SilQuest™
BY MOMENTIVE









SilQuest™ PA-1

PFAS Alternative Polymer Processing Aid for Polyolefin Extrusion

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SilQuest PA-1 is a PFAS alternative polymer processing aid that is specially designed for polyolefins processing. At low dosage levels, it can be effective to enhance material processability, eliminate melt fracture, reduce die pressure, reduce die build-up & die drool, and increase material throughput without impacting critical film properties for flexible food packaging (layer adhesion, printability, heat sealability). SilQuest PA-1 is compliant with food contact regulations in the US, EU, China, Japan, and LAM (See Food Contact Compliance section for more information).

Key Features and Typical Benefits

- **PFAS Alternative Polymer Processing Aid:** Fluorine-free chemistry.
- **Food Contact Acceptance:** Widely accepted for use in polyolefin film applications that involve food contact. Reach out for more information on our global recommendations.
- **Processability:** Improves processability of polyolefin resins (LLDPE, LDPE, HDPE, PP, etc.). Easily and accurately metered in open or closed systems. No residue buildup or accumulation of processing aid on metal surfaces
- **Economical:** Effective at 250 - 1000 ppm levels. Can eliminate the need for metal stearates. Reduced wear extends the service life of existing equipment.
- **Versatility:** Can be used as a liquid additive, as a solid formulated into a carrier resin (in masterbatches), or as an ingredient in multi-component additive packages.
- **Increased Production:** Throughput on modified extrusion equipment can be significantly increased. Scrap rates are lowered and processability is improved. Performance benefits usually become apparent 10 to 15 minutes after the additive is introduced.
- **Improved Products & Surface Characteristics:** Melt fracture on blown film can be eliminated. Can be effective with high molecular weight HDPE products that are difficult to use.
- **Printability:** No adverse effect on ink adhesion, heat sealing or film blocking.

Relevant Silquest PA-1 Physical Properties:

Physical Property	Value
Physical State	Liquid
Color	Colorless
Viscosity at 25 °C [cST]	1100
Actives [%]	100
Solubility in Water	Insoluble

Table 1. Physical properties are average data and are not to be used as or to develop specifications.

Why are polymer processing aids needed?

PPAs are typically **low surface energy materials.** It can migrate to the extruder/die wall surface and create a thin low surface energy layer that enables the molten polymer to slip. This improves the flow behavior of the molten polymer to form a more uniform velocity front, and therefore **eliminates melt fracturing** and **die build-up.**

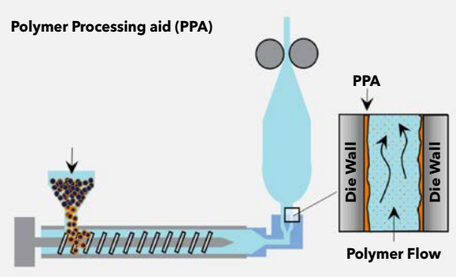


Fig 1. Blown Film line process diagram with PPA mechanism inset. This serves as a representative example for types of polyolefin extrusion processes enhanced by using Silquest PA-1

Improving Film Clarity

LLDPE blown film extrudate was collected and the resulting film was examined for melt fracture. In the case where the blown film extrusion contained only processing antioxidants (neat LLDPE) the resulting extrudate contained sever melt fracture. The collected film is shown in Fig 2 and the melt fracture (surface roughening) is sever enough to obscur the momentive sign behind it.

The same processing conditions were replicated with including 1000 ppm of Silquest PA-1. Fig 3 highlights LLDPE film extrudate collect after 4 minutes of processing. As can be observed, the film quality is significantly improved after 4 minutes of processing. The elimination of melt fracture and die build-up is examplified by the transparent film that makes the momentive sign clearly legible.



Fig 2. Neat LLDPE film collecting without using any PPA.



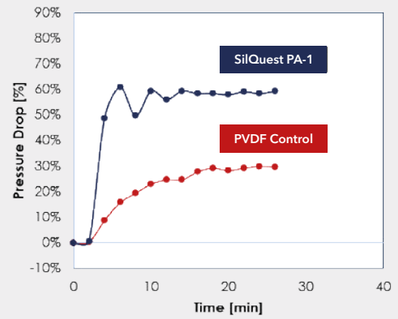
Fig 3. LLDPE film collected with using 1000 ppm Silquest PA-1.

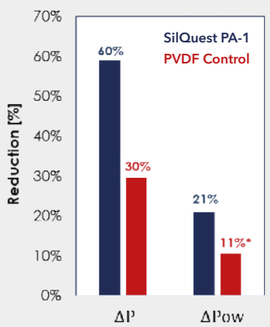
WHY USE SILQUEST PA-1 FOR POLYOLEFIN EXTRUSION?

Process Efficiency Testing.

SilQuest PA-1 and a fluoropolymer control were tested on a lab scale blown film line. Both products were used as a processing aid in butene copolymer resin [1.0g/min 190 °C at 2.16 Kg, b-LLDPE] at 1000 ppm during extrusion [letdow from a 10% loaded 10.0g/min 190 °C at 2.16 Kg LLDPE carrier resin]. The blown film extrusion line consisted of a 64 mm single screw extruder [24:1 L:D ratio], 100 mm die diameter, 0.75 mm die gap, and operated with 200 °C die temperature. Before each run the extruder was purged and the neat LLDPE was run at the same opperating conditions to ensure each run had identical process histories. The extruder was ran continously and the extruder pressure, barrel power, and film was collected.

For consistency, the extrusion conditions and material paramters as discussed above are the same for each part of this brochure unless specifed otherwise.





By comparison to the neat b-LLDPE resin, we observed a 60% and 21% reduction in extruder pressure and power respectfully using SilQuest PA-1 as a processing aid. Overall, SilQuest PA-1 was found to have outperformed the fluoropolymer control in both categories.

Fig 4. (Top) Extruder pressure data collect during PPA kinetic trial run. Prior to the run start the system was purged and neat b-LLDPE was run at the prescribed operating conditions until all parameters stabilized. (Bottom) Summary of the end-of-run pressure and power reductions achieved by using both PPA additives. *ΔPow was calculated from the extruder barrel power.

PROCESS THROUGHPUT ENHANCEMENT

The maximum achievable process throughput using the three different formulations listed in Table 2 was determined using the following methodology: (1) The formulation was introducting into the process line and the system was allowed to reach steady-state at a low extruder speed. (2) The film extrudate was collected for a fixed period of time, checked for melt fracture, and weighed to determined the throughput. (3) The extruder speed was incrimentally increased and steps (1) & (2) were repeated until the film extrudate showed melt fracturing. The extruder speed that yielded melt fractured film for each formulation was considered the maximum achievable throughput and Table 1 reports the throughput enhancement [%] relative to the barefoot resin.

Exp Num.	PPA	Formulation	Throughput Enhancement [%]
1	No	Process antioxidant only	1
2	PVDF Control	Process antioxidant, 1000ppm PPA	18
3	SilQuest PA-1	Process antioxidant, 1000ppm PPA	30*

Table 2. Experimental conditions for process throughput enhancement.

Incorporating the PVDF control yield roughly a 18 improvement while SilQuest PA-1 produced an impressive >30% improvement. From this analysis, Silquest PA-1 was found to outperform the PVDF control PPA and yield significantly higher improvements in process throughput. Please note the asterisk (*) using in Table 2 (Exp Num. 3) is used to denote that the maximum extruder speed was reached before observing melt fracture in the LLDPE film extrudate. Thus, the relative improvements in process throughput achieved by using Silquest PA-1 might be greater than what was reported.

Partner with Momentive

Momentive offers tailored solutions based on polymer type, processing method, and regulatory requirements. Contact our technical team for formulation support or product selection. Optimize your polymer processing—without regulatory or sustainability compromises. Contact us today to explore silicone PPA solutions tailored to your applications.

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