PARALOID™ K-120ND Processing Aid for Vinyl Compounds

Description

PARALOID™ K-120ND processing aid is a readily dispersible acrylic powder that improves the processing of rigid and flexible Vinyl. Compounds containing PARALOID K-120ND processing aid fuse rapidly, flow smoothly, and have excellent hot melt strength. The ability of PARALOID K-120ND processing aid to disperse the Vinyl particles helps eliminate gels that can mar the surface of Vinyl products. In addition, PARALOID K-120ND processing aid does not contribute gels to the compound.

PARALOID K-120ND processing aid is recommended for Vinyl packaging applications where clarity and excellent dispersion are important, and also for specialty injection molding and any other Vinyl applications that require critical rheological properties.

PARALOID™ K-120ND processing aid complies with U.S. Food and Drug Administration (FDA) regulations 21CFR177.1010 and 21CFR178.3790.

Benefits

Some benefits of using PARALOID K-120ND processing aid in Vinyl compounds are:

- Readily dispersed in the compounds without added gel
- Shortened fusion time and more homogeneous melt for easier processing
- Excellent melt strength and parison control
- Increased output rates and improved production efficiency
- Smooth glossy surfaces free of surface imperfections

Typical Uses

Because of the benefits obtained with PARALOID K-120ND processing aid, it is widely used in the processing of many rigid and flexible Vinyl products made by blow molding, calendering, extrusion, and injection molding. Key applications include:

Rigid and Flexible Calendered Film

Advantages in calendering operations resulting from the use of PARALOID K-120ND processing aid:

- Faster fluxing
- Smooth rolling bank with completely knitted running edges
- Reduced plateout on processing, embossing and polishing rolls
- Improved surface smoothness and gloss

Blow-molded Bottles

PARALOID K-120ND processing aid provides these advantages in blow-molded bottles.

- Excellent parison control and hot strength
- Improved gloss and smoother surface with no melt fracture
- Uniform wall thickness and bottle weight

Injection Moldings

Using PARALOID™ K-120ND processing aid in Vinyl compounds for injection molding yields these advantages:

- Faster processing because higher injection pressures can be used before undesirable levels of gate blush occur
- Improved impact resistance at lower temperature, indicating better fusion

Extruded Construction Products

Using PARALOID™ K-120ND processing aid is suggested in the manufacture of Vinyl construction products such as pipe, siding, profile, decking and fencing.

- Faster fusion
- Controlled part dimensions
- Better melt strength
- Improved surface characteristics

Blown or Extruded Vinyl Film

Benefits similar to those listed above are found with PARALOID™ K-120ND processing aid in these applications.

Performance Properties

Ease of Processing

The processing properties of Vinyl compounds with and without PARALOID™ K-120ND processing aid provided in the following tables and photographs show how this processing aid reduces fusion time and yields strong, highly homogeneous melts.

PARALOID K-120ND processing aid can provide manufacturing economies due to higher output rates, and greater output consistency. Lower sensitivity to shearing stresses permits extrusion and calendering at higher rates. Reduced plateout lowers the frequency of cleanups, thus extending the length of production runs.

Dispersibility

PARALOID™ K-120ND easily disperses in Vinyl and enhances the dispersion of Vinyl particles, making it ideal for use in clear packaging applications.

Effect of PARALOID K-120ND Processing Aid on Packaging Grade Vinyl (K=58)
Brabender Fusion Time and Torque (150°C, 45 rpm, 59 gm charge)

	Fusion			Equilibrium	
	time (seconds)	torque (meter-grams)	temperature (°C)	torque (meter-grams)	temperature (°C)
No Processing Aid	82	4564	163	3149	167
PARALOID K-120ND (1 phr)	74	4738	164	3092	167
PARALOID K-120ND (2 phr)	70	4746	163	2939	168
PARALOID K-120ND (3 phr)	52	5000	158	3089	168

Vinyl (K=58) - 100, Tin Stabilizer (ADVASTAB™ TM-181FS) - 1.5, Glyceryl Monostearate (ADVALUBE™ F-1005) - 0.5, Montan Ester Wax (ADVALUBE E-2100) - 0.2, PARALOID K-120ND - as shown

Effect of PARALOID K-120ND Processing Aid on Siding Grade Vinyl (K=66)
Brabender Fusion Time and Torque (150°C, 45 rpm, 59 gm charge)

	Fusion			Equilibrium	
	time (seconds)	torque (meter-grams)	temperature (°C)	torque (meter-grams)	temperature (°C)
No Processing Aid	160	2417	191	2274	195
PARALOID K-120ND (2 phr)					
No impact modifier	94	2972	190	2356	198

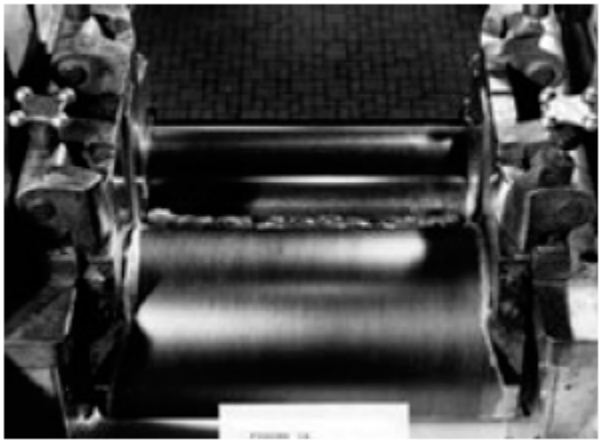
PARALOID™ KM-334 (5 phr)	79	3241	190	2448	198

Vinyl (K=66) - 100, Tin Stabilizer (ADVASTAB TM-181FS) - 1.2, Calcium Stearate - 1.3, Wax 165 - 1.0, Titanium Dioxide - 10.0, PARALOID Additives - as shown

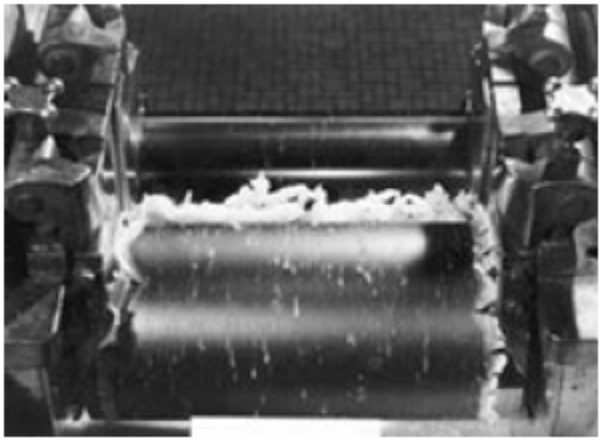
Uniform Compound

PARALOID K-120ND processing aid promotes the formation of a smooth rolling bank and a strong smooth sheet with well-knit edges when Vinyl is processed on a mill at 350°F. Unmodified Vinyl does not form a smooth rolling bank when processed under the same conditions. Using PARALOID K-120ND processing aid results in a compound with excellent melt strength and cohesion and finished products with smooth glossy surfaces free of imperfections.

VINYL PROCESSING WITH PARALOID K-120ND PROCESSING AID



with PARALOID K-120ND...



and without.

Sheet Integrity

Vinyl containing PARALOID™ K-120ND processing aid forms a strong sheet free of pinholes, air streaks and melt fractures. When unmodified Vinyl sheet is stretched, it tears, crumbles, and loses its integrity.

INTEGRITY OF VINYL SHEET WITH PARALOID K-120ND PROCESSING AID

with PARALOID K-120ND PROCESSING AID...

and without.

Clarity

PARALOID™ K-120ND processing aid offers processing efficiency without negative side effects on the optical properties of the compounded Vinyl. The clarity of Vinyl with PARALOID K-120ND processing aid is essentially the same as unmodified Vinyl.

Optical Properties
Effect of PARALOID™ K-120ND Processing Aid

	Use Level (phr)	
	0	2
Haze, % (1/8" plaques)	3.2	3.3

Haze Determination Testing Used the Following Formulation:

Ingredient	Use Level (phr)
Vinyl (K=58)	100
Tin Stabilizer (ADVASTAB TM-181FS)	1.5
ADVALUBE F-1005	0.5
Montan Ester Wax (ADVALUBE E-2100)	0.2
PARALOID K-120ND	2.0

Melt Strength and Die Swell

Improved melt strength and increased die swell result from using PARALOID™ K-120ND processing aid in Vinyl compounds. The melt strength improvement is demonstrated by the longer time-to-floor when the material is unsupported as it leaves the die. The higher weights as the level of PARALOID K-120ND processing aid increases indicate the enhanced ability of the extrudate to resist stretching as it drops from the die.

Vinyl Bottle Formulation:

Ingredient	Use Level (phr)
Vinyl (K=57)	100
ADVASTAB TM-181FS	1.5
ADVALUBE F-1040L	1.0
Oxidized Polyethylene	0.1
PARALOID BTA-733ER	12.0
PARALOID K-120ND	2.0
PARALOID K-175	0.5
Toner	AS NEEDED

Melt Strength and Die Swell
Effect of PARALOID K-120ND Processing Aid
Brabender Extruder Conditions
Temperatures (Zone 1 to die), °C: 170/180/185/190
Screw Speed: 45 rpm

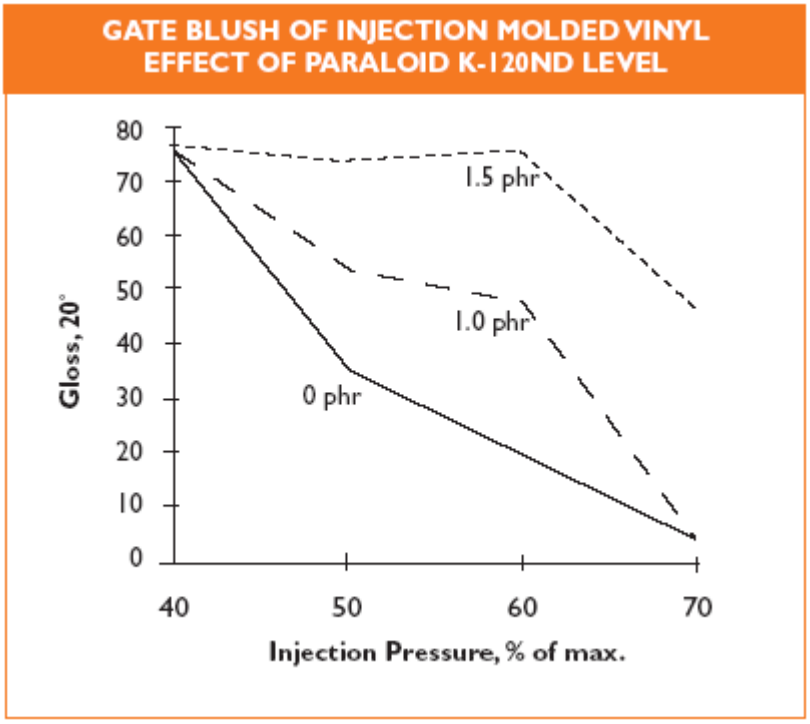
	Time to Floor (seconds)	Extrudate Weight (grams)	Die Swell (%)
No Processing Aid	31.0	28.4	23.6
PARALOID K-120ND (1 phr)	33.3	30.3	29.2
PARALOID K-120ND (2 phr)	37.7	32.4	33.2
PARALOID K-120ND (3 phr)	40.0	33.9	37.2

Injection Molded Vinyl Performance

Injection molded Vinyl parts containing PARALOID™ K-120ND processing aid have better resistance to low temperature impact due to the improved fusion characteristics. The compound is more readily processed through the equipment. Higher injection pressures can be used before undesirable levels of gate blush occur.

Dynatup Impact Resistance of Injection Molded Vinyl

	23°C		0°C	
	ft-lbs	% Ductile	ft-lbs	% Ductile
No Processing Aid	22.2	100	0.8	0
PARALOID K-120ND (1 phr)	22.7	100	23.8	100



The tensile characteristics of the Vinyl used are unchanged by the addition of PARALOID K-120ND processing aid. The data in the tables compare Vinyl (K=61) with and without the processing aid.

Tensile Properties of Injection Molded Vinyl

	Yield Strength (psi)	Yield Modulus (ksi)	Elongation (%)
No Processing Aid	8600	455	32.9
PARALOID K-120ND (1 phr)	8400	425	42.1

Vinyl Injection Molding Formulation:

Ingredient	Use Level (phr)
Vinyl (K=52)	100
Tin Stabilizer (ADVASTAB TM-181FS)	1.2
Montan Ester Wax (ADVALUBE E-2100)	0.2
Calcium Stearate	1.0

Oxidized Polyethylene	0.1
TiO_2	2.5
$CaCO_3$	5.0
PARALOID™ BTA-753ER	13.0
PARALOID K-120ND	0.5
PARALOID K-175	1.0

Typical Physical Properties

Appearance	Fine, white, free-flowing powder
Bulk Density, g/cc	0.40 to 0.46
Molecular Weight (Mw)	approximately 1.5 million
Specific Gravity, at 25°C	1.18
Refractive Index, at 25°C	1.49
Glass Transition Temperature, °C	91
Typical Volatiles, %	0.50
Solubility	methyl ethyl ketone, cyclohexanone, tetrahydrofuran, toluene, and ethylene dichloride (moderately cloudy solutions that form clear films)

Safe Handling Information

Avoid high concentrations of dust in air and accumulation of dust on equipment. An airborne dust of this material can create a dust explosion. When handling and processing this material, local exhaust ventilation may be required to control dust and reduce exposure to vapors. To prevent dust explosions, employ bonding and grounding for operations capable of generating static electricity.

Dispose by placing powder or pellets in airtight bags. Incinerate or landfill at a permitted facility in accordance with local, state, and federal regulations.

Material Safety Data Sheets (MSDS)

MSDS's are available outlining hazards and safe handling methods. Contact The Dow Chemical Company for copies of the MSDS for this product and for other handling information.

The Dow Chemical Company Plastics Additives Product Range

ACRYLIGARD™	**Weatherable Acrylic Capstock Resins** CS-115: Weatherable Capstock Resins with Gloss Reducer
ADVALUBE™	**Specialty Lubricants** F-1000: Internal Lubricants E-2000: External Lubricants B-3000: Balanced Lubricants
ADVAPAK™	**Stabilizer/Lubricant One-Packs** S-1000: Methyl Tin One-Packs
ADVASTAB™	**Thermal Stabilizers** TM-Series: TGA-based and Reverse Ester Stabilizers
ADVAWAX™	**Specialty Waxes** 200 Series: Balanced Lubricants for Broad Process Window in Extrusion and Injection Molding

PARALOID™	**Impact Modifiers** BTA Series: MBS Impact Modifiers for Non-weatherable Vinyl Applications KM Series: Acrylic Impact Modifiers for Weatherable Vinyl Applications
PARALOID	**Processing Aids** K-100 Series: General Purpose Acrylic Processing Aids K-400 Series: High Molecular Weight Acrylic Processing Aids
PARALOID	**Acrylic Multi-functionals and Specialties** KF-710: For Matte Appearance in Vinyl KM-377: Low-Gloss, Wood-Look/Smooth, Satin Finish KM-5450: High-Gloss, Fast Fusion, Improved Processability
PARALOID EXL™	**Additives for Engineering Resins** EXL-2300/3300 Series: Acrylic Impact Modifiers for Engineering Resins EXL-2600/3600 Series: MBS Impact Modifiers for Engineering Resins EXL-5136: Gloss Reducer for Engineering Resins
SURECEL™	All Acrylic Foam Cell Stabilizers

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