Application Example

Wood-Plastic Composites

Introduction

Wood-plastic composites may be one of the most dynamic sectors of today's plastic industry. Although the technology is not new, there is growing interest in the new design possibilities this mariage of materials offers.

The production of WPC typically uses a fine wood waste (cellulose based fiber fillers such as hardwood, softwood, plywood, peanut hulls, bamboo, straw, etc.) mixed with various plastics (PP, PE, PVC). The powder is extruded to a dough-like consistency and then extruded to the desired shape.

Additives such as colorants, coupling agents, stabilizers, blowing agents, reinforcing agents, foaming agents, lubricants help tailor the end product to the target area of application.

With up to 70 percent cellulose content, wood-plastic composites behave like wood using conventional woodworking tools. At the same time, they are extremely moisture-resistant. There is little or no water present, thus increasing resistance to rot.

Wood-plastic composites are already widespread in outdoor use for decking, cladding, park benches, etc. There is also a growing market for potential indoor uses such as door frames, trim and furniture.

Products

Lumber, decking and railing, window profiles, wall studs, door frames, furniture, pallets, fencing, docks, siding, architectural profiles, louvers, automotive components

Characteristics

- Fastest growing sector of plastics industry
- Volume processors must produce faster, better, cheaper
- Weatherability and life cycle costs are major factors
- Formulation variations that increase wood content offer expansion into other uses
- Environmentally safe and efficient

Key Blending Considerations in Wood-Plastic Composites

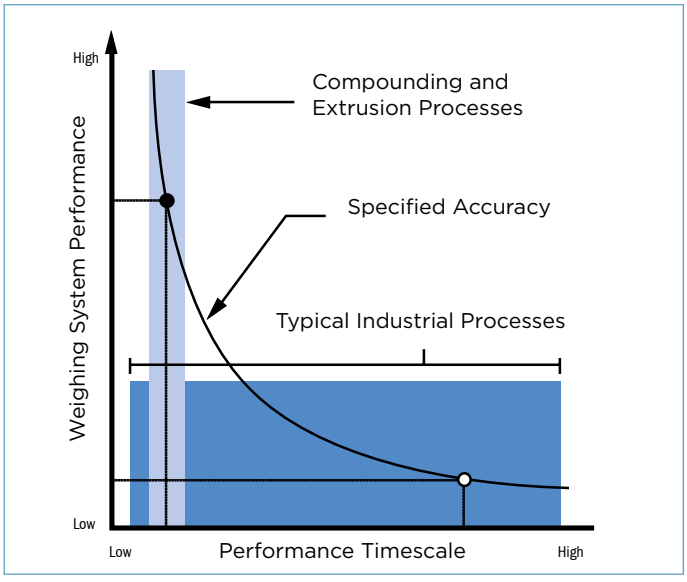
Compared to many other processes, on-line compounding and extrusion exhibit short performance timescales, consistent with the mixing time of the extruder.

For high formulation quality the feeding system must achieve and maintain its required blending accuracy within this brief time.

Key to a feeder's ability to attain high accuracy over short intervals is the resolution of its weighing device and response of its process controller. As the illustration at right shows, lengthy performance timescales permit a given blending accuracy to be attained with a low performance weighing system.

However, to achieve the same accuracy in the short interval characteristic of compounding and extrusion operations, a much higher weighing performance is required.

Additional important blending system considerations in wood/plastic composite processing include control and weigh system insensitivity to environmental disturbances, and the ability to reliably handle/control difficult organic components.



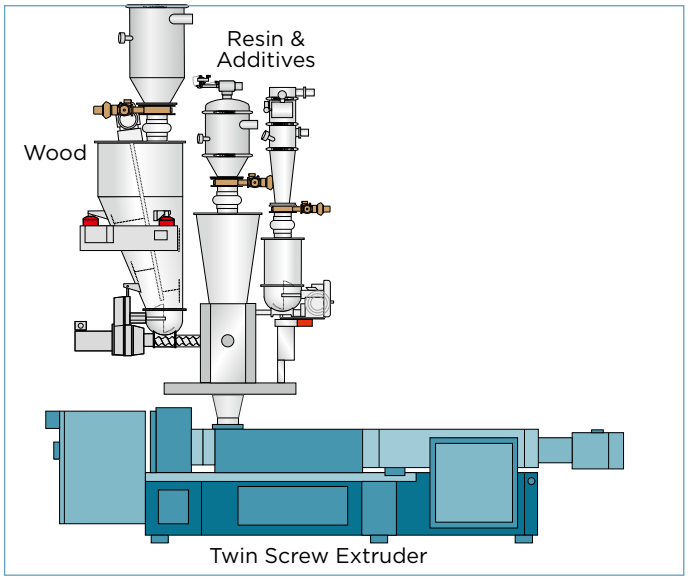
Weighing performance is a combination of scale resolution, sophistication of filter, weighing speed and response time of the controller.

High Wood-Plastic Composite Quality Requires Feeding Accuracy and Consistency

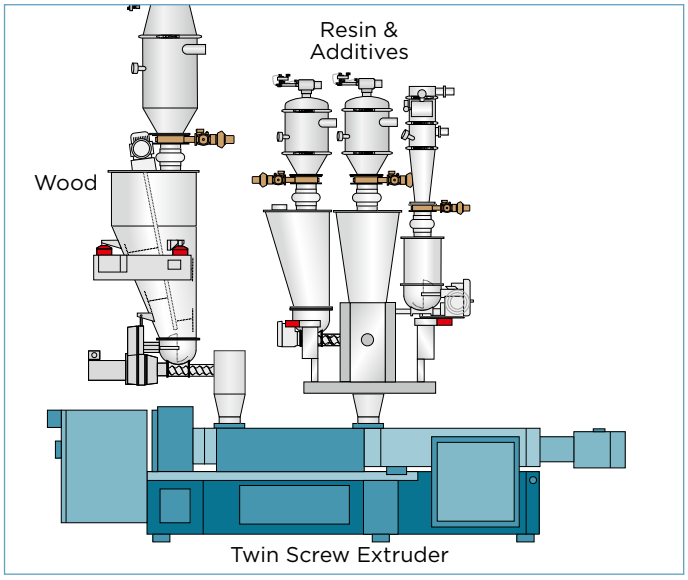
Process Description

Compounding and extrusion of wood-plastic composites

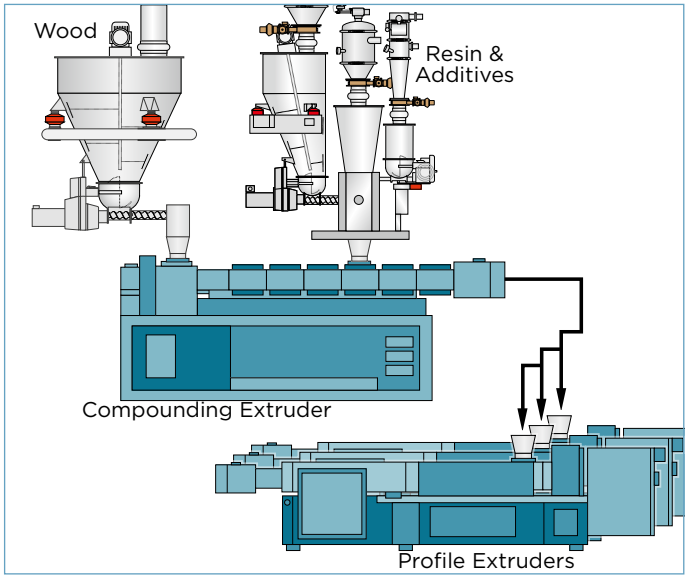
This promising and evolving technology is marked by a variety of approaches to compounding and end product extrusion. Below, the term 'wood' is used to identify any of the many forms of organic material used in these processes.



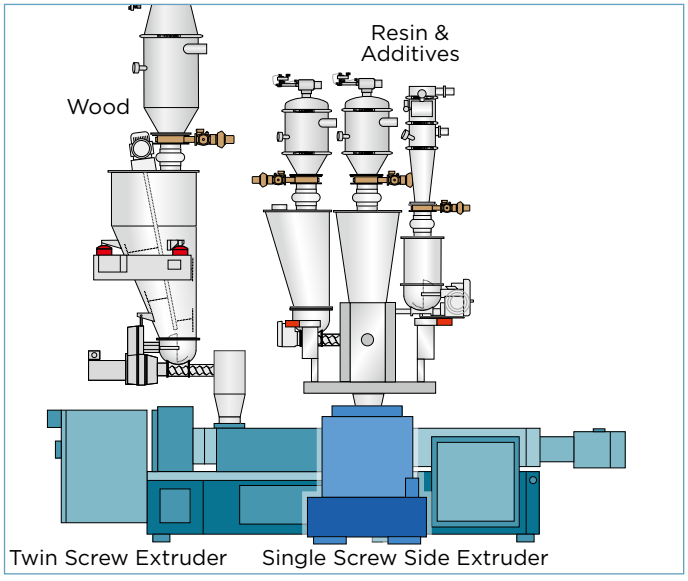
1. Pre-dried wood along with resin/regrinds and additives all enter at the throat of a twin screw pelletizing extruder.



2. Pre-dried wood enters at twin screw pelletizing extruder throat with resin/regrind and additives introduced along the barrel.



4. A high-speed compounding extruder supplies multiple single or twin screw profiling extruders. Alternatively,compounding extruder feeds a gear pump to produce the profile.



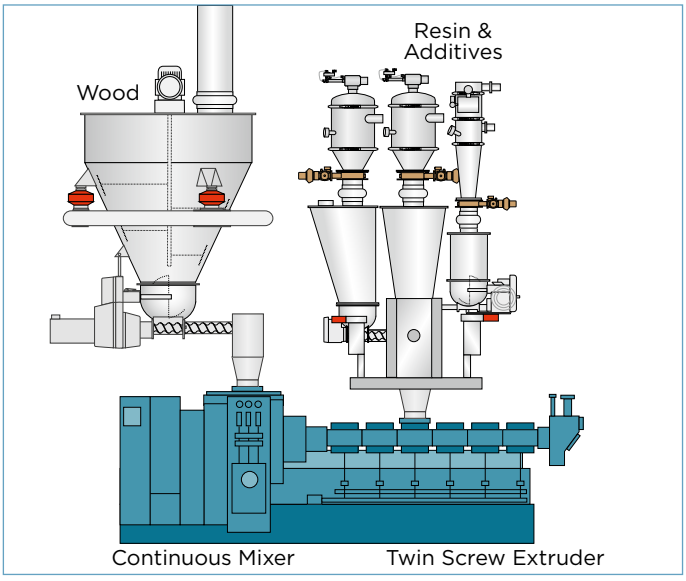
5. Wood enters twin screw extruder throat and is dried within the extruder. A single screw extruder injects melt along barrel.

Material Handling Know-How

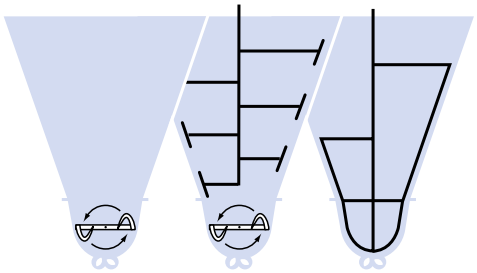
With the diversity of organic components used in wood/plastic composite processing, there is no single answer to reliably handling these potentially difficult materials.

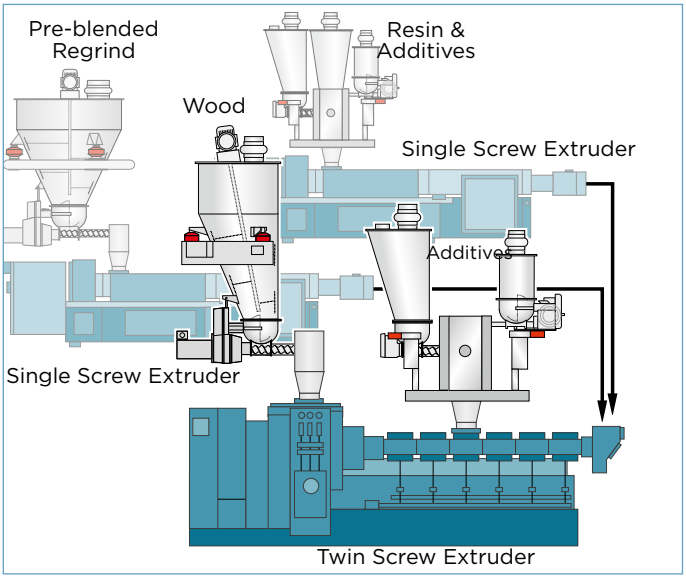
Pre-purchase testing helps determine the optimal combination of bin design, agitation and other flow aid strategies for the specific material in use. Coperion K-Tron's fully-equipped testing facilities are available to evaluate your materials and determine the optimal combination of equipment components to assure the highest level of accuracy and reliability. Computerized performance test reports document equipment performance.

Feeder design and agitation solutions are also key to handling difficult bulk materials. Coperion K-Tron offers over 30 years of experience in material handling technology.



3. Continuous mixer discharges dry wood at twin screw extruder throat with resin/regrind and additives introduced along barrel to produce end product profile.





6. Multi-extrusion application with wood and resin, regrind, and additives on main twin screw extruder with flanking single screw extruders discharging to die head.

Smart Feeding Solutions

For Wood and Other Organics

Coperion K-Tron loss-in-weight feeders offer the perfect solution to precise feed rate control of the full range of wood and other organic components in wood/plastic composites. Features include stable, all-digital SFT weighing technology with 1:4,000,000 resolution in 80ms, large hemispherical feed bowls, extensive agitation options and metering screw selection.

For Resins, Regrind and Additives

Coperion K-Tron's K4G Feeding & Blending System is designed for on-line blending of up to six components at low to medium rates. Able to accommodate various Coperion K-Tron feeders for combining pelletized, granular, and powdered or flaked materials which are blended simultaneously on the extruder.

Coperion K-Tron's K4G systems are available in 1-, 4-, and 6-ingredient stands, specially designed to be mounted directly on the extruder in a highly compact configuration. To facilitate cleaning or material changeover, each K4G feeder easily swings out providing full, unobstructed access.

For Powders, Flakes, and Non Free-Flowing Materials

Coperion K-Tron's standard and Compact Line single and twin screw loss-in-weight feeders gravimetrically control the flow of even the most challenging bulk solid materials at rates as low as 100 g/hr.

High resolution Smart Force Transducer digital weighing technology combined with the industry's most advanced loss-in-weight control enables the highest possible accuracy even in the most difficult process environments.

Coperion K-Tron's standard loss-in-weight feeders (top left) feature stable 3-point weighing. Smaller Compact Line loss-in-weight feeders (above) employ precision platform-based weighing.

SmartConnex, Smart Control Environment

SmartConnex is Coperion K-Tron's Smart Control Environment which reflects the latest thinking in process plant control and communications technology.

- One software package supports all types of applications, batch and continuous, simplifying programming
- Choose a Coperion K-Tron operator interface or direct connection between PLC/host computer and feeder control module
- Reduce or eliminate feeder control panel expense
- Reduce cable purchases; feeders are networked with simple twisted pair wire
- High speed field bus reduces wiring and checkout time; 90% less cable and conduit to install
- Simple connection to factory network and support for common protocols lower integration cost
- Integrated vacuum loader control

coperion K-TRON

Manufacturing plants:

Coperion K-Tron Pitman, Inc.
590 Woodbury-Glassboro Rd
Sewell, NJ 08080, USA
Tel +1 856 589 0500
Fax +1 856 589 8113

Coperion K-Tron Salina, Inc.
606 North Front St.
Salina, KS 67401, USA
Tel +1 785 825 1611
Fax +1 785 825 8759

Coperion K-Tron (Switzerland) LLC
Lenzhardweg 43/45
CH-5702 Niederlenz
Tel +41 62 885 71 71
Fax +41 62 885 71 80

info@coperion.com