted, etc
- Common thermoplastics –
 - PVC –
 - Polyvinyl Chloride
 - Used as – building material, electronic items, shoes, soles, etc
 - Teflon –
 - Scratch proof, corrosion resistant
 - Used as – protective coverings – non-stick frying pans, paint of cars
 - Polyethylene –
 - Inexpensive uses – supermarket bags, plastic bottles, packaging materials, etc
 - Also used – pipes – transport water
 - Polystyrene –

- Thermocol disposables utensils, food containers, CD covers
- Insulate refrigerator walls

Thermosetting

- Once shaped – cannot be reheated and reshaped
- Common thermosetting plastics –
 - Bakelite –
 - Plugs, switches, electrical fittings, etc
 - Melamine –
 - Unbreakable kitchen ware
 - Coated on uniforms of firemen – fire resistant

Plastics – A Threat to the Environment

- Access use of synthetic polymers – environmental problems
- Plastics – proved to be magical – reason – properties – strength, weather resistance, chemical resistance, etc – BUT – negative side as well
- Disposal – major problem – non- biodegradable
 - Waste – thrown carelessly – may contain plastic – cattles – search for food – accidentally swallow plastic – cause choking – may be death
 - Burning plastics – air pollution – poisonous fumes – residue – after burning – harmful
 - Plastic materials – not disposed properly – clog (choke) drains – sewage water – overflow – many problems
 - Plastic items – block soil pores – block percolation (transfer of water through soil) – soil pollution
- Environmental problems – increased too much – people advised – use cloth bags
- Reduce problems – reuse or recycle waste – use natural alternatives
- Separate bins –
 - Biodegradable –
 - Domestic waste – vegetable peels, paper, cotton cloth, wood, etc
 - These wastes – decompose – prepare manure (compost)
 - Green bins
 - Non-Biodegradable –
 - Other wastes – plastics, metals, synthetic clothes, etc
 - These wastes – recycled accordingly
 - Blue bins