Silquest* PA-1

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Description

Silquest PA-1 organosilicone is an additive acceptable at trace level for food contact; it is used to enhance the extrudability of high-viscosity polyolefins. Resin producers can add it to reactor fluff or can add it later during extrusion or compounding. Silquest PA-1 organosilicone is an excellent carrier and dispersant for other additives, and it can eliminate the need for metal stearates.

Resin Producer Benefits

FDA Acceptance

Widely accepted for use in polyethylene film applications that involve food contact – see “Food Contact Acceptability” section.

Processability

Improves processability of high molecular weight polyethylene resins.

Dispersibility

Easily dispersed during compounding; excellent dispersant for additives.

Economical

Effective at 500-1000 ppm levels.

Ease of Handling

Easily and accurately metered in open or closed systems.

Versatility

Can be used as a liquid additive, as a free-flowing powder absorbed on reactor fluff or carrier (in masterbatches), or as an ingredient in multi-component additive packages.

Extruder Compounder Benefits

Increased Production

Throughput on modified extrusion equipment is increased up to 15%. Scrap rates are lowered and processability is improved.

Reduced Capital Requirements

Reduced wear extends the service life of existing equipment; new investment is postponed due to increased productivity of existing equipment.

Improved Products

Melt fracture on blown film can be eliminated. Effective on many HMW-HDPE products that are difficult to use.

Excellent Surface Characteristics

No adverse effect on ink adhesion, heat sealing or film blocking.

Clean-Running

No residue buildup or accumulation of processing aid on metal surfaces.

Fast Transition

Performance benefits usually become apparent 10 to 15 minutes after the additive is introduced.

Potential Applications

Silquest PA-1 organosilicone can be readily incorporated into fully formulated resins at 500-1000 ppm or higher effective use levels. Solid masterbatch forms can be utilized by shear mixing Silquest PA-1 organosilicone with granular reactor powder prior to feeding into pelleting extruders. In multi-component additive packages, Silquest PA-1 organosilicone can be used as an additive or as the carrier of additives.

In a properly designed package containing Silquest PA-1 organosilicone, metal stearates can be eliminated (along with the associated smoking and buildup). Metal stearates can interfere with and/or diminish the efficiency of Silquest PA-1 organosilicone. Generally, addition levels of 1000 ppm are sufficient to accommodate zinc stearate at levels up to 500 ppm. To completely eliminate extrudate melt fracture, higher concentrations of zinc stearate or the use of other metal stearates, particularly calcium stearate, may require higher use levels of Silquest PA-1 organosilicone.

Case Study: HMW-HDPE

Melt fracture had limited the output of this HMW-HDPE line to 95kg/hr but incorporation of Silquest PA-1 organosilicone eliminated the melt fracture problem. It helped increase output by 44% at essentially constant extruder power. Bubble cooling capability of the equipment was the sole factor limiting output after addition of

Silquest PA-1 organosilicone.

Equipment Configuration 60 mm Windmoller and Holscher grooved barrel extruder 25:1 L:D screw 150-mm diameter die 0.8 mm die gap		
Conditions 32 micron film gauge 940 mm lay flat 4:1 BUR Resin 8 HLMI, 945 kg/m^3 density HMW HDPE		
Operating Data	No Silquest PA-1 organosilicone	1000 ppm Silquest PA-1 organosilicone
Screw Speed, rpm	40	75
Extruder Amps	70	72
Output, kg/hr	95	138
Power Efficiency, kg/hr/amp	1.35	1.9
Head Pressure, MPa	28.4	37.7
Melt Fracture	Severe	None

Case Study: HDPE

Output of this HDPE line had been limited by bubble instability created by cooling capacity restrictions. Addition of Silquest PA-1 organosilicone silane produced a 39% increase in the output rate, by helping to maintain (essentially) constant melt temperature.

Equipment Configuration 60 mm Reifenhauser extruder 25:1 L:D screw 150-mm diameter die 1.4 mm die gap
Conditions 32 micron film gauge 700 mm lay flat 3:1 BUR Resin 0.3 MI, 960 kg/m^3 density HDPE

Operating Data	No Silquest PA-1 organosilicone	1000 ppm Silquest PA-1 organosilicone
Screw Speed, rpm	60	80
Extruder Amps	31	35
Melt Temperature, °C	238	240
Output, kg/hr	62	86
Power Efficiency, kg/hr/amp	1.03	1.07
Head Pressure, MPa	–	No pressure gauge

Case Study: Fractional Melt Index LLDPE

In this application, Silquest PA-1 organosilicone enabled a film extruder to eliminate severe melt fracture. In fact, it was only by using Silquest PA-1 organosilicone that the process could occur. Simultaneously, output was increased by 26%, head pressure was reduced by 16% and temperature was fully controlled.

Equipment Configuration 60 mm Windmoller and Holscher extruder 24:1 L:D LLDPE barrier design screw 760 mm diameters die (low-pressure spider design) 1.5 mm die gap 300 HP motor
Conditions 76 micron film gauge 2400 mm lay flat 2:1 BUR Resin 0.5 MI, 918 kg/m^3 density C2/C4 LLDPE

Operating Data	No Silquest PA-1 organosilicone	1000 ppm Silquest PA-1 organosilicone
Extruder Amps	400	360
Melt Temperature, °C	252	246
Output, kg/hr	238	300
Power Efficiency, kg/hr/amp	0.59	0.83
Head Pressure, MPa	31.9	26.8
Melt Fracture	Severe	None

Food Contact Acceptability

United States

The Food and Drug Administration (FDA), as published in the Federal Register, March 15, 1989, has amended the Food Additive Regulations (Part 177) to allow for the safe use of Silquest PA-1 Organosilicone as an extrusion aid in the production of olefin polymers that comply with 21 CFR 177.1520(b) at concentration levels not to exceed 0.3 percent by weight of the polymer (3000 ppm). There are no limitations on the process, as long as it is an extrusion process (this includes blow molding and injection molding). There is no limitation on the thickness of the manufactured article.

There are no limitations in polymer density or polyolefin type, that is, Silquest PA-1 organosilicone is allowed in LLDPE, HDPE, VLDPE, PP, et al. These polymers can be used in contact with foods under conditions of use B through use H described in Table 2 of 21 CFR 176.170 as follows:
B. Boiling water sterilized.

C. Hot-filled or pasteurized above 66°C (150°F).

D. Hot-filled or pasteurized below 66°C (150°F).

E. Room-temperature filled and stored (no thermal treatment in the container).

F. Refrigerated storage (no thermal treatment in the container).

G. Frozen storage (no thermal treatment in the container).

H. Frozen or refrigerated storage-ready prepared foods intended to be reheated in container at time of use:

1. Aqueous or oil-in-water emulsion of high- or low-fat.

2. Aqueous, high- or low free oil or fat.

European Union

Silquest PA-1 organosilicone is approved for use in plastic materials and articles that come in contact with food. It is listed in the EU Directive 2002/72 under Annex III as an approved additive without restrictions with reference number PM 80640. It means it can be used in all the different EU Member States in plastics that are used for food contact.

No chemical should be used as or in a food, drug or cosmetic, or in a product or process in which it may contact a food, drug or cosmetic, until you have determined the safety and legality of use.

Since government regulations and use conditions are subject to change, it is the user's responsibility to determine that the information is appropriate and suitable under the applicable laws and conditions.

Shelf Life

Silquest PA-1 organosilicone should be stored in closed containers to exclude moisture. When stored under these conditions, its shelf life is approximately three years.

Patent Status

Nothing contained herein shall be construed to imply the nonexistence of any relevant patents or to constitute the permission, inducement or recommendation to practice any invention covered by any patent, without authority from the owner of the patent.

Product Safety, Handling and Storage

Customers should review the latest Safety Data Sheet (SDS) and label for product safety information, safe handling instructions, personal protective equipment if necessary, emergency service contact information,

and any special storage conditions required for safety. Momentive Performance Materials (MPM) maintains an around-the-clock emergency service for its products. SDS are available at www.momentive.com or, upon request, from any MPM representative. For product storage and handling procedures to maintain the product quality within our stated specifications, please review Certificates of Analysis, which are available in the Order Center. Use of other materials in conjunction with MPM products (for example, primers) may require additional precautions. Please review and follow the safety information provided by the manufacturer of such other materials.

Limitations

Customers must evaluate Momentive Performance Materials products and make their own determination as to fitness of use in their particular applications.

Contact Information

For product prices, availability, or order placement, contact our customer service at Momentive.com/CustomerService/

For literature and technical assistance, visit our website at: www.momentive.com

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