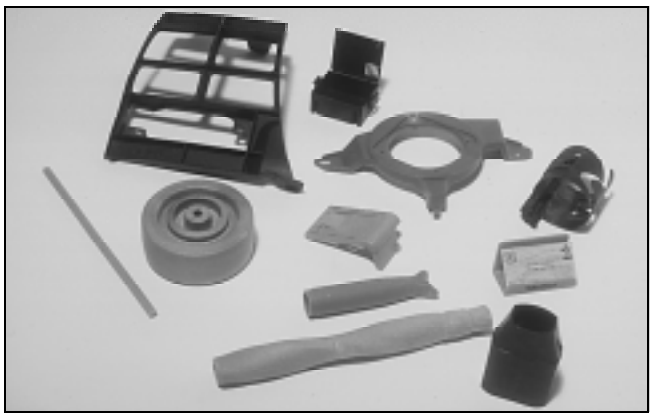
TECHLINE
Properties and Use of Wood, Composites, and Fiber Products

Melt-Blended Wood Fiber-Thermoplastic Composites



One area of current research at the Forest Products Laboratory (FPL) is focused on the use of wood fiber with thermoplastic resin. Thermoplastic resins, such as polypropylene, polyethylene, polystyrene, and polyvinyl chloride, are resins that soften when heated and harden when cooled. This property allows other materials, such as wood, to be mixed with the plastic to form a composite product. The resulting low-cost composite products have the ability to be easily processed into various shapes and recycled.

The manufacture of melt-blended composites is usually a two-step process. Wood flour or fiber is combined with molten thermoplastic to produce a homogeneous composite material, pushed through a die into strands, and cut into pellets. The three most common types of product-forming methods for wood-plastic composites are extrusion (forcing molten plastic through a die), injection molding (using a cold mold), and compression molding (pressing between calendars or between mold halves).

Composites are typically made using up to 50% of wood filler or reinforcements. Most composites research has used wood flour as a filler in plastics. Wood flour is processed commercially by grinding postindustrial material, such as planer shavings, chips, and sawdust, into a fine, flour-like consistency. Wood fibers, although more difficult to process when compared to wood flour, can lead to superior composite properties and act more as a reinforcement than as a filler. Wood fibers are available from both virgin and recycled sources. Recycled sources can include wood-based materials such as demolition wood and recycled newspapers and magazines.

Several factors influence processing wood with thermoplastics. Moisture can disrupt many thermoplastic processes, resulting in poor surface quality, voids, and unacceptable parts. The material must be predried or vented equipment used. Melt temperatures should be kept below 200°C (392°F) because of the low degradation temperature of wood. Prolonged exposure to high temperatures can result in release of volatiles, discoloration, odor, and degradation of the wood component. As a result, current composite research centers on using virgin plastics with low melting points, such as polypropylene and polyethylene.

Common fillers for thermoplastics include mineral fillers such as calcium carbonate, talc, and wollastonite. Using wood as a filler or reinforcement for thermoplastics results in a product that is less abrasive to the processing equipment, costs less, and has a lower density than a composite with mineral fillers. Different applications take advantage of the properties that wood fiber-thermoplastic composites offer. For example, automotive applications take advantage of the lower specific gravity, and household products such as paintbrush handles, scissors handles, and computer disk cases take advantage of the aesthetics, resulting in a "wood-looking" product that can be processed like a plastic.

For more information, contact:
Nicole Stark, Chemical Engineer
Forest Products Laboratory
One Gifford Pinchot Drive
Madison, WI 53705–2398
Phone: (608) 231–9392; FAX: (608) 231–9582