

CH0204 Organic Chemical Technology

Lecture 12

Chapter 4 Synthetic fibers

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Overview of topics

Chapter 4 Synthetic Fibers

- 1 Acrylics
- 2 Polyamides
- 3 Polyesters

Synthetic (or man-made fibers)

What are **Synthetic Fibers**?

The clothes that we wear are made up of **fabrics**

Fabrics are made up of **fibers**



Depending on the sources the fibers are classified in two types

1. **Natural** and 2. **Synthetic**

Natural fibers are the fibers which are obtained from **plants and animals** e.g. silk and wool

Synthetic fibers are made by human beings or also called as **man-made fibers** Nylon, Polyester, Rayon etc.

Synthetic (or man-made fibers)

Natural Fiber, Silk wool



Synthetic (or man-made fibers)

Synthetic Fibers

Nylon



Polyester





Synthetic (or man-made fibers)

The first synthetic or man-made fiber is **cellulose nitrate** and the next synthetic fiber is **regenerated cellulose or viscose**.

Some of the man-made fibers emerged after 1940's were **acrylics, polyamides, polyesters and polyolefin**.

The uses of man-made fibers depend upon the nature of the individual fiber. **Clothing, Carpets, and Upholstery** are all made largely, or wholly, of synthetic fibers.

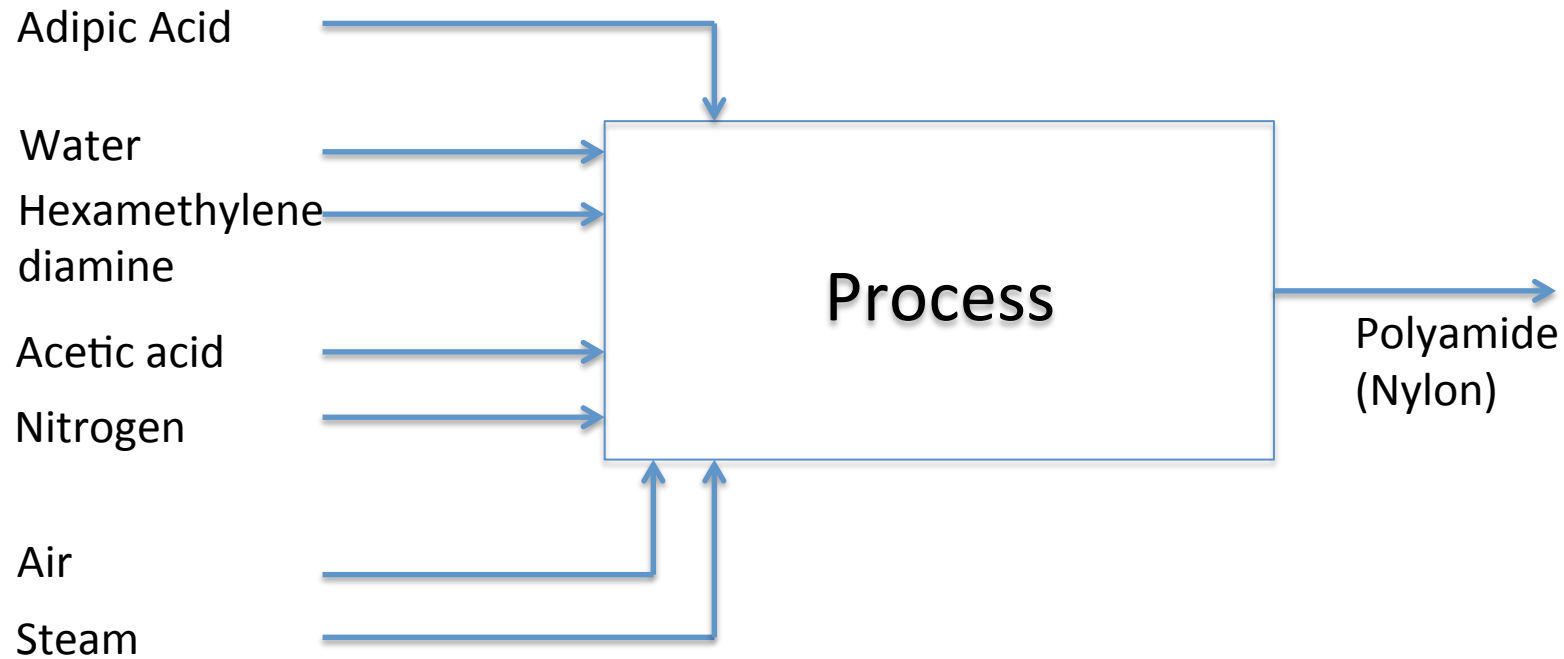


Acrylics

Acrylic fibers are **synthetic fibers** made from a polymer (**polyacrylonitrile**) with an average molecular weight of ~100, 000 about 1900 monomer units

The Dupont Corporation created the first Acrylic fibers in 1941 and trademarked them under the name **“Orlon”**

Polyamide (Nylon fiber) Production





Polyamides

A polyamide is a polymer containing **monomers of amides**.

They occurs both **naturally and artificially**.

Polyamides are commonly used in **textiles, automotives, carpet and sports wear**.

Polyamides – Method of production

Adipic acid

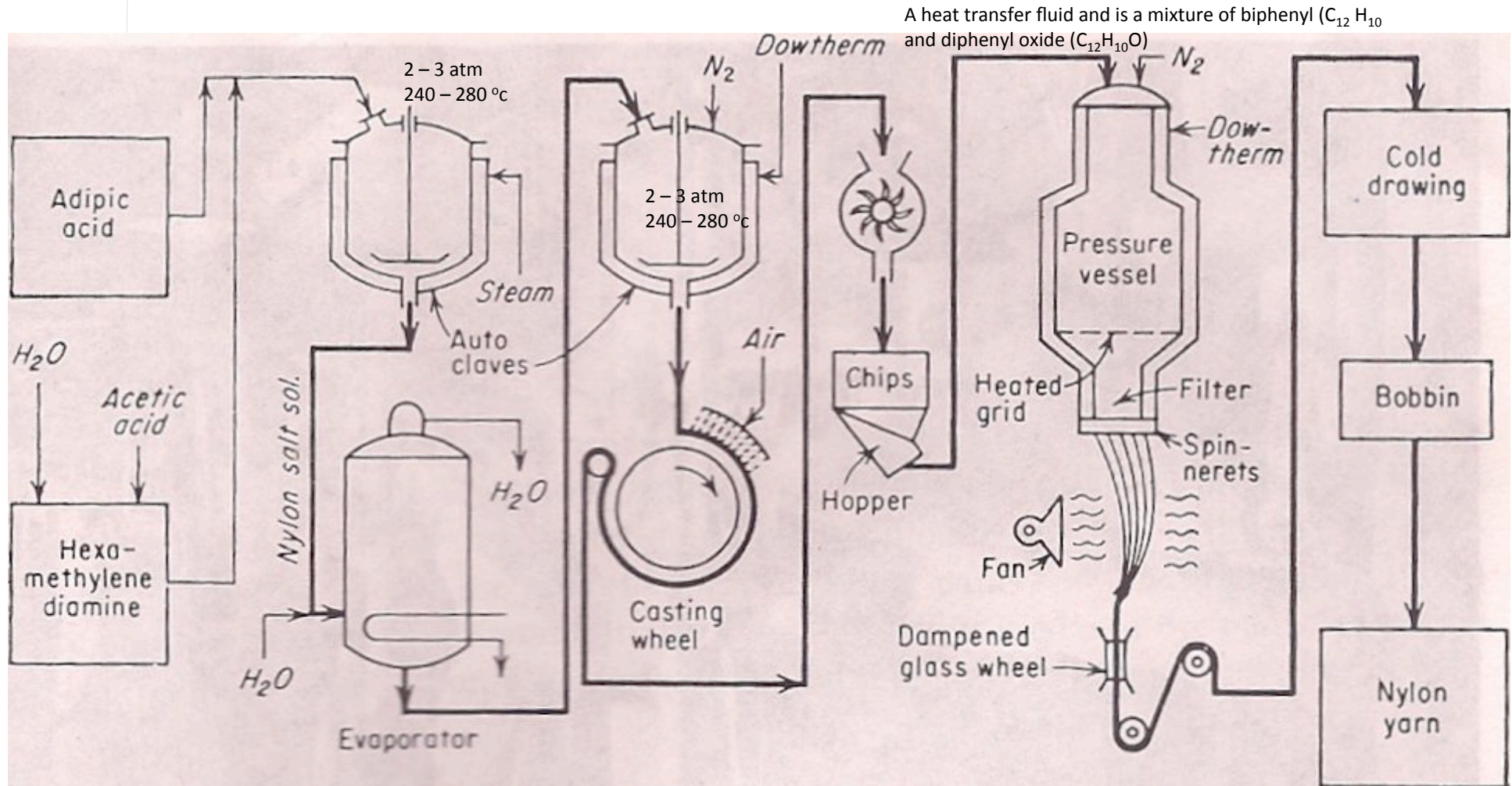
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Hexamethylene diamine \longrightarrow

Hexamethylene diammonium adipate (or)
nylon salt \longrightarrow

Poly(hexa methylene adipamide) or **Nylon**

Polyamides (Nylon)





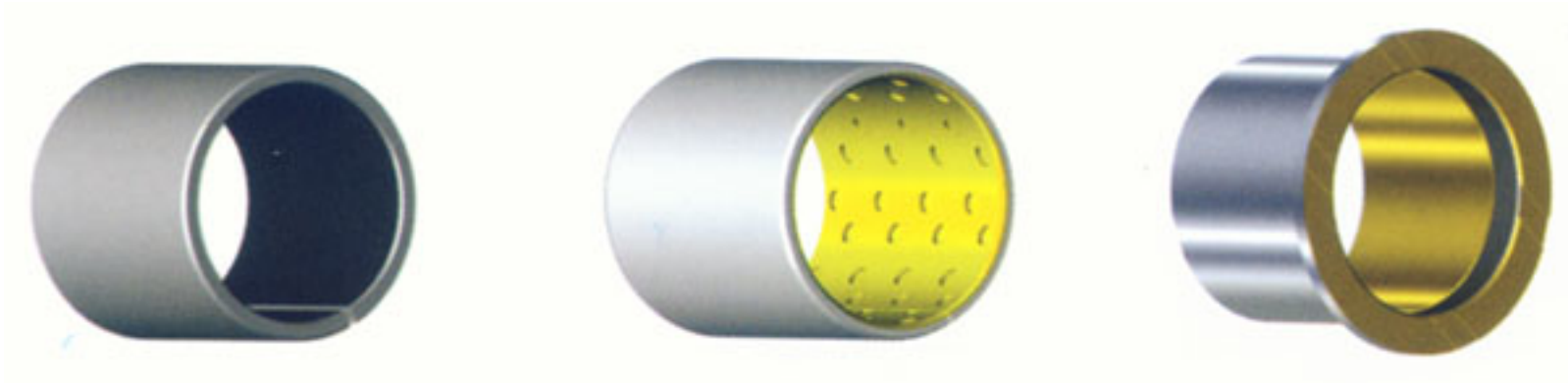
Uses of Polyamides (Nylon)

Used in the manufacture of

1. Unlubricated or non lubricated bearings
2. Bags
3. Fabrics
4. Ropes
5. Fishing line or net

Uses of Polyamides (Nylon)

Used in the manufacture of unlubricated or non lubricated bearings



Uses of Polyamides (Nylon)

Used in the manufacture of bags



Used in the manufacture of fabrics



Uses of Polyamides (Nylon)

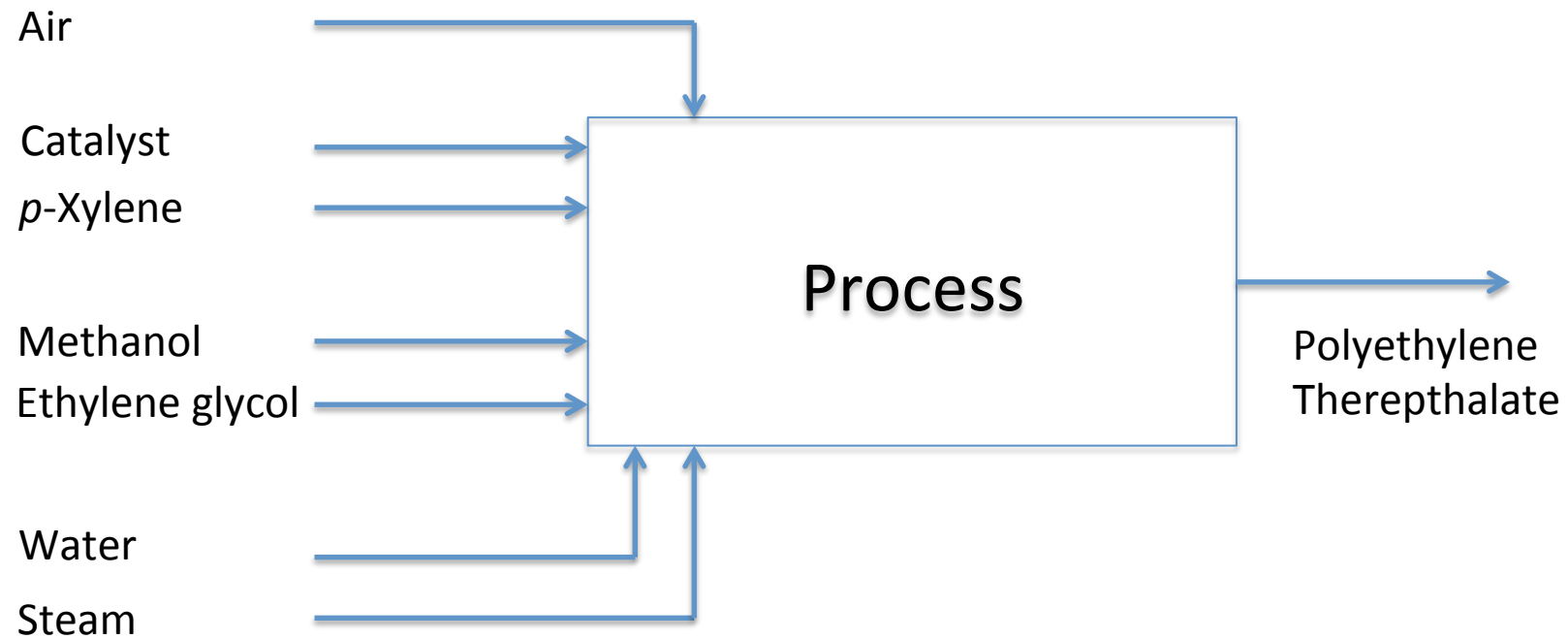
Used in the manufacture of ropes



Used in the manufacture of
Fish lines or fish nets



Polyesters (PET)

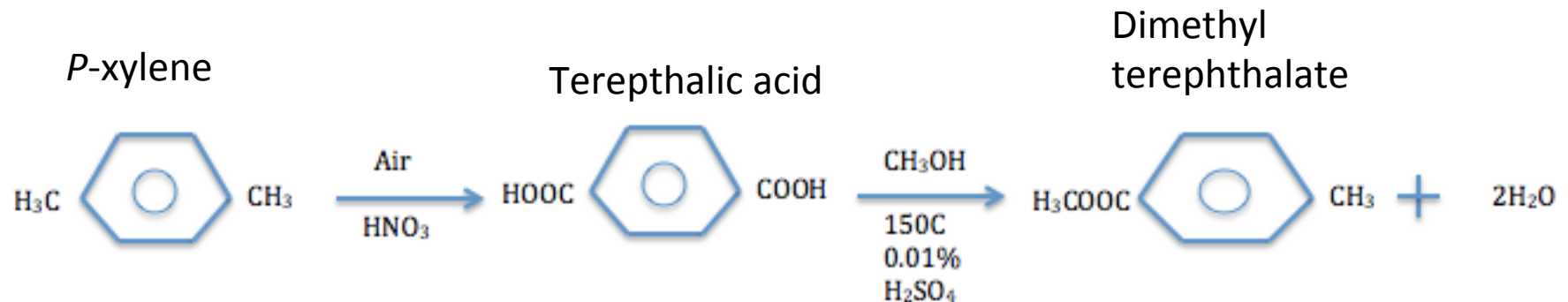


Polyesters (PET)

The common polyester fibers are polymers of **the ester formed from dimethyl terephthalate and ethylene glycol**

Production steps

1. Preparation of intermediates
2. Polymerization of ester monomers



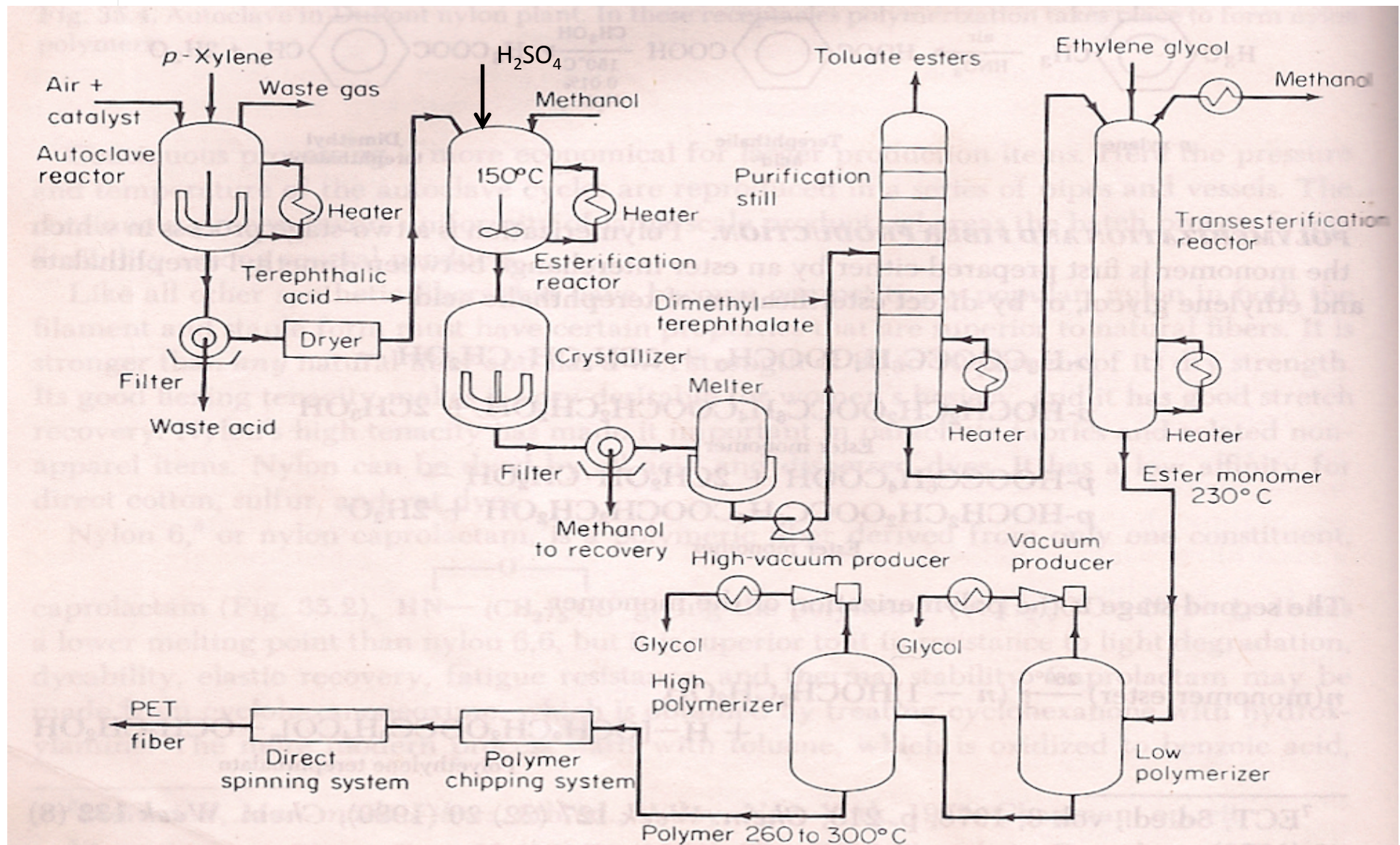


Polyesters (PET)

Polymerization is a two stage

1. Monomer is first prepared either by **an ester interchange** between dimethyl terephthalate and ethylene glycol or by direct esterification of terephthalic acid
2. The second stage is the **polymerization of monomer** to yield polyethylene terephthalate (Polyester)

Polyesters-PET





Uses of Polyesters (PET)

Used in the manufacture of

1. Fabrics
2. Wrinkle free fabrics
3. Hoses
4. V belts
5. Pillows
6. Carpets

Uses of Polyesters

Fabric



Wrinkle free fabric

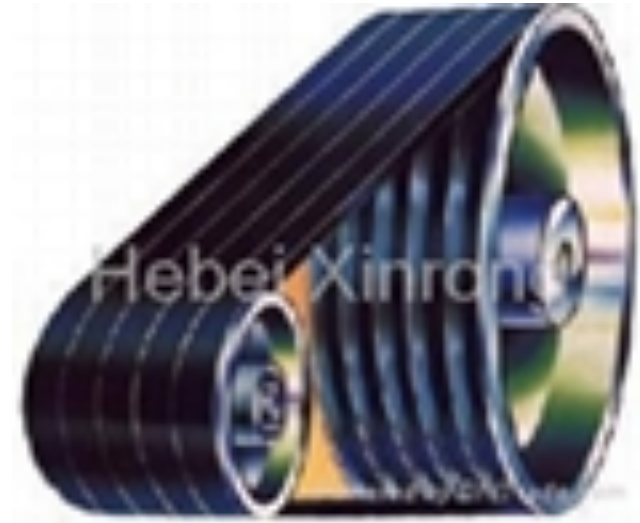


Uses of Polyesters

Hose



V - Belts



Uses of Polyesters



Pillows

Carpets





Polyesters manufacturers in India

VACMET INDIA LIMITED

Anant Plaza, IInd Floor
4/117-2A, Civil Lines,
Church Road, Agra - 282 002,
Uttar Pradesh (INDIA)

Filatex India Limited (FIL)

Noida Office and Plant

A-2 Noida Extension, Phase-II, Dist.
Gautam Budh Nagar (U.P)-201301
(INDIA)

Indo Rama Synthetics (India) Limited

31-A, MIDC Industrial Area, Butibori,
Nagpur - 441122

Relance Industries Limited

Barabanki Manufacturing Division
Near Lucknow, Uttar Pradesh
India

Jiwarajka Textile Industries

220 Atlanta Estate, 2nd Floor, Vit Bhatti,
Goregaon (E), Mumbai 400063

Viscose Rayon

Major Steps

1. Alkali Conversion



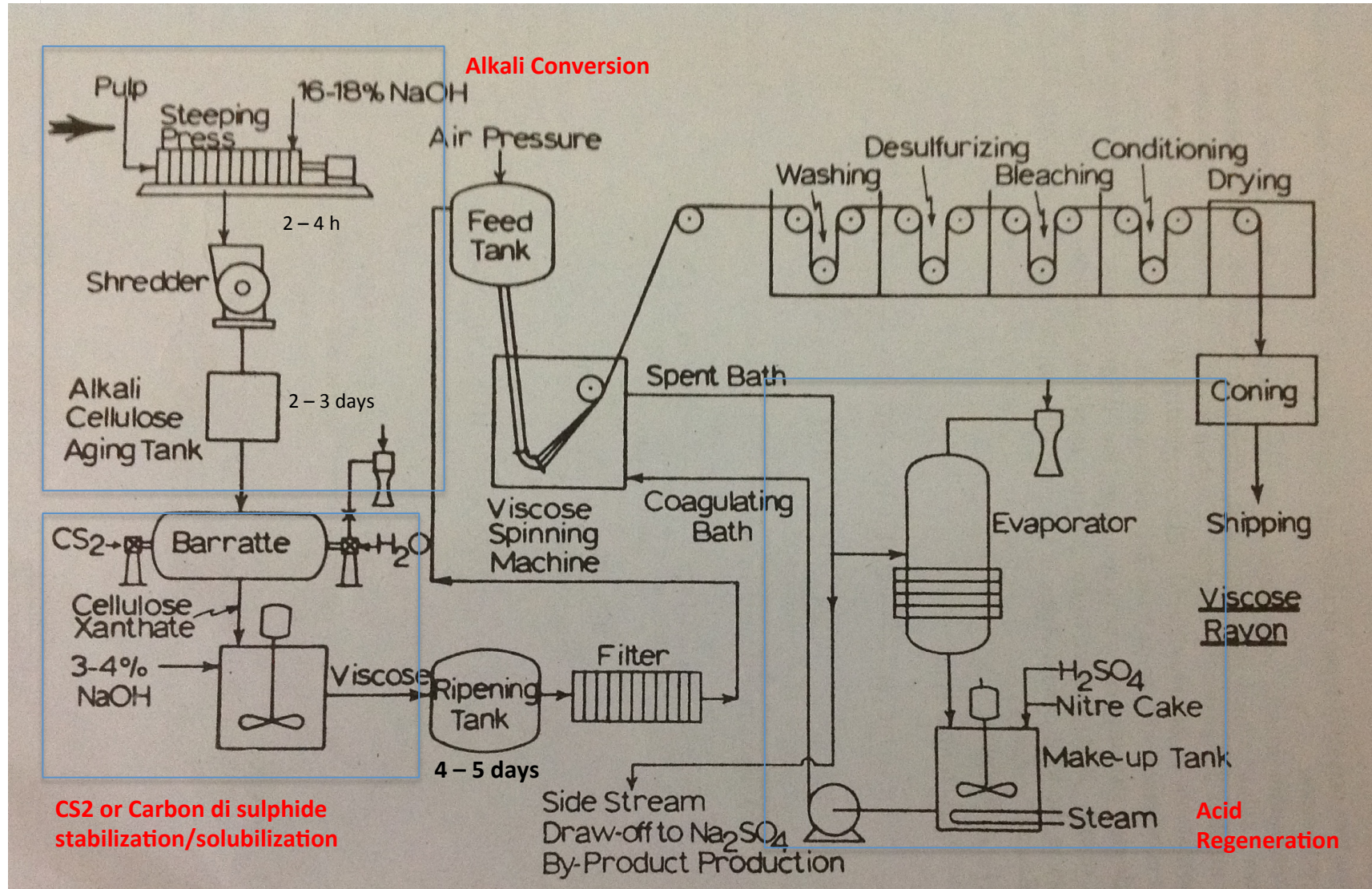
2. CS₂ Stabilization/Solubilization



3. Acid Regeneration



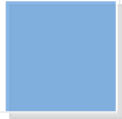
Viscose Rayon





References

1. Dryden C. E, *Outlines of Chemical technology – for the 21st Century*, 3rd edition, East-West Press (2004)
2. Austin G. T, *Shreve's Chemical Process Industries*, 5th edition, Mc Graw Hill International editions (1984)



Thank you