


2016 學術發表 要旨集

2016 PROCEEDINGS OF THE KOREAN SOCIETY OF WOOD
SCIENCE AND TECHNOLOGY ANNUAL MEETING

2016年 4月 15日(金) ~ 16日(土)
(국민대학교)

주최  **한국목재공학회**
사단법인
The Korean Society of Wood Science & Technology



국민대학교 산림과학연구소
KOOKMIN UNIVERSITY INSTITUTE OF FOREST SCIENCE

후원 **목재산업단체총연합회**

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¹충북대학교 산학협력단부설 목재연료소재은행, ²충북대학교 목재·종이과학과
- 09:15 - 09:30 A-02 Learning from Cherry Wood Works: Remarkable Mechanical Property and its Biological Significance
Yoko Ura¹, Satoshi Kimura², Kayoko Kobayashi², Izumi Kanai², Junji Sugiyama²
¹Nara National Institute for Cultural Properties,
²Research Institute for Sustainable Humanosphere, Kyoto University
- 09:30 - 09:45 A-03 Role of auxin on cambial growth in early growing season in locally heated stems of *Abies homolepis* seedlings
Md Hasnat Rahman¹, Kayo Kudo^{1,2}, Yusuke Yamagishi^{1,3}, Shahanara Begum^{1,4}, Michito Hosaka¹, Satoshi Nakaba¹, Ryo Funada¹
1. Tokyo University of Agriculture and Technology, 2: Akita Prefectural University, 3: Hokkaido University, *4: Bangladesh Agricultural University
- 09:45 - 10:00 A-04 월악산 잣나무와 화백나무 형성층의 계절적 활동
서정욱¹, 최은비¹, 남지연¹
¹충북대학교 농업생명환경대학 목재·종이과학과

좌장 : 서정욱 (충북대학교)

- 10:00 - 10:15 A-05 Anatomical and physical characteristics of stem, branch and root woods in *Paulownia tomentosa*
Yue Qi, Jae-hyuk Jang, Wahyu Hidayat, Ae-hee Lee and Nam-hun Kim
Department of Forest Biomaterials Engineering, College of Forest and Environmental Sciences, Kangwon National University
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이광희¹, 김요정¹, 손병화¹, 정현민¹, 서정욱², 한규성²
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Anatomical and physical characteristics of stem, branch and root woods in *Paulownia tomentosa*

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1. Introduction

Paulownia tree is a fast growing hardwood species in Korea. It has a number of characteristics on wood quality that make it highly desirable and suitable for use in a wide range of applications. For example, *Paulownia* has the characteristics of beauty appearance with clear wood grain, higher dimensional stability, and higher durability for fungi and termite. Until now, several *Paulownia* species such as *Paulownia elongate* (Bao *et al.*, 2001), *Paulonia fortunei* (López *et al.*, 2012) and *Paulownia tomentosa* (Senelwa and Sims, 1999), were studied on the wood qualities. *Paulownia tomentosa* has a long history as an important material for making Korean musical instrument and traditional furniture in Korea. In order to optimally utilize *Paulownia tomentosa* wood as a bioresource, the anatomical and physical characteristics should be fully understood. Thus, this study was undertaken to investigate the anatomical and physical characteristics of stem, branch, and root wood of *Paulownia tomentosa*.

2. Material and methods

2.1 Material

Thirteen years old *Paulownia tomentosa* was obtained from the Research Forest of Kangwon National University in South Korea. Air-dried wood samples were categorized in stem wood, branch wood and root wood.

2.2 Methods

2.2.1 Anatomical characteristics

Wood sections with 15µm thick were cut by a sliding microtome (Nippon Optical works, Japan). These sections were stained with Safranin-Astra blue, dehydrated in a graded series of alcohol (50%, 70%, 90%, 95%, and 99%), mounted using Canada balsam, and observed under an optical microscope (Nikon Eclipse E600, Japan). The anatomical characteristics were determined according to the IAWA hardwood feature list using Total Imaging Solution software (IMT, I-solution Lite, USA).

2.2.3 Crystalline characteristics

An X-ray diffractometer (Rigaku DMAX2100V Japan) equipped with a Cu target was used for measuring the crystalline properties, at 40 kV and 40 mA. The relative crystallinity (%) and crystallite width (nm) were calculated, respectively.

2.2.2 Physical characteristics

The size of small blocks in near pith and near bark were the dimension of 2cm(tangential) × 2cm(radial) × 4cm(longitudinal). The density, shrinkage, and moisture content were studied by KS F 2198 and KS F 2203(Korean standards association, 2004).

3 Results and Discussion

3.1 Anatomical characteristics

The anatomical characteristics of stem, branch, and root wood in *Paulownia tomentosa* are presented in Table 1. Statistical analysis(one-way ANOVA) showed that there were significant differences in the number and diameter of vessel and the number, height and width of ray among stem, branch and root parts. However, fiber length was not significantly different among these three parts. The relative crystallinity of root wood was lowest among these three parts. Moreover, branch wood showed smaller crystallite width than stem and root wood (Table 1).

Table 1. Anatomical characteristics of stem, branch and root wood in *Paulownia tomentosa*

Characteristics	Stem	Branch	Root	P-value
Vessel number/mm ²	7.3(0.8)A	10.3(0.6)B	5.0(0.1)C	0.000
Diameter (μm) Tangential direction	218.4(19.7)A	180.0(14.8)B	182.2(0.8)B	0.012
Diameter (μm) Radial direction	266.6(29.3)A	210.2(25.2)AB	238.5(4.7)B	0.038
Ray number/mm ²	12.1(1.6)A	19(1.0)B	12.1(0.5)A	0.001
Ray width (μm)	27.9(0.9)A	28.7(3.0)AB	46.8(5.5)B	0.028
Ray height (μm)	257.0(14.3)A	227.6(16.9)B	311.2(23.5)A	0.003
Fiber length (μm)	758.2(58.1)A	808.8(36.7)A	746.0(43.4)A	0.315
Crystallinity (%)	55.1	54.3	44.6	-
Crystallite width (nm)	2.82	2.50	2.69	-

Notes: means within a row followed by the same capital letter are not significantly different at 5% significance level using Duncan's test.

3.2 Physical characteristics

The physical characteristics of stem, branch, and root wood in *Paulownia tomentosa* are summarized in Table 2. With statistical analysis, green and oven-dried density, moisture content, and shrinkage were significantly different among stem, branch and root parts.

Table 2. Physical characteristics of stem, branch and root wood in *Paulownia tomentosa*

Characteristics	Stem	Branch	Root	P-value
Green density (g/cm ³)	0.75(0.05)A	0.61(0.04)B	0.75(0.03)A	0.001
Oven-dried density (g/cm ³)	0.29(0.01)A	0.33(0.01)B	0.25(0.01)C	0.000
Green moisture content (%)	237.1(5.7)A	100.4(6.6)B	203.4(5.4)C	0.001
Tangential shrinkage	4.7(0.5)A	7.2(1.1)B	4.1(0.9)A	0.006
Radial shrinkage	1.9(0.4)A	4.9(0.6)B	2.5(0.7)A	0.001
T/R ratio (%)	2.6(0.8)A	1.7(0.3)B	1.5(0.3)B	0.025

Notes: means within a row followed by the same capital letter are not significantly different at 5% significance level using Duncan's test.

Acknowledgement This study was supported by Kangwon National University in South Korea. Yue Qi also sincerely thanks the ACES-KNU scholarship of Kangwon National University for financial support from 2012.

Reference

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