XV International Conference on Durability of Building Materials and Components
DBMC 2020, Barcelona
C. Serrat, J.R. Casas and V. Gibert (Eds)

Innovative Approaches to Increase Service Life of Poplar Lightweight Hardwood Construction Products

Joris C.R. Van Acker, Xiuping Jiang and Jan B.B. Van den Bulcke

Ghent University (UGent), Laboratory of Wood Technology (UGent-Woodlab), Coupure links 653, 9000 Ghent, Belgium, joris.vanacker@ugent.be

Keywords: *Poplar, Engineered Wood Products, Wood Protection, Wood Modification.*

1 Introduction

Wood products in construction are limited in service life when conditions are close to those present in forest ecosystems. We are able to select wood species with different levels of natural durability fit for an envisaged end use. When environmental conditions do not involve soil contact or high moisture dynamics as in the forest we can expect wood products to last longer.

Low durability wood species that we want to use in applications that require a long service life under conditions similar to those at soil level require solutions like wood preservation. Over the last decades, wood protection has altered focus towards end uses out of ground contact and also interior applications are expected to perform better. Parallel to this evolution, wood modification treatments were assessed to improve general performance of wood species. Besides an increased potential for using low durability wood species, mainly dimensional stability related properties are envisaged.

During the second half of last century the forestry-wood chain has evolved and today ecosystem services in a sustainability framework are important. An increased need for more renewable resources both for material and energy use has initiated extra interest for the potential to produce more lignocellulosic biomass, in short to increase wood production. One option is to provide in complementary production in planted forests. Both forestry and agriculture can take part in this. The cultivation of fast-growing poplar hybrids in the temperate regions allows producing lightweight hardwood with a low natural durability, but with an important potential as construction material especially as engineered wood products.

All wood protection methods are of interest to be evaluated for this wood resource, making it suitable even for high quality applications (Van Acker 2019). Poplar, for many reasons, has been nominated as hardwood with the best potential to perform similarly as softwoods for applications in wood construction. Benchmarking with wood species like spruce is relevant for several engineered wood products like plywood, LVL and even CLT. Wood treatments to increase durability have evolved from traditional wood preservation towards modification techniques such as thermally modified timber. Innovative poplar based products have been assessed on their performance and are designed to fit for purpose in relation to a specific combination of use class and service life.

2 Increasing Service Life of Poplar Based Engineered Wood Products

Introducing innovative poplar based construction product for green building requires adequate testing tools. Performance based assessment should allow to integrate different protective

measures. Related to moisture dynamics and the linked fungal decay risk, opportunities to extend service life are manifold.

This paper intends to present several innovative poplar based construction products and show some cases of benchmarking in relation to an integrated service life approach. In Table 1 an overview is provided on how the service life of different engineered wood products could be increased. The different engineered wood products are subdivided in categories depending on the components constituting the product: strands, veneer and timber. For each category a wood based panel product as well as a beam like product is used as example. The use of durable wood species is clearly related to the use of primarily heartwood which is often difficult to achieve in full. Vacuum pressure based wood preservation of the final product is often limited by the treatability. Glue-line additives are mainly useful when thin veneers or strands need to be protected. Finally a third option related to wood preservation technology is spraying a diffusible component based product (*e.g.* borates) on the surface. Modification technologies might have some impact on mechanical properties and hence not fully adequate for loadbearing applications, but thermal modification for full panel products and chemical modification of strands prior to incorporation in a panel is potential technology. Finally resin treatments have similar or even better potential than glue-line additives and could also be applied as modification methods for timber based products. Applying coatings to control moisture dynamics is mainly useful for veneer and timber based products.

Table 1. Options to increase service life of Engineered Wood Products (EWP).

Component	EWP	Durable wood	Vacuum pressure[1]	Glue-line additive	Surface spray[2]	Thermal modification	Chemical modification	Resin[3]	Coatings
Strand	OSB	-	-	±	+	+	+	+	-
	LSL	-	-	±	±	-	-	+	-
Veneer	Plywood	+	+	+	+	+	±	+	+
	LVL	±	±	+	±	±	±	+	+
Timber	CLT	+	+	-	+	+	±	±	+
	GLT	+	+	-	±	±	±	±	+

Legend: +: existing option, ±: feasible option, -: less probable option

[1]: deep impregnation with biocides; [2]: surface biocide application with potential diffusion, *e.g.* borates, [3]: analogue to glue used for production or a hydrophobing agent; Abbreviations: EWP = engineered wood product; OSB = oriented strand board; LSL = laminated strand lumber; LVL = laminated veneer lumber; CLT = cross laminated timber; GLT = glue laminated timber or glulam.

ORCID

Joris Van Acker: http://orcid.org/0000-0002-8961-0176
Xiuping Jiang: http://orcid.org/0000-0002-0752-2691
Jan Van den Bulcke: http://orcid.org/0000-0003-2939-5408

References

Van Acker, J. (2019). Towards better integration of wood protection in the forestry wood industry chain, case study on hybrid poplar. Proceedings of the International Research Group on Wood Protection Doc. N° 19-50359, 19p.