



Advantages of GREENMANTRA's A120 PE Additive Compounded with Post-Consumer Recycled HDPE

GREENMANTRA[®] combines **TECHNOLOGY** with **SUSTAINABILITY** to create unique **CERANOVUS**[®] A Series Polyethylene (PE) Additives from recycled plastics.

GREENMANTRA[®] has verified the performance advantages of **CERANOVUS**[®] A120 Polyethylene Additive when compounded at 2% and 4% levels, respectively, with a fractional melt post consumer recycled HDPE resin.

TYPICAL PROPERTIES OF CERANOVUS[®] A120 PE ADDITIVE

Density (g/cm ³) ASTM D1298	Drop Point (°C) ASTM D3954	Penetration @ 25°C in dmm ASTM D1321	Viscosity cps @ 140°C BROOKFIELD
0.93	122	2	700

CERANOVUS[®] A120 Polyethylene Additive delivers the following physical property benefits and operational improvements in extrusion, injection molding and blow molding processes:

- Increases Melt Flow Rates by > 50 %
- Maintains Flexural Modulus, Tensile Strength, IZOD and Density while significantly improving Elongation
- Reduces back pressure by 10% correlating to less equipment wear
- Improves throughput by > 25 % with no increase in energy requirements

These enhanced properties and optimized processing conditions were confirmed at Plastics Forming Enterprises LLC. Actual results are shown in the tables below.

Table 1, Physical Properties of HDPE Compounded with CERANOVUS[®] A120 PE Additive

Formulation and Performance Variables	Control	Sample 1	Sample 2
Post Consumer Recycled HDPE %	100	98	96
CERANOVUS[®] A120 PE Additive %	0	2	4
Pellet Melt Flow Rate (g/10min)	0.40	0.63	0.63
Pellet Melt Flow (% relative to Control)	-	58%	58%
Part Melt Flow Rate (g/10min)	0.38	0.53	0.53
Part Melt Flow (% relative to Control)	-	39%	39%
Density (lbs/in ³)	0.95	0.95	0.95
IZOD (lb-ft/in)	10.20	11.44	10.20
Flexural Modulus (PSI)	164,447	168,343	166,538
Tensile Strength @ Yield (PSI)	3805	3921	3921
Elongation Average	374%	444%	607%
Elongation Increase (% relative to Control)	-	19%	62%

Formulation and Trial Conditions:

Post Consumer Recycled HDPE pellets with 0%, 2%, and 4% **CERANOVUS**[®] A120 PE Additive were extruded and then injection-molded into parts and bottles

Performance Advantages:

- ✓ Pellet melt flow rate increased by 58% and part melt flow rate increased by 39%
- ✓ Maintained Flexural Modulus, Tensile Strength, IZOD and Density
- ✓ Elongation improved by 19% and 62%, respectively
- ✓ Drop testing of bottles demonstrated reduced breakage by over 50%

Table 2, Processing Results at Constant Screw Speed and Constant Feed Rate

Formulation and Performance Variables	Control	Sample 1	Sample 2
Post Consumer Recycled HDPE %	100	98	96
CERANOVUS® A120 PE Additive %	0	2	4
Constant Extruder Screw RPM	125	125	125
Temperature (°C)	121	121	121
Fractional Melt Flow Rate (g/10min)	0.47	0.62	0.67
Melt Flow (% relative to Control)	-	32%	42%
Average Pressure (PSI)	1769	1595	1566
Pressure (% relative to Control)	-	-10%	-10%
Average Energy Usage (kW/hr)	69	55	59
Energy Usage (% relative to Control)	-	-20%	-14%
Average Throughput (lbs/hr)	289	293	285
Throughput (% relative to Control)	-	2%	-1%
Energy Use per Pound (kW/lbs)	0.24	0.19	0.21
Energy Use Change (% relative to Control)	-	-21%	-13%

Formulation and Trial Conditions:

CERANOVUS® A120 PE Additive added at 2% and 4% to Post Consumer Recycled HDPE

Steady-state extrusion with constant screw speed of 125 RPM

Feed rate of 290 lbs/hr

Performance Advantages:

- ✓ Improved melt flow rate by 32-42%
- ✓ Decreased back pressure by 10%, correlating to less equipment wear and tear
- ✓ Reduced average energy requirements by 13 - 21% while maintaining throughput



**IMPROVE
PERFORMANCE**



**REDUCE
COSTS**



**ENHANCE
SUSTAINABILITY**

Table 3, Processing Results at Varying Screw Speeds to Maintain Constant Back Pressure

Formulation and Performance Variables	Control	Sample 1	Sample 2
Post Consumer Recycled HDPE %	100	98	96
CERANOVUS® A120 PE Additive %	0	2	4
Extruder Screw RPM = 122 Back Pressure	125	165	170
Temperature (°C)	120	120	120
Fractional Melt Flow Rate (g/10min)	0.47	0.63	0.63
Melt Flow (% relative to Control)	-	34%	34%
Average Pressure (PSI)	1769	1827	1798
Pressure (% relative to Control)	-	3%	2%
Average Energy Usage (kW/hr)	69	72	70
Energy Usage (% relative to Control)	-	6%	2%
Average Throughput (lbs/hr)	289	366	370
Throughput (% relative to Control)	-	27%	28%
Energy Use per Pound (kW/lbs)	0.24	0.20	0.20
Energy Use Change (% relative to Control)	-	-16%	-16%

Formulation and Trial Conditions:

CERANOVUS® A120 PE Additive added at 2% and 4% to Post Consumer Recycled HDPE

Varied extruder screw speed to maintain constant 122 PSI back pressure

Performance Advantages:

- ✓ Increased the melt flow rate by 34%
- ✓ Increased throughput by approx. 27% while maintaining average hourly energy consumption
- ✓ Reduced overall energy requirements per unit output by approx. 16%



Products containing CERANOVUS A Series additives contribute towards LEED certification and credits programs.



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CERANOVUS A Series polyethylene and polypropylene additives are made from 100% post consumer and post industrial recycled plastics as certified by SCS Global Services