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Broad Spectrum Utilisation of Wood

Edited by
Alfred Teischinger and Joris Van Acker

in Co-operation:
COST - European Co-operation in the field of
Scientific and Technical Research
Action E44 - Wood Processing Strategy

Primary Wood Conversion Processes

Tree Quality leads to processing trees using saw milling for timber, chipping into particles and peeling or slicing trees into veneer. Decision on selecting one of these options in respect of further processing is both related to the forest resource itself and the end products envisaged. Quality of raw materials is defining the possibilities and profitability for further processing.

Integrated Processing of Forest Products

Integrated processing of forest products can use different strategies to combine primary wood conversion processing. These combinations are based on sorting and grading of logs and sawn timber but also as innovative options for secondary processing of a primary processing product.

Mixed Stand and Mixed Species Processing

New forest strategy approaches will lead to more mixed stands in the future. New options for the utilisation of mixed stand and even mixed species processing will become essential.

Processing in Relation to Tree Dimensions and Partitioning of Trees

Processing of small diameter logs into sawn timber components is an important topic for future economics of whole stem processing. This will also have to deal with problems induced by the presence of juvenile wood, spiral grain, reaction wood, ... Large dimension trees will deed new options for processing or as part of it and even the total tree use strategic factors in the broad spectrum utilisation of wood.

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Abstracts - Session 3: Species and applications

Prospects for developing the production of solid wood products taking into account the raw-material base

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Key words: wood resources, medium-sized wood, solid wood materials

ABSTRACT

In this report data about state of forests in Republic of Bulgaria are being analyzed. Special attention is given to the harvesting of medium and large-sized wood as a potential raw material for the wood processing industry. Objective of this research is the state of raw-material resources in Bulgaria up to 2000 and prognoses for their development. While carrying out the analysis, scientific-based standards for steady development of forest resources are taken into account, which allow conservation and growth of forests; trends in development of other big consumers of wood raw materials (veneer, plywood, cellulose, paper, etc.), prognoses for development of solid wood materials. Conclusions concerning the expansion of raw-materials have been made.

Stem analysis - The better way to look to intra-tree variability

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Keywords: stem analysis, tree-ring, radial trends, within tree variation, juvenile wood

ABSTRACT

A comprehensive knowledge of the characteristics of any material is essential to its best utilization. This is especially true for wood because of its cellular nature. Variability of wood parameters in a tree is sometimes a rather nebulous concept since variability is evident within single cells, from early- to latewood, from pith to bark and from stem base to the top of a tree. Comparing data from different heights within a stem is usually referred to as stem analysis. So far, stem analyses have been done using a restricted number of parameters, mostly ring-width, and using a restricted number of samples in longitudinal direction. This study analyses a number of parameters from a single tree. An 81-year old spruce tree was felled and internodal disks were taken from each annual terminal shoot. All tree rings in each disk were measured and a whole-stem analysis was completed for the following parameters: ring-width, mean ring density, percentage of latewood and type of transition from early- to latewood. We have found significant patterns for different parameters. Parameters mainly influenced by the climate during wood formation show more consistent pattern along the stem axis. The strongest signal – expressed in well visible lines parallel to the bark - was seen for the type of transition from early- to latewood. The results give helpful ideas for the discussion of how cores or disks taken at breast height represent the entire tree.

Using poplar timber in light constructions: The problem of non-uniform moisture distributions after drying

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Keywords: Poplar wood, Wet pockets, moisture distribution, drying properties, light construction

ABSTRACT

Poplar is an important tree species in the Flemish region, Belgium, delivering in short rotations of 20 year a substantial amount of approximately 380.000 m³ round wood a year. This light wood is used in a wide variety of applications due to a large variability in wood quality. To use the wood in more durable products as furniture and light constructions the lumber needs to be dried. In this regard clonal variability is highly important. Wood that was not dried properly induces risks on the part of biological attack, strength and stiffness, glueing and finishing as well as all machining properties.

This study aimed at comparing clones from a multiclonal stand dried with a conventional kiln-drying process at low temperature, followed by a two week homogenization period, and defining the variability in end MC. The homogenization period additionally lowered the average end MC significantly with 2-3%. Poplar clones show a different end MC after drying, meaning that the drying schedules need adaptation per clone or clonal groups. This may directly affect the logistic organisation within drying companies. In practice, the distinction between clones can rarely be made on the level of delivered logs.

The occurrence of wet pockets is a major issue of concern in drying poplar lumber. Because literature does not give an objective and overall applicable definition of wet pockets, several definitions have been evaluated in this paper. The definition based on absolute differences between the locally measured MC and the MC corresponding with the 25% percentile value increased with 5%, allowed to discriminate beams containing wet pockets with high certainty. Again clonal differences have been found. However the results are influenced to some extent by the end MC reached after kiln drying.

Further research is needed to see if this approach can be used to compare different drying schedules and to make links to other important drying quality criteria such as deformations and residual stresses.

Possibilities of utilisation of small-sized coniferous wood in Bulgaria

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INTRODUCTION

Bulgaria's forests are a part of the European and world forest wealth. They are of global and national ecological, economic, social and cultural significance.

Bulgaria's total forest area is 3.9 mn ha or 34% of the country's territory. 3.4 mn ha of them are covered with forests. Wood resources exceed 520 mn m³, at an annual increase of about 12.3 mn m³, with the average age of forests being 49 years. Almost 55% of them are young, nearly 30% are at the age of 40 to 80 years, and the centuries-old plantations are 9.2%.

The objective conditions today necessitate the creation of an efficient system for multipurpose management of forests and the development of a modern forest industry that requires new solutions. From this point of view, the matter of the complex utilisation of wood is especially important and along these lines the small-sized wood obtained as waste during wood harvesting represents a considerable reserve.

Advantages and disadvantages of mixed wood species utilization for wood based panels

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Key words: particleboard, single wood species, mixed wood species, bending strength, modulus of elasticity, internal bond, thickness swelling

ABSTRACT

Fifteen particleboards from spruce (*Picea abies* Karst. L.), beech (*Fagus sylvatica* L.), oak (*Quercus robur* L.), poplar (*Populus nigra* L.) and their mixtures were used to evaluate the impact on the important properties such as bending strength, modulus of elasticity, internal bond and thickness swelling. The evaluation of results was made with regard to the number of species used to produce the particleboard. As expected the best properties were observed when particleboards were made from spruce, oak or poplar (single wood species). Also worst boards are observed when beech particles were used (single wood species). The variability between particleboards from single wood species is higher, due to the differences between wood species used. The variability of the results is lower at mixed species particleboards, because negative properties of one wood species are diminished by positive properties of another. It was also determined that the properties of particleboards from single wood species are dependant on the wood species used and are therefore in some cases even lower than those observed at particleboards from mixed species.

High Quality Beech Glulam

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Keywords: gluelam, Beech wood, hardwood, market potential, cutting process, mechanical properties, climate storage, delamination, resin treatment, manufacturing cost, grading

ABSTRACT

The reported project is dealing with the hearted beech (*Fagus sylvatica* L.) as raw material for glued laminated beams. The research focused on the mechanical capability of the material. A great number of experimental tests were performed to find out about gluing performance and bending behaviour as structural size element. Further aspects considered included the long-term availability of the raw material and the evaluation of this product by building professionals in Germany.

There seems to be a future for beech glulam, as well as homogenous or as hybrid element, combined with softwood, e.g. spruce lamella in middle layers of the beam. The material has a strong mechanical capability. Also a good gluing quality is possible in dry conditions. Additional research is certainly necessary, e.g., related to optimized processing conditions – in particular pressing - and to improve high-capable finger-joints, which reflect the excellent material characteristics. Research needs also include strength grading of hardwoods as beech and continuing investigation of the material behaviour under moist conditions.

Wood properties of larch grown on plantation vs. old-grown natural sites

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Keywords: larch, wood quality, heartwood, growth, durability, grading

ABSTRACT

Among softwood species, the genus *Larix* has gained reputation for its superior wood properties. In addition to its native mountainous range, larch is also an appreciated species in afforestation or reforestation of lowlands. Larch is characterized by a fast juvenile growth, strong wind firmness, low susceptibility to pests and particularly high quality of its timber, including high wood density, superior mechanical strength and natural durability. The objective of this research was to assess various wood quality parameters with particular concern of the question how wood quality from plantation-grown larch wood compares to high-elevation mature larch wood.

From four geographic European regions (France, Belgium, Great Britain, Austria) 300 planted and naturally-grown larch trees (*Larix decidua*, *L. kaempferi*, *L. decidua* x *L. kaempferi*), different varieties (alpine, sudetan and polish European larch), age classes, and elevations were examined for their natural variability regarding wood anatomy, wood chemistry, decay resistance and timber grading. Within European larch, huge differences between provenances were found, with the old-grown native alpine sources more durable than those from young low-altitude plantations. However, some lowland origins - such as the Polish European larch origin Blizyn or the hybrid from France - compare well with Japanese larch durability.

Because of its appealing heartwood colour and its higher wood density, larch wood has been a traditionally appreciated species for many purposes. The requirements of this high quality product are therefore mainly driven by the visual appearance with heartwood colour and knottiness.

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