GREENMANTRA® TECHNOLOGIES

CERANOVUS® A120 Polyethylene and A155 Polypropylene Polymer Additives in Wood Plastic Composite Formulations

GREENMANTRA® combines TECHNOLOGY with SUSTAINABILITY to create unique CERANOVUS® A Series Polyethylene and Polypropylene polymer additives from recycled plastics.

CERANOVUS® A120 Polyethylene and A155 Polypropylene polymer additives were each evaluated at a 3% level in two WPC formulations with 48% and 56.5% wood flour, using a post-consumer recycled HPDE (MFI 6.3) as the matrix system.

This study confirms that **CERANOVUS®** A Series Polyethylene and Polypropylene polymer additives can deliver the following performance, formulation and operational advantages to WPC manufacturers:

1. Increases strength (Modulus of Rupture) and stiffness (Modulus of Elasticity)
2. Reduces water absorption through efficient dispersion of the wood into the polymer matrix
3. Enables formulation flexibility and broader feedstock selection while still meeting performance requirements:
   - Offset or reduce need for virgin plastics
   - Increase usage of low-cost fractional melt recycled plastics
4. Maintains processing parameters with stable torque and die pressure
5. Increases recycled content, enhancing your sustainability profile

Table 1: WPC Test Formulations, Compounding Process Parameters and Water Absorption Results

Formulation Components	48.0 % Wood Flour Content			56.5 % Wood Flour Content		
	Control A	Formula 1 - A120 PE Wax Polyethylene	Formula 2 - A155 PP Wax Polypropylene	Control B	Formula 3 - A120 PE Wax Polyethylene	Formula 4 - A155 PP Wax Polypropylene
Wood Flour (hardwood 40-80 mesh)	48.0%	48.0%	48.0%	56.5%	56.5%	56.5%
Post Consumer Recycled HDPE (MFI 6.3)	48.5%	48.5%	48.5%	40.0%	40.0%	40.0%
Antioxidant (generic version of 1010)	0.5%	0.5%	0.5%	0.5%	0.5%	0.5%
Calcium Stearate Lubricant	3.0%	-	-	3.0%	-	-
CERANOVUS® A120 PE Wax	-	3.0%	-	-	3.0%	-
CERANOVUS® A155 PP Wax	-	-	3.0%	-	-	3.0%
Process and Property Measurements						
Torque (%)	41	45	45	48	49	48
Die Pressure (PSI)	853	836	807	1,048	1,096	1,022
Water Absorption (24 hr, % - ASTM D1037)	1.42	0.96	1.04	2.64	2.07	2.54

Testing conducted by the National Research Council Canada, Ottawa ON
Compounding and extrusion on Coperion 34 mm twin-screw extruder at 125 rpm

CERANOVUS® A120 Polyethylene and A155 Polypropylene polymer additives increase the strength by 23% (see Chart 1, Modulus of Rupture) and stiffness by 20% (see Chart 2, Modulus of Elasticity) when tested in the WPC formulations independent of the effect of a stearate lubricant.

Chart 1: Modulus of Rupture (PSI), ASTM D790

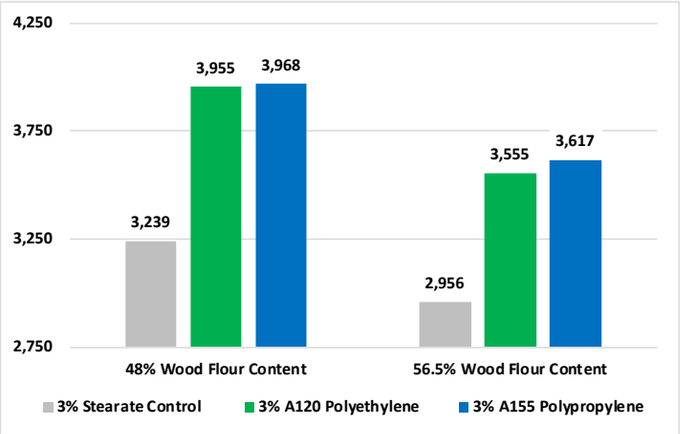
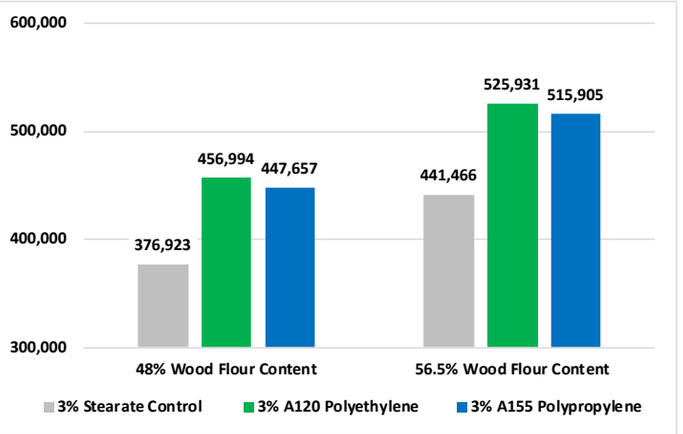


Chart 2: Modulus of Elasticity (PSI), ASTM D790



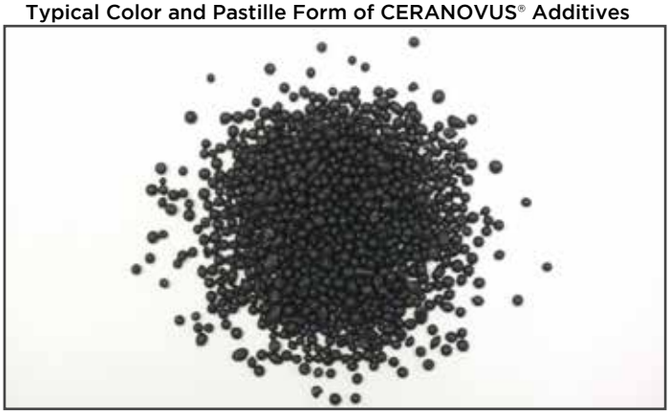
Utilizing 100 percent recycled plastic feedstocks, **CERANOVUS**® waxes and polymer additives are consistently produced to precise physical property specifications and supplied in free flowing pastilles (2-4 mm) for ease of use with extrusion and molding processes.

GreenMantra® **Technologies** offers stable and sustainable long-term pricing for annual contracted volumes.

Typical Properties of CERANOVUS® Additives

Physical Properties and Test Methods	CERANOVUS® Additives	
	A120 PE	A155 PP
Density (g/cm³) ASTM D1298	0.93	0.90
Drop Point (°C) ASTM D3954	122	155
Penetration (@ 25 °C in dmm) ASTM D1321	2	2
Viscosity (cps @ 140 °C) BROOKFIELD	700	-
Viscosity (cps @ 190 °C) BROOKFIELD	-	75

Typical Color and Pastille Form of CERANOVUS® Additives



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

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