

TEXTILE ENGINEERING (MID TERM TEST)

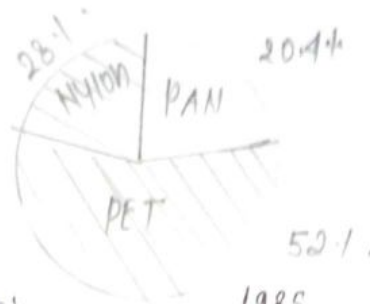
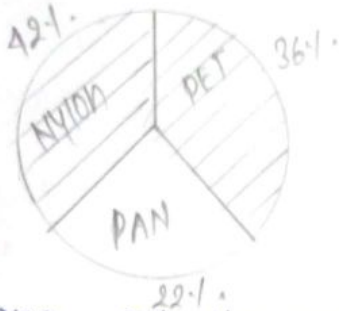
Final year - 7th Sem

FIBRE SCIENCE - II

①

The world per capita consumption of textile fibre has increased from 5.6 kg in 1965 to 7.5 kg in 1983

Growth of Individual synthetic fibres:-



1970

Among all the synthetic fibres, polyester fibre has shown maximum rate of growth and to day it has 50% of total synthetic fibre production. It has second largest production coming next to cotton.

1985

Staple Vs. Filament:-

Need of staple:- Short length fibres are suitable for blending with other fibres according end users. Continuous filament yarns have metallic lustre unpleasant handle lack of hairness, low bulk and high cost due to low rate of production. Blended material can not be easily made with filament yarns.

So it is a common practice to produce staple fibre yarn, either alone or blending with others.

Common blends:- P/C, P/V, P/W, W/A

Synthetic fibres in India:-

The production of synthetic fibres was started in India from 1962. In 1985 the production of synthetic fibres was 1.7 lakh tons and is likely to increase very rapid in next 15 years. Following table shows the production of all textile fibres.

Year	Cotton	Wool	Silk	Rayon	Synth
1960	750	30	1.65	42.5	-
65	825	32	2.17	74.6	2.86
70	809	33	2.91	101.02	15.64
75	1011	35	3.07	102.15	30.59

Q.1. write in details about growth of man-made fibre.

Ans:- Growth of Synthetic Fibre:- The world production of synthetic fibre is increase at a very rapid rate during the last 35 years. The production of synthetic and other fibres from 1950 to 1985 are shown in table No.1. From table it has been clearer that the share of synthetic fibres in total fibre production is increased in spectacular manner and the production of other natural fibre also increase but percentage share of total production is decrease.

World production of textile fibres (thousand tonnes)

Year	COTTON	wool & silk	Synthetic fibre	Regenerated fibre
1950	6650	1170	70	1610
1960	10113	1462	702	2656
1965	11605	1526	2052	3339
1970	11686	1643	4701	3491
1975	11809	1551	7346	2959
1980	13991	1663	10476	3242
1985	18714	2030	15885	8215 2999
1990	18714	1732	15885	3215
1995	18602	1859	20159	3013

The share of cotton went down from 70.1 to 50.1, and the share of wool & silk declined from 12.32% to 1.98% & that of rayon reduced from 16.95 to 8.62%.

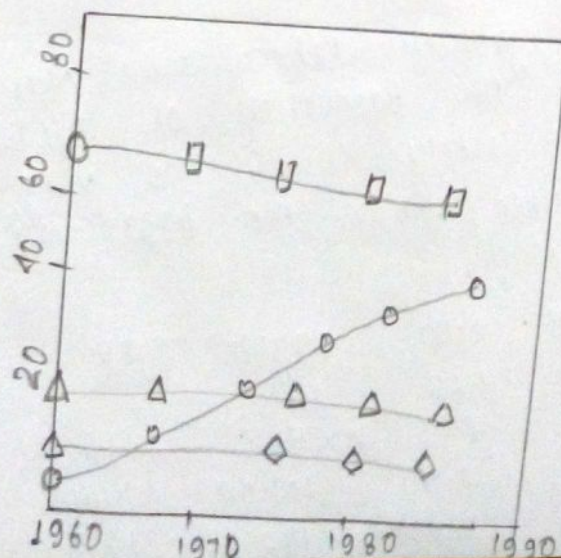


Fig. 1. world percentage share of various fibres

1980	1191	35	5.00	118.20	59.92
1985	1785	40	7.50	134.64	169.32
1990	1800	43	11	160	490
1995	1870	46	15	190	800
2000	2040	50	20	230	1125

The production of various fibres increase as follows.

- (In last twenty yrs). 1965 to 1985
- cotton → 2.27 times
- wool → 1.25 times
- silk → 3.5 times
- cellulose rayon → 1.8 times
- Synthetic → 60 times.

Q.2. Explain manufacturing process of Polyester fibre by PTA route?

Ans:-

Polyester:-

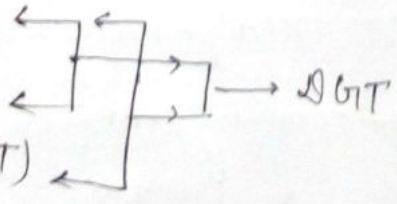
Definition:-

Polyester is defined by International standard organization (ISO)

"It is defined as that the polyester is a manufactured fibre comprising a long chain synthetic linear macromolecule or polymer which having in the chain at least 85% (by weight) of an ester of ethylene glycol & terephthalic acid"

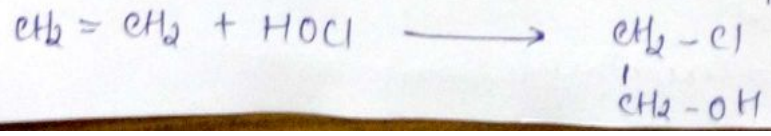
Raw materials:-

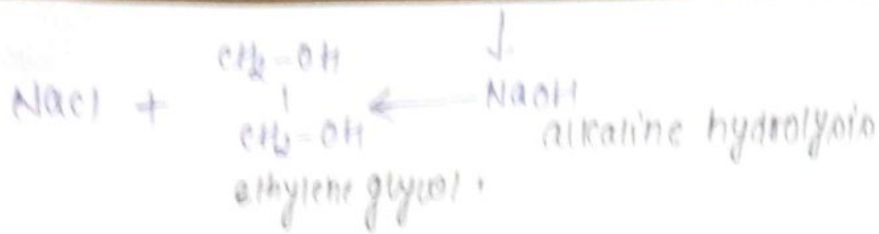
- Mono ethylene glycol (MEG)
- Pure terephthalic acid (PTA)
- Di-methyl terephthalate (DMT)



Mono ethylene glycol (MEG):-

chlorine process:- Here raw material is ethylene.





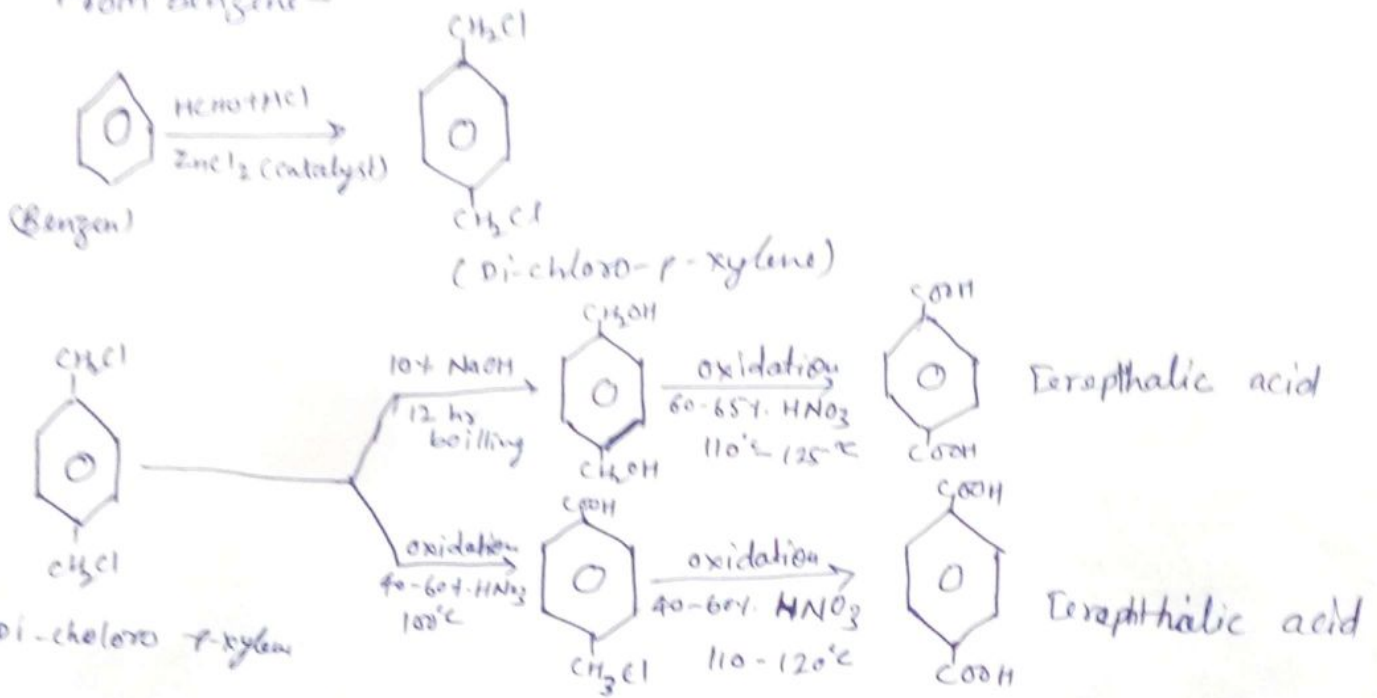
direct oxidation:-



Terephthalic acid:- (PTA):-

starting materials:- Benzene, Toluene, P-Xylene

From benzene-

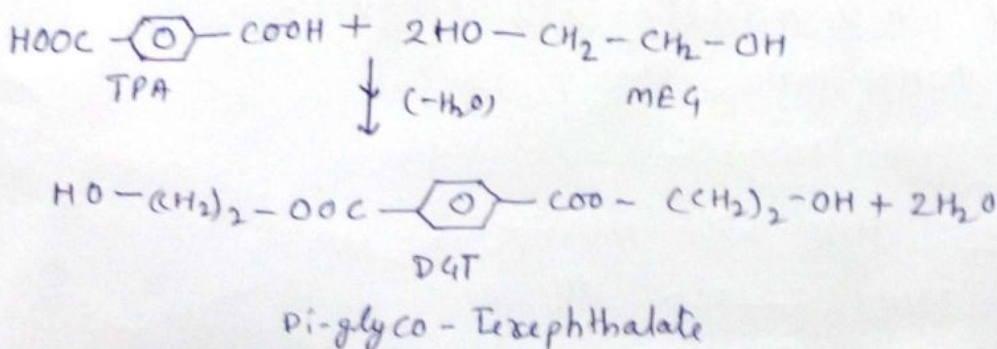


Polyester Polymer Production method:-

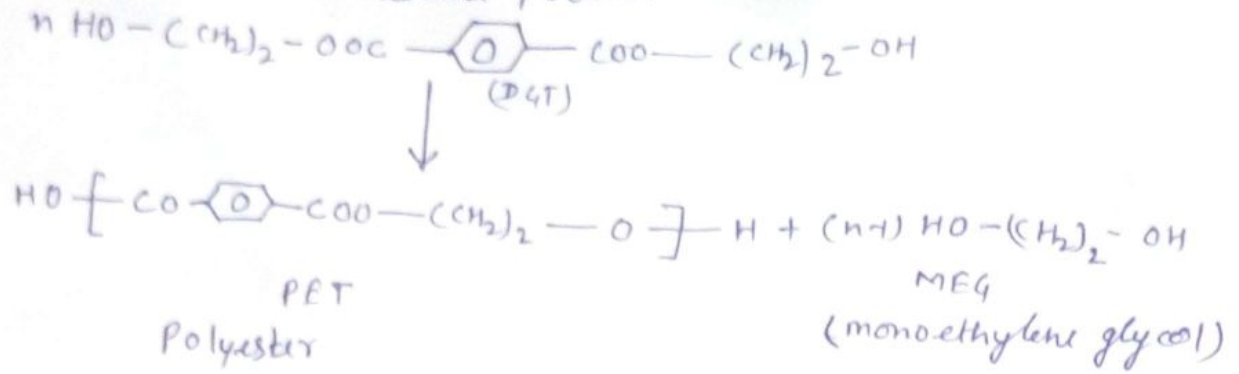
Direct esterification method:- It is also called PTA Route.

Here raw material are terephthalic acid (PTA) and monoethylene glycol (MEG).

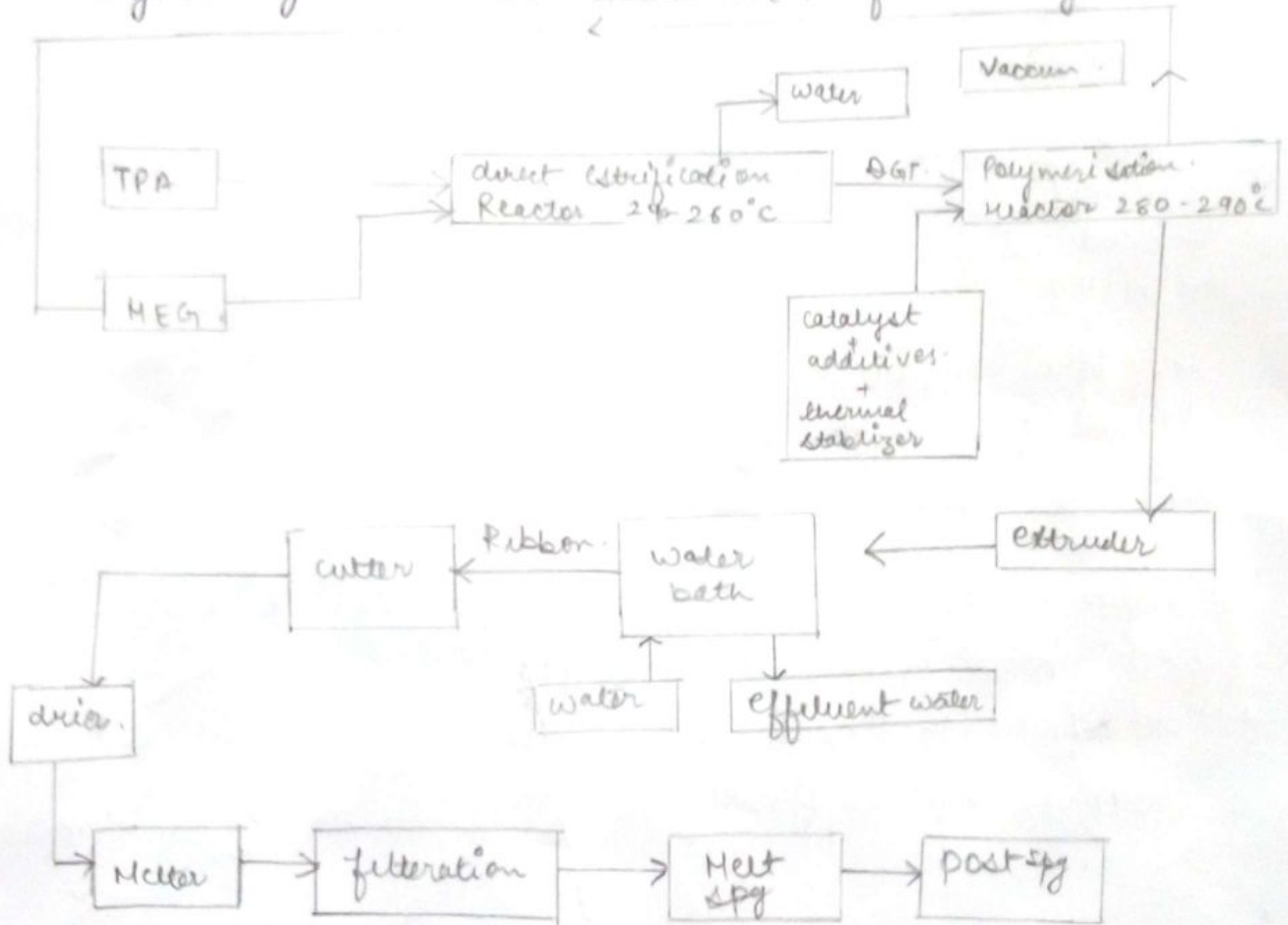
In 1-step:- $\text{TPA} + \text{MEG} \longrightarrow \text{DGT}$



II-Step → After I-stage polycondensation is occur in second stage ⁽³⁾
 From DGT intermediate product.



Flow diagram by PTA Route :- excess MEG for recovery



* Properties of polyester :-

- ↳ longitudinal view :- very regular in longitudinal, rod like structure uniform appearance.
- ↳ Cross-sectional view :- Circular in cross section. Now a days may be Cross section is present.
- ↳ Colour :- white in colour generally.
- ↳ Tenacity :- dry → 3-10 gpd or 29-50 gpt
 wet → 3-10 gpd or 29-50 gpt

- ↳ Breaking elongation (%): — 18-50%
- ↳ moisture regain :- at standard condition (0.4%)
- ↳ heat conductivity :- poor heat conductivity
- ↳ soft ironing temp :- 135°C
- ↳ Melting temp :- 250-260°C [256°C] generally
- ↳ Density :- 1.38 gm/cc.
- ↳ Softening temp :- 220-240°C

APPLICATION AREA : —

- ① Apparel & household sectors :-
 - ↳ As filling fibre for quilts, pillows and sleeping bags, Non-wovens
 - ↳ for ~~limited~~ knitted fabrics & other carpet,
 - ↳ Home furnishing, threads etc.
- ② Biomedical applications : —
 - ↳ filters
 - ↳ blood vessel
 - ↳ knitted or woven porous tube etc.
- ③ Industrial applications : —
 - ↳ Ropes ↳ Threads ↳ Conveyor or belt
 - ↳ Rubber ↳ Seat belt.

Production of Staple & Multifilament Yarn : —

- ↳ Solid phase polymerisation
- ↳ Fibre production by batch process.

