

Outdoor Durability of Wood–Plastic Composite Lumber

Wood–plastic composites for interior applications such as parts for small household products and automotive parts have been extensively investigated. Recently, wood–plastic composites have been used in outdoor applications such as material for decking, and this has led to a flurry of activity in the area of wood–plastic composite lumber. The growth outlook for wood–plastic composite building products has been estimated to increase 50% each year for the next 5 years.

Studies have shown that stiffness increases and thermal expansion decreases when wood is added to unfilled plastics. In addition, wood–plastic composites have environmental advantages such as diverting both wood and plastic from waste streams and a continuous recycling of the scrap produced during processing and installation of these materials.



**Wood–plastic composite lumber
used in decking**

However, even though wood–plastic composite lumber is promoted as durable, resistant to cracking and warping, and requires less maintenance than traditional pressure-treated wood decking, little information is publicly available about durability and service-life of this wood–plastic composite lumber.

Background

Public concern about the durability of wood–plastic composite lumber was brought to the attention of the USDA Forest Products Laboratory (FPL) through inquiries and conference feedback. Few articles have been published on the durability of these composites, and little information is available in the public domain. Many studies have been completed that examine the mechanical properties of wood–plastic composites. However, the durability and service-life of wood–plastic composite lumber used in decking needs additional investigation.

Objectives

The objectives of this study are to

- ascertain the durability of wood–plastic composite lumber when exposed over time to fungi and ultraviolet (UV) radiation,
- determine how additives such as stabilizers, pigments, and fungicides improve UV resistance and fungal durability, and
- gain knowledge about the ease of scale-up from laboratory to industrial processing equipment.

Approach

The study will be divided into two phases: (1) laboratory-scale investigation of wood-plastic composite durability and (2) industrial processing trials and full-size composite lumber evaluation. In phase 1, laboratory composites will be tested for UV stability and fungal resistance. The effectiveness of additives used to promote the durability of the composite, such as fungicides and UV stabilizers, will also be investigated. Durability will be evaluated based on weight loss, mechanical performance, and visual appearance. Additive packages that afford the highest UV resistance and fungal protection will be used in phase 2. The best wood-plastic composite formulations will be run on commercial profile extruders to determine processing ease.

Expected Outcomes

This research program will result in

- baseline information on the durability of wood-plastic composite lumber,
- a better understanding of how additives improve the durability of these composites,
- a determination of additive packages that afford the best protection against fungal attack and photodegradation for lumber applications, and
- knowledge about processing ease and scale-up abilities of the formulations for industrial production.

Timeline

Complete the study in 2 years. Evaluation of the additives will be completed the first year. Industrial trials will take place during the second year.

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