Chapter - V COST ANALYSIS

5.1. INTRODUCTION:

From the growth rating results, quality of the film and ease of processing LDPE with 25% groundnut oil was considered for the mass production in conventional extruder. The films from other material i.e. HDPE, PS and PP were not manufactured by the conventional extrusion process because the polymers do not retain plasticizer to a greater extent. Due to their higher crystallinity the plasticizer exude out of the polymer matrix. The films with minimum possible thickness were manufactured from both, virgin and plasticized material. The minimum possible thickness which can be extruded depends on the tensile strength or the hot stretch strength of the material. (D.V. Rosato, 1997, Charles A. Harper, 2006).

Manufacturing of LDPE microfilms uses extruder with accessories of blown film plant. The major machineries required are:

◊Extruder

◊Blown film die

◊Take off unit

◊Air compressor

◊Winding unit

◊Cutting and sealing unit

Conventional extruder can be used for manufacturing plasticized LDPE film.

5.2. PROCESSING DATA FOR FILM:

MULTI-LAYER FILM EXTRUDER SPECIFICATIONS:

MAKE	:	KILLION EXTRUSION INC. VERONA, NEW JERSYE, RIVIERA BEAGH, FLORODA.
SCREW DIAMETER:		25 mm
L/D RATIO:		24:1

OUTPUT: 15 Kg/hr.

SCREW rpm: 0-140

DRIVE: DC motor

MAX.LAYFLAT: 300mm

SCREW TYPE: GP-PVC, NYLON

PROCESSING PARAMETERS FOR SPECIMEN ----- A: VIRGIN LDPE

LAYER ZONE	EXTRUDER-A TEMP-° C	EXTRUDER-C TEMP-° C	DIE-ABC TEMP-° C
ZONE-1	200	150	C:6 195
ZONE-2	210	160	C:7 200
ZONE-3	205	160	A:6 200
ZONE-4	210	180	A:7 200
ZONE-5	195	190	B:5 210
ZONE-6	205	200	
ZONE-7	210	210	
MELT TEMP-° C	183	202	
MELT PRESSURE- BAR	24	15	
SCREW SPEED - rpm	20	20	
MOTOR AMPERE	2.1	2.1	
TAKE-OFF SPEED m/min	0.1		
FILM THICKNESS	5 MICRON		

PROCESSING PARAMETERS FOR SPECIMEN ----- B: PLASTICISED LDPE

Layer Zone	Extruder-A Temp° C	Extruder-C Temp° C	Die-ABC Temp° C
ZONE-1	110	110	C:6 130
ZONE-2	110	110	C:7 130
ZONE-3	115	115	A:6 130
ZONE-4	115	115	A:7 130
ZONE-5	120	125	B:5 130
ZONE-6	130	130	
ZONE-7	130	130	
MELT TEMP-° C	111	104	
MELT PRESSURE- BAR	36	36	
SCREW SPEED - rpm	20	15	
MOTOR AMPERE	1.7	1.8	
TAKE-OFF SPEED m/min	2.8		
FILM THICKNESS	3 MICRON		

5.3. THE RAW MATERIAL COST ANALYSIS:

Virgin LDPE costs Rs. 75/Kg.

The extruder will process Output = 15kg/hr*24hrs.*300days/year

=108000000g/year

Let x = the lay flat area of the film

Thickness of the film = 5 micron

The density of the raw material = 0.96g/cc.

The volume of film manufactured by 1 Kg of material = 5*0.96/10000

The lay flat area of the film available=Y = 108000000/ 5*0.96/10000

= 225000000000cm²

Plasticized LDPE cost Rs. 75/Kg.

The extruder will process Output = 15kg/hr*24hrs.*300days/year

=108000000g/year

Let y = the lay flat area of the film

Thickness of the film = 3 micron

The density of the raw material = 0.96g/cc.

The volume of film manufactured by 1 Kg of material = 3*0.96/10000

The lay flat area of the film available=X = 108000000/ 3*0.96/10000

= 375000000000 cm^2

Saving in Raw material = X-Y = 150000000000cm^2

Saving in kg = 150000000000*3*0.96/10000

= 43200kg. In one year. Considering 15Kg/hr. output of extruder.

Saving in Rupees = 43200*75

= Rs. **32, 40,000** in one year. Considering 15Kg/hr. output of extruder.

For 100Kg of Material Saving in Rupees= 3240000*100/108000

= **Rs. 3000**

5.4. COST FOR POWER CONSUMPTION:

For virgin film:

5 micron film is processed at 200 °C temperature requires p kwh power

108000kg raw material processed at 200 ° C requires 108000 *0.16 = 17280 kwh power

For plasticized film:

3 micron film is processed at 110 ° C temperature requires q kwh power

108000kg raw material processed at 110 ° C requires 108000 *0.088 = 9504 kwh power

Saving in power consumption = p-q

= 17280 - 9504

= 7776 kwh In one year. Considering 15Kg/hr. output of extruder.

Industrial power costs @ Rs. 4.5

Saving in Rupees = 7776 * 4.5

= Rs. **34992.** In one year. Considering 15Kg/hr. output of extruder.

For 100Kg of Material Saving in power consumption in Rupees

= 34992*100/108000

= **Rs. 32.4**

Table 5.1 Cost Analysis

Sr.No.	Material	Cost	Tensile strength	Film thickness	Material consumption	Lay flat area m^2	Power consumption
1.	Virgin	Rs.75/Kg	56.131 kgf/cm^2	5 micron	108000 Kg/year	22500000	17280 kwh
2.	Plasticized	Rs.75/Kg	69.229 kgf/cm^2	3 micron	108000 Kg/year	37500000	9504kwh
3.	Saving		@ 1.25 times	@ 1.67 times	43200Kg/year	15000000	7776 kwh
4.	Saving in Rupees				108000 Kg/year	Rs.32, 40,000	34992 Rs.4.5/unit
5.	Saving in Rupees				100 Kg	Rs.3000	32.4 Rs.4.5/unit

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5.5. CONCLUSION:

◊The minimum thickness that can be manufactured from the virgin LDPE is 5 micron, and that from the plasticized LDPE is 3 micron.

◊The tensile strength results produced using NEXYGEN from Lloyd LR 30 K plus UTM from the Department of Chemistry, Sardar Patel University, Vallabh Vidyanagar-388120, reveals that the tensile strength of virgin film is 56.131 kgf/cm^2 (50mm/min) and that of plasticized film is 69.229kgf/cm^2 (50mm/min) i.e. the strength of the plasticized film is greater (@ 1.25 times) than that of the virgin film. (Table 4.1 in preceding chapter).

◊The thickness required to manufacture the film of a given strength will be lesser with the plasticized material (@ 1.67 times). Hence for a given strength lesser material consumption is observed (@ 1.67 times). This in turn results in saving in material cost.

◊This saving can be observed with all combinations of thicknesses because the strength of the film is proportional to the thickness of the film i.e. as the thickness of the film increases the strength of the film increases and vice versa.

◊The strength of a 20 micron film from virgin material can be obtained from a 12 micron film from plasticized material. The corresponding material saving will be @ 1.67 times.

◊The State of Gujarat has banned films below 20 microns thickness used for carry bags because they are non biodegradable. But if these films become biodegradable there is no necessity of ban. Hence films up to 3 microns thickness can be manufactured. There will be a great saving in raw material consumption if the costs of 3 micron films are compared with those of the 20 micron films.

◊Before the ban came in force films having thickness up to 5 microns were produced in State of Gujarat.