

# MALAYSIAN INTERNATIONAL TRADING CORPORATION

[CO NO: 80474-V]

## Extrusion Guide for **ECOPLUS™** 105 Degradable HDPE

### Introduction

To produce film successfully from **ECOPLUS™** pre-compounded degradable HDPE resin, processors must ensure that good control is exercised over the extrusion process and the ancillary downstream equipment. Good extrusion practice will ensure that film produced from the **ECOPLUS™** pre-compounded degradable HDPE resin will demonstrate the expected performance required by the industry

### Pellet Handling

Prevention of contamination entering the pellet feedstock during any handling is vitally important. Contamination, once in the pellet feedstock will end up in finished product unless filtered out during the extrusion process. Incorporation of any foreign material into film could potentially lead to premature failure of the film. Any handling of pellet should take place where there is no chance of ingress of contamination. All feed hoppers and silos should be closed systems. Free flow of pellet from silos to feed hoppers and through the feed hoppers to the extruder is essential.

### Film Blowing Process

Blown film extruders are gravity fed with pellet from a feed hopper above the feed zone of the extruder. If the feed of pellet to the extruder is interrupted then inconsistent feed of pellet will result in variations in output from the extruder and subsequently film thickness variations.

**ECOPLUS™** pre-compounded degradable HDPE resin can be processed perfectly well on any model of blown film extruder. Today, the typical pipe extruder supplied is normally 20D to 30D (20-30 times the extruder barrel diameter), but shorter extruders are used successfully.

A typical screw for processing **ECOPLUS™** pre-compounded degradable HDPE resin requires a compression ratio of between 2.5:1 to 3.5:1. The screw compression is calculated from the ratio of the cross sectional area of the annulus between the screw root and the barrel in the feed zone and that in the metering zone.

The following are a guide to typical set temperatures used for extruding **ECOPLUS™** pre-compounded degradable HDPE resin on a 25D single screw extruder :

|                          |             |
|--------------------------|-------------|
| Groove Feed Zone         | Cooled      |
| Barrel Zone Temperatures | 170 - 210°C |
| Die Temperature          | 210 - 220°C |

Different temperature profiles are used with different extruders; some use a rising temperature profile from feed zone to die head, some a flat profile across the extruder and head or a decreasing temperature profile from feed zone to die. Extruder manufacturers and the MITCO (PETRONAS Polymer Technology Centre) will advise as necessary.

To aid melt homogeneity, it is recommended that an 80 mesh screen pack is fitted to the breaker plate situated between the barrel and the die. In addition to helping melt homogeneity, fitting an 80 mesh screen pack will also provide a safeguard against contamination.

The temperature profile used with each extruder should be optimised to ensure efficient extrusion at reasonable melt temperatures. During extrusion, attempts should be made to control melt temperatures below 220°C.

### **Extruder Start Up Procedure**

It is important that the extruder and die are at the advised temperatures before extrusion of material is begun. The various heating zones of the extruder and head should be switched on and allowed to come to their pre-set temperatures. When all heating zones reached their set temperature allow the extruder to stand for a further hour before starting extrusion. It is advisable to start the extruder at low screw revs with, if possible, a trickle feed of pellets. Once extrudate is exiting from the head, full flood feed of pellets can be started.

Before sufficient flushing of material previously kept inside extruder and/or die must be done to avoid any form of contamination to the incoming new batch of pre compounded degradable HDPE resin.

### **Extruder Shut Down Procedure**

The prime objective of any shut down procedure should be to prevent possible degradation of material caused by prolonged contact of hot melt with air. The extruder screw should be switched off. The die lips and the immediate inner surfaces of the die and mandrel should be scraped clean with a brass rod or scraper. The die is then allowed to cool naturally.

| <b><u>Trouble Shooting Guide</u></b> |  |                             |   |
|--------------------------------------|--|-----------------------------|---|
| <b>Fault</b>                         | <b>Cause</b>   | <b>Fault</b>                | <b>Cause</b>  |
| SPLITTY FILM IN MACHINE DIRECTION    | Blow up ratio too low<br>Neck height too low                         | WRINKLES ON FILM EDGE       | Poor A-frames adjustment  |
| UNSTABLE BUBBLE                      | Output too high  | LINES OF BUBBLED FILM IN MD | High shrinkage at thicker sections due to too high haul-off height  |
|                                      | Blow up ratio too low  | WEB DROOPING ON ONE EDGE    | Nip rolls and die mis-aligned   |
|                                      | Film too thin  |                             |   |
|                                      | Air velocity too high  | WEB DROOPING ON BOTH EDGES  | Too high friction at A-frames due to too small A-frames angle   |
| POOR COLOUR DISPERSION               | Melt temperature too high  | WEB DROOPING AT CENTRE      | A-frames angle too large  |
|                                      | Neck height too low  |                             |   |
| SHARKSKIN(MELT FRACTURE)             | Too rapid change of bubble shape/screw speed/ haul-off speed         | DIE LINES                   | Hang up in die<br>Dirty die gap<br>Improper colour masterbatch<br>Change of resin of higher molecular weight to resin of lower molecular weight |
|                                      | Extruder surging   |                             |   |
| POOR HEAT SEALING                    | Nip roll surging   | NON-CIRCULAR BUBBLE         | Bands of lower thicknesses on bubble<br>Non-uniform flow at ports due to too low temperature at ports   |
|                                      | Plugged screen pack  |                             |   |
|                                      | Improper colour masterbatch  |                             |   |
| POOR THICKNESS UNIFORMITY            | Screen filter too coarse   | POOR INK FASTNESS           | Corona treatment level too low[should be about 38-40 dynes/cm]  |
|                                      | Die/adaptor temperature too low                                      |                             |   |
|                                      | Melt temperature too low   |                             |   |
| WRINKLES IN MACHINE DIRECTION        | Temperature sensitive colour masterbatch                             | POOR INK FASTNESS           | Corona treatment level too low[should be about 38-40 dynes/cm]  |
|                                      | Moisture in resin  |                             |   |
| U-SHAPED WRINKLES AT CENTRE          | Over corona treatment  | POOR INK FASTNESS           | Corona treatment level too low[should be about 38-40 dynes/cm]  |
|                                      | Oxidation in extrusion:melt temperature too high                     |                             |   |
| U-SHAPED WRINKLES AT CENTRE          | Too large film thickness variation                                   | POOR INK FASTNESS           | Corona treatment level too low[should be about 38-40 dynes/cm]  |
|                                      | Antistatic additive  |                             |   |
| U-SHAPED WRINKLES AT CENTRE          | Improper colour masterbatch  | POOR INK FASTNESS           | Corona treatment level too low[should be about 38-40 dynes/cm]  |
|                                      | Poor die adjustment  |                             |   |
| U-SHAPED WRINKLES AT CENTRE          | Non uniform air ring flow  | POOR INK FASTNESS           | Corona treatment level too low[should be about 38-40 dynes/cm]  |
|                                      | Temperature variation along die opening                              |                             |   |
| U-SHAPED WRINKLES AT CENTRE          | Unstable bubble  | POOR INK FASTNESS           | Corona treatment level too low[should be about 38-40 dynes/cm]  |
|                                      | Bubble diameter varying  |                             |   |
| U-SHAPED WRINKLES AT CENTRE          | Friction too high at A-frames  | POOR INK FASTNESS           | Corona treatment level too low[should be about 38-40 dynes/cm]  |
|                                      | Haul-off height too low causing too high film temperature at A-frame |                             |   |

#### **HANDLING AND USE IN INDUSTRY**

A separate MITCO Product Information Sheet entitled "The Handling in Industry of **ECOPLUS™** Polyethylene" is available and should be consulted before handling and use of **ECOPLUS™** pre compounded degradable HDPE resin.

#### **FOODSTUFFS CONTACT AND TOY APPLICATIONS**

Where **ECOPLUS™** materials are likely to come into contact with foodstuffs, directly or indirectly, or are used in the manufacture of toys, prior written clearance for these applications should be obtained from MITCO. No liability can be accepted for any damage, loss or injury arising out of the failure to obtain such clearance or failure to observe any recommendations given.

Further information is available from :

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#### **ECOPLUS AND THE ENVIRONMENT**

**ECOPLUS™** degrade when subjected to sunlight, UV, heat and mechanical stress.

**ECOPLUS™** Polymers, as supplied, can be degraded through disposed in landfill without detriment to the environment.

In landfill sites, **ECOPLUS™** polymers do not degrade to produce voids, and do not emit dangerous degradation gases or contribute to groundwater pollution.

**ECOPLUS™** polymers, as manufactured, comply with the limits for heavy metals (100 ppm total of lead, cadmium, mercury and hexavalent chromium) in packaging materials as defined in the European Union Directive 04/62/EC on packaging and packaging waste and the corresponding US CONEG cases.

If pigment or other additives are incorporate into the **ECOPLUS™** Polymers at the processing stage the above statement may not be fully valid and MITCO will be pleased to offer advice in specific cases.

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#### **IMPORTANT NOTICE :**

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