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The Effect of Thermal Modification on Anatomical Properties of *Daniellia oliveri* (Rolfe) Hutch and Dalziel from Ghana

Utjecaj toplinske modifikacije na anatomska svojstva drva *Daniellia oliveri* (Rolfe) Hutch i Dalziel iz Gane

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ABSTRACT • *Understanding the biological changes from heat treatment is essential for effective wood application and quality control. Reliable evaluation ensures premium treated wood for the market. However, research on environmentally friendly thermal modification methods is limited. This gap must be addressed to evaluate the impact on lesser-known species like Daniellia oliveri. Five matured Daniellia oliveri trees were purposively selected and harvested from Du-West community and converted into standard sizes for the determination of the various properties. Fiber morphology, sectional characteristics as well as vessel measurements were evaluated in accordance with the International Association of Wood Anatomist (IAWA) Committee recommendations. The study revealed that, with the increase of the modification temperature, crystallization of wax occurred in the lumen of the modified specimens. The study further brought to light that with the increase in temperature fiber length decreased. Double fiber wall thickness and vessel diameter showed similar trends as their values decreased with the increase of the modification temperature. On the other hand, fiber lumen diameter and fiber diameter increased as temperature increased. This study highlights the significant impact of thermal modification on the anatomical properties of Daniellia oliveri wood. These insights underscore the importance of understanding the thermal modification response of wood species to enhance their application and ensure quality control.*

KEYWORDS: *thermal wood modification; anatomical wood properties; wood fiber morphology; Daniellia oliveri*

SAŽETAK • *Razumijevanje bioloških promjena drva zbog toplinske obrade ključno je za njegovu učinkovitu primjenu i kontrolu kvalitete. Pouzdana procjena utjecaja toplinske obrade osigurava vrhunsku kvalitetu modificiranog drva za tržište. Međutim, istraživanja ekološki prihvatljivih metoda toplinske modifikacije ograničena su.*

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Taj se nedostatak mora riješiti kako bi se procijenio utjecaj toplinske obrade na manje poznate vrste drva poput Daniellia oliveri. Za potrebe istraživanja odabrano je i posječeno pet zrelih stabala Daniellia oliveri iz područja Du-West te su pripremljene standardne veličine drva za određivanje različitih svojstava. Morfologija vlakana, obilježja presjeka, kao i promjeri traheja procijenjeni su u skladu s preporukama Međunarodnog udruženja anatoma drva (IAWA). Studija je otkrila da se s povećanjem temperature modifikacije vosak u lumenima uzoraka kristalizirao. Nadalje, ispitivanjem je uočeno da se s povećanjem temperature modifikacije duljina vlakana smanjuje. Također, s povećanjem temperature modifikacije smanjile su se i vrijednosti debljine dvostruke stijenke vlakana i promjera traheja. Nasuprot tome, s porastom temperature povećavali su se promjer lumena vlakana i promjer vlakana. Ova studija naglašava važnost utjecaja toplinske modifikacije na anatomska svojstva drva Daniellia oliveri. Rezultati upozoravaju na potrebu razumijevanja reakcije pojedinih vrsta drva na toplinsku modifikaciju kako bi se poboljšala njihova primjena i osigurala kontrola kvalitete.

KLJUČNE RIJEČI: *toplinska modifikacija drva; anatomska svojstva drva; morfologija drvnih vlakana; Daniellia oliveri*

1 INTRODUCTION
1. UVOD

There are over 800 different timber species found in the Ghanaian forests. However, only the commercially known species have been patronized by furniture and other timber users over the past decades (Appiah-Kubi *et al.*, 2019). A cursory look at the dwindling state of the traditionally known timber species in the furniture and construction industry in Ghana reveals a consistent decline in their volume. Therefore, mounting pressure on the few remaining commercial tree species such as Sapele, Mahogany, Odum, Ebony, Danta, Wawa amongst others that have been used for furniture and construction works since time immemorial (Asamoah *et al.*, 2023; Dumenu, 2019).

The imbalance between demand and supply of raw material for production purposes poses a bleak future for furniture and construction industries since there will be less supply of raw materials for continuous production (Antwi-Boasiako i Boadu, 2016). Despite difficulties with the availability of raw materials to the furniture and construction industries, a study conducted by Ofosu *et al.* (2019) asserted that the demand for wood-based products is still rising internationally. There are therefore significant ongoing efforts to expand the raw material base by finding alternative timber resources from tropical forests to compliment the endangered commercial timber species (Ofosu *et al.*, 2019).

Wood dimensional stability, appealing aesthetics as well as resistance to biodegradation when subjected to outdoor use are major wood qualities when purchasing and using wooden materials. However, not all timber species have these desired properties and to maximize and improve these properties, effective treatments such as wood preservation should be implemented. When these treatments are improperly done or managed, they turn to pose a concerning circumstance that will require immediate attention in seeking to achieve Sustainable Development Goals (SDGs) 14 and 15, i.e. “life below water and life on land”, respectively.

The term wood modification refers to structural, mechanical, and chemical transformations occurring in the lignocellulosic material when gradually heated up to specific temperature ranges (Godinho *et al.*, 2021). It is still not quite apparent how the process will affect end-of-life circumstances, the environment, and product functionality in general despite the fact that many components of these treatments are well understood. The interactive evaluation of parameters used in the process, developed product attributes, and environmental implications must all be included. Much more data regarding all process-related environmental impacting aspects needs to be obtained to optimize modification processing with the aim of minimizing environmental impacts.

Heat treatment is a more environmentally friendly approach to changing wood properties than other methods such as chemical treatments (Elsheikh *et al.,* 2022; Garcia *et al.,* 2012; Kubovský *et al*., 2020; Lee *et al*., 2018; Teng *et al*., 2018). Although heat treatment generates major pleasant changes in the characteristics of wood, it also causes unwanted reductions in mechanical qualities such as the modulus of elasticity (*MOE*) and modulus of rupture (*MOR*) (Adebawo *et al.,* 2022; Kučerová *et al*., 2016; Rautkari *et al.,* 2014; Tang *et al.*, 2019). It is essential to identify the ideal heat treatment conditions (such as temperature levels, heating rate and time) In order to achieve that testing must be done to determine the value of the characteristics of heat-treated wood specimens at different temperatures.

By doing so, this research evaluated the anatomical changes and determined whether thermal modification can address the inherent limitations of *Daniellia oliveri* wood to enhance its performance, making it suitable for wider commercial and industrial applications.

According to Hutchison and Dalziel (1928), *Daniellia oliveri* is a member of the Fabaceae family and was named Paradaniellia oliveri Rolfe as the basionym. *Daniellia oliveri* (Rolfe) Hutch & Dalziel is a lesser-known timber species that, although not a significant species on the globally traded timber market, plays a crucial role in the lives of the individuals in its surrounding zones (Schmelzer & Louppe, 2012). *Daniellia oliveri* (Rolfe) Hutch & Dalziel is called "Kanchil" by the Sissala tribe of Ghana where samples were collected. The wood is not long-lasting, and it is vulnerable to lumber-degrading micro-organisms such as fungi, pinhole borers, sea borers, and termites (Schmelzer & Louppe, 2012). As a result, a certain degree of efficient wood treatment is required to extend its useful lifespan. *Daniellia oliveri* (Rolfe) Hutch & Dalziel is a dominating species in humid savannah and abundant in deciduous woodland.

Although *Daniellia oliveri* (Rolfe) Hutch & Dalziel tends to be less durable, according to Schmelzer and Louppe (2012) its heartwood is commonly used for construction purposes such as roofing rafters, home furnishings, manufacturing packages and mortar (Achigan-Dako *et al.,* 2010). Because of the availability of *Daniellia oliveri* (Rolfe) Hutch & Dalziel in various geographical zones in Ghana, the wood is also used for charcoal and as fuel wood. *D. oliveri*, if treated effectively with strong preserving agents, can last longer in service, helping to prevent deforestation and its harm to commercial timber species.

According to Haeuser *et al.* (1970), *Daniellia oliveri* (Rolfe) Hutch & Dalziel is a big tropical plant that produces immense quantities of copal when its stem is injured. Since copal differs from other Amherstiae and solidifies when exposed to the atmosphere, they are widely used as varnishes. *Daniellia oliveri* (Rolfe) Hutch & Dalziel is also renowned for making copal resin. Copal has been used for ages in African traditional medicine, art, and faith-related rites as incense. It is obtained by creating slices in the bark of the tree and enabling the resin to flow out and solidify (Haeuser *et al.,* 1970). Copal has been marketed all over the world and is employed in a variety of cultural and religious traditions because of the brimming African population's reliance on medicinal plants. Various tribes have delved deeper into the plant for the cure of multiple conditions such as seizures and spasm pain, sexual dysfunction and to avoid premature births in pregnant women (Balogun *et al.,* 2023).

The aim of the present study therefore is to investigate the impact of thermal modification on the anatomical properties of *Daniellia oliveri* (Rolfe) Hutch & Dalziel wood from Ghana, with a focus on understanding how thermal modification influences its structural characteristics and potential applications.

2 MATERIALS AND METHODS
2. MATERIJALI I METODE

2.1 Research site
2.1. Lokalitet istraživanja

The Sissala West District is one of Ghana's 275 Metropolitan, Municipal, and District Assemblies (MMDAs), and is part of the Upper West Region consisting of 11 Municipalities and Districts. The Sissala West District is in Ghana's northern sector (Savannah ecological zone). It is located approximately at longitude 213w and 2:36w and latitude 10:00N 11:00N, with Gwollu serving as the administrative capital. Sissala West has a total land area of about 4, 11289 km^2, accounting for approximately 25 % of the total landmass of the Upper West Region. On the northern side of the Region, the district shares a border with Burkina Faso, which facilitates cross-border socioeconomic operations. The district shares boundaries with Sissala East Municipal in the east, Wa East District in the south, Jirapa Municipal and Lambussie Karni District in the west, and Daffiama Bussie Issa District in the southwest (GSS, 2010).

According to Fagariba *et al*. (2018), the annual rainfall in the Sissala West district ranges from 800 mm to 1,000 mm, which is lower than in the transition zone. This is due to the proximity of Guinea Savannah to the coast. This region encompasses the majority of Ghana and accounts for 63 % of the overall area of Ghana's major climate zone. This environment provides for a 180-200-day growing season. With barely a few rains from August through October, April and July are the wettest months of the year. The five Northern Regions of Ghana typically follow this pattern. The long dry season known as harmattan, which lasts from early November to March, is characterized by chilly and foggy weather and coincides with the rainy season. Relative humidity (RH) can drop to 20 % during the dry season, but it can reach 70 – 90 % during the rainy season. The mean yearly temperature of the Region is between 28 °C and 37 °C, although seasonal variations are occasionally brought about by variations in the local climate. The vegetation is made of perennial grasses interspersed with fire-resistant trees, including baobab (*Adansonia digitata*), *Daniellia oliveri* (Rolfe) Hutch & Dalziel, kapok (*Ceiba pentandra*), Shea trees (*Vitellaria paradoxa*), and others.

2.2 Sample collection and preparations
2.2. Prikupljanje i priprema uzoraka

Owing to their prominence and abundance in the area, in March 2024, five mature *Daniellia oliveri* (Rolfe) Hutch & Dalziel trees, ranging in age from 25 to 48 years, and with diameters between 60 – 80 cm, were harvested from the community's natural woodland in Duwest. The diameters of the five trees were purposefully chosen, and their straight trunks and defect-free state were noted before they were cut down. Following the felling of the chosen trees, a one-meter sectional length was removed from the base of each tree. Each tree was cut to the desired length, the trees had about 60 – 80 cm diameter clear boles that measured roughly 15 meters in length. The billets were turned into boards using the quarter sawing technique, which minimizes warping boards and facilitates the easy separation of heartwood and sapwood for the determination of radial properties. At the wood workshop/lab of the AAMUSTED - Kumasi campus, the wood samples were produced to the required dimensions in conformity to IAWA committee recommendations. Defect-free specimens were carefully selected from the staked sawn wood together with the modified specimens and then conditioned for 6 days in a climate-controlled room with a temperature of (20 ± 2) °C and a relative humidity of (62 ± 2) % before being sawn into various sizes for further studies.

2.3 Thermal modification process
2.3. Proces toplinske modifikacije

Labline Technology Muffle furnace model MLF-1200/12 with a capacity of 12 liters and a maximum temperature of 1200 °C was used to modify 6 sets of heartwood and sapwood at 160 °C, 180 °C and 200 °C without oxygen, securely closed for 3 hours. Untreated set of 10 replicates of heartwood and sapwood served as the control. The oven was then adjusted to the temperatures at which the primary heat treatment was performed. The specimens were removed from Muffle furnace and allowed to cool in a desiccator filled with silica gel.

2.4 Determination of anatomical properties of control and modified specimens
2.4. Određivanje anatomskih svojstava kontrolnih i modificiranih uzoraka

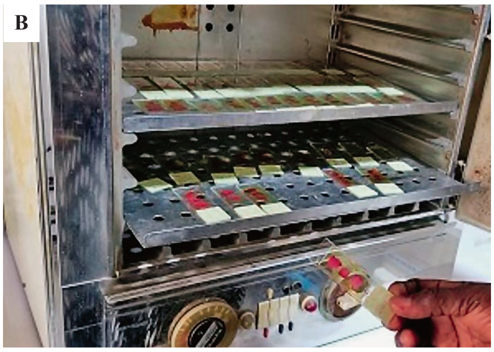
The durability, physical, mechanical and chemical properties of fibrous lignocellulosic materials have been noted to be influenced by its anatomical structure. Using an optical microscope attached to a desk top computer and its peripherals, three sectionals (transverse, tangential and radial) slides were prepared from the study materials, which were used for the identification of cells of the materials that may contribute to the properties under study. Eight 20mm squared cubes samples were prepared from the control and modified specimens and from each of the five selected trees of *Daniellia oliveri* (Rolfe) Hutch & Dalziel wood for the anatomical test. Specimens were placed in a well labelled plastic vial containing water for about 21 days to ensure fibers are completely softened to enhance easy slicing with a microtome.

Thin sections of 25 µm thickness were cut from transverse, tangential and radial surfaces of the specimen using a sliding microtome. The sections were first washed in distilled water (Figure 1A) and then stained in 1 % safranin and in 50 % ethanol solution for about 10 – 15 min. Afterwards, the sections were rewashed in distilled water and dehydrated in increasing concentration of ethanol from 30 %, 50 %, 70 %, 95 %, and 100 % after keeping specimens in each concentration for 15 minutes to gradually remove the moisture from the thin sections and also to minimize crumbing during the test process. Specimens were then immersed in xylene for another 15 minutes to remove little traces of water. The sections were placed in a container and Canadian balsam was added. Thereafter, the specimens were placed on a slide with a cover slip carefully placed making sure there was no air bubbles trapped in the histological slides. The prepared slides were then oven-dried at 60 °C overnight (Figure 1B) before mounting them on the microscope for determining the various sectional measurements.

2.5 Maceration of specimens for fiber measurements
2.5. Maceracija uzoraka za mjerenje vlakanaca

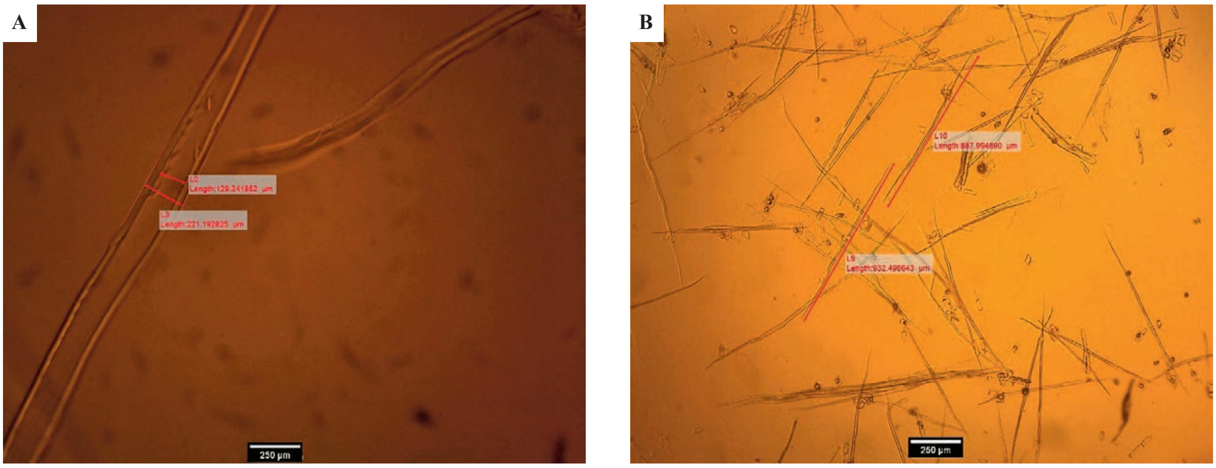
In order to separate wood elements, the Franklin (1927) methods for wood maceration were used. Two matchstick-sized specimens were taken from each softened wood cube and placed in a labelled test tubes using cotton wool as cork. A mixture of 50mL of acetic acid and 50ml of hydrogen peroxide at a ratio of (1:1) was poured into the test tubes containing the specimens and left to soak for at least 7 days (Schweingruber, 2007). The specimens were boiled to facilitate the chemical re-

A) Specimens soaked in distill water
A) Uzorci potopljeni u destiliranu vodu



B) Slides kept in an oven to dry
B) Sušenje predmetnih stakalaca u sušioniku

Figure 1 Examining anatomical sections of control and thermally modified specimens for the study
Slika 1. Ispitivanje anatomskih presjeka kontrolnih i toplinski modificiranih uzoraka



A) Measurement of fiber diameter and fiber lumen
A) Mjerenje promjena vlakana i lumena vlakana

B) Measurement of fiber length
B) Mjerenje duljine vlakana

Figure 2 Determination of fiber dimensions using an optical microscope attached to an HP desk top computer
Slika 2. Određivanje dimenzija vlakana uz pomoć optičkog mikroskopa spojenoga na HP stolno računalo

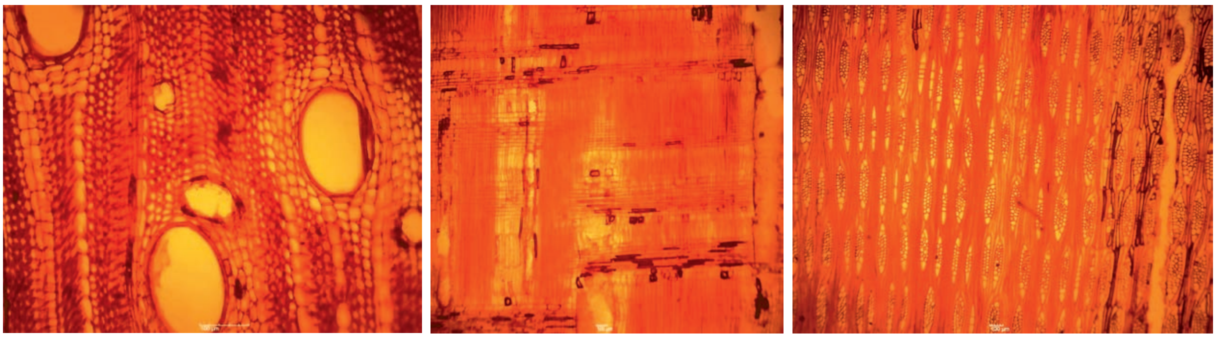
action on the wood; samples were checked every 24hr until wood was completely white (macerated); thereafter, specimens were washed to get rid of the chemicals. Distil water and alcohol were added to the macerate for preservation. A piece of the macerate was then taken into a petri dish and drops of glycerol were added. The specimen was then carefully teased out to separate individual wood components and poured into slides and properly covered with the slide cover. The slides were placed in an optical microscope where the fiber length, fiber diameter, vessel diameter, fiber lumen and cell wall thickness were measured (Figure 2A and 2B). Motic Image Plus (MIP) software and ImageJ software were used to do all anatomical measurements. Straight and unbroken pieces were measured for fiber length and vessel diameter.

2.6 Data analysis
2.6. Analiza podataka

All the trees in the study had their testing qualities determined. For every tree, experiments were carried out with different treatment temperatures and radial sections to examine variations in the quality of species tested. For the chosen parameters, the mean, standard deviation, and standard error of the mean were found. Two-way analysis of variance (ANOVA) was used to assess the significant difference between the two factors (temperature and wood section) and at an alpha value of $P<0.050$, differences were deemed significant.

3 RESULTS AND DISCUSSION
3. REZULTATI I RASPRAVA

The anatomical features of the modified and unmodified *Daniellia oliveri* (Rolfe) Hutch and Dalziel wood studied are presented in Figure 3 and 4, whereas Table 1 presents the results for the fiber morphology and vessel diameter. Generally, *Daniellia oliveri* (Rolfe) Hutch and Dalziel wood is a diffused-porous wood, as seen by the transverse section, and massive earlywood

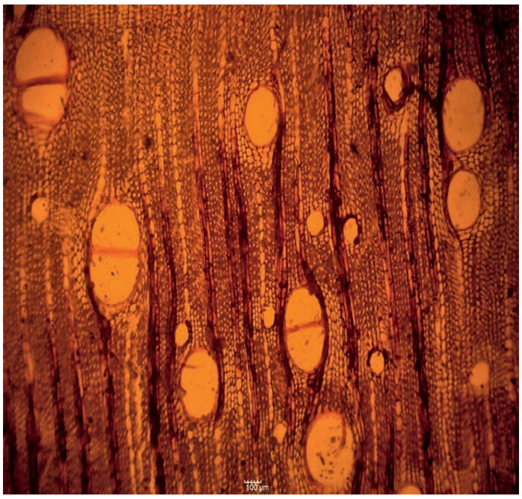


Transverse section of untreated *Daniellia oliveri* (Rolfe) Hutch and Dalziel specimen
Poprečni presjek nemodificiranog uzorka *Daniellia oliveri* (Rolfe) Hutch i Dalziel

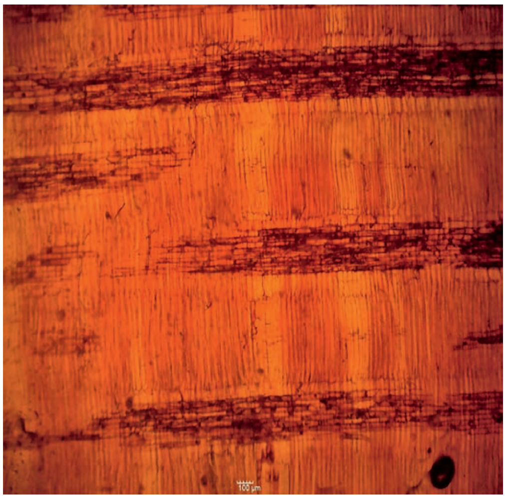
Radial section of untreated *Daniellia oliveri* (Rolfe) Hutch and Dalziel specimen
Radijalni presjek nemodificiranog uzorka *Daniellia oliveri* (Rolfe) Hutch i Dalziel

Tangential section of untreated *Daniellia oliveri* (Rolfe) Hutch and Dalziel specimen
Tangentni presjek nemodificiranog uzorka *Daniellia oliveri* (Rolfe) Hutch i Dalziel

Figure 3 Sectional images of untreated *D. oliveri* wood (magnification 100 µm)
Slika 3. Slike presjekâ nemodificiranog drva *D. oliveri* (povećanje 100 µm)



Transverse section of modified *Daniellia oliveri* (Rolfe) Hutch and Dalziel specimen
Poprečni presjek modificiranog uzorka *Daniellia oliveri* (Rolfe) Hutch i Dalziel



Radial section of modified *Daniellia oliveri* (Rolfe) Hutch and Dalziel specimen
Radijalni presjek modificiranog uzorka *Daniellia oliveri* (Rolfe) Hutch i Dalziel

Tangential section of modified *Daniellia oliveri* (Rolfe) Hutch and Dalziel specimen
Tangentni presjek modificiranog uzorka *Daniellia oliveri* (Rolfe) Hutch i Dalziel

Figure 4 Sectional images of modified *D. oliveri* wood (magnification 100 µm)
Slika 4. Slike presjekâ modificiranog drva *D. oliveri* (povećanje 100 µm)

vessels are lodged in parenchymatous tissues. Vessels are round to oval in shape, and primarily single with few multiples of two or three. Few vessels have been found to contain tyloses. The *Daniellia oliveri* (Rolfe) Hutch and Dalziel wood tangential section (Figure 3 and 4) reveals that the rays are primarily multi-seriate, with four to six cells per parenchyma strand.

Table 1 shows that there was a substantial variation in fiber morphology between the modification temperatures. The heat-treatment has brought about the formation of cross-fissures and crystallization of wax inside the pores as shown in Figure 4. The volatilization of extractives and rupture of polysaccharides also occurred to the heat-treated wood under study. Generally, it could be observed that there is great color change between the sections of the modified specimens and that of the unmodified specimens. The specimens became darker as the modification temperature rose to 200 °C, and it was also observed that the vessel diameter decreased as the modification temperature increased (Figure 5).

The result of the present study is in conformity with that of Johnson and Smith (2024), who demonstrated that heat treatment generally leads to a reduction in both vessel length and diameter. These changes in vessel dimensions were attributed to the thermal degradation of

Table 1 Measurement of selected anatomical properties of treated and untreated *Daniellia oliveri* (Rolfe) Hutch and Dalziel wood with standard deviation in parenthesis
Tablica 1. Rezultati mjerenja odabranih anatomskih svojstava modificiranoga i nemodificiranog drva *Daniellia oliveri* (Rolfe) Hutch i Dalziel sa standardnom devijacijom u zagradi

Properties, µm *Svojstva*, µm	**Tree section** *Dio stabla*	**Untreated (Control)** *Nemodificirani (kontrolni)*	**Modification at 160 °C** *Modificiran na 160* °C	**Modification at 180 °C** *Modificiran na 180* °C	**Modification at 200 °C** *Modificiran na 200* °C
Fiber length *duljina vlakana*	Heart / *srž*	1648.43 (172.41)	1632.37 (168.84)	1602.15 (166.74)	1561.29 (174.37)
	Sap / *bjeljika*	1616.55 (57.47)	1564.15 (91.51)	1535.76 (91.82)	1503.89 (99.72)
Fiber diameter *promjer vlakana*	Heart / *srž*	24.80 (3.34)	25.24 (3.31)	25.65 (3.35)	25.92 (3.30)
	Sap / *bjeljika*	26.35 (2.06)	26.83 (2.38)	27.26 (2.33)	27.56 (2.49)
Fiber lumen diameter *promjer lumena vlakana*	Heart / *srž*	16.28 (3.31)	16.72 (3.32)	17.21 (3.34)	17.44 (3.31)
	Sap / *bjeljika*	18.09 (2.09)	18.68 (2.04)	19.13 (2.02)	19.40 (1.97)
Double cell – wall thickness *debljina dvostruke stanične stijenke*	Heart / *srž*	8.46 (0.73)	8.46 (0.74)	8.40 (0.75)	8.42 (0.65)
	Sap / *bjeljika*	8.15 (0.71)	8.07 (0.62)	8.03 (0.58)	8.02 (0.64)

cell wall components, such as lignin and hemicellulose, which occur during the heat treatment process. The degradation of these components results in structural modifications within the vessels, leading to reductions in vessel size. Their study further noted that the magnitude of changes in vessel morphology varied depending on the specific heat treatment parameters used. According to Gupta *et al*. (2023) higher temperatures and prolonged treatment durations were associated with more pronounced alterations in vessel length and diameter, indicating the importance of treatment intensity in influencing vessel characteristics.

Moreover, Chen and Wang (2021) investigated the effects of different heat treatment conditions on vessel morphology and observed similar trends. They found that higher temperatures and longer treatment durations resulted in more pronounced reductions in vessel length and diameter. These changes are attributed to the increased degradation of cell wall components at higher temperatures and longer durations, leading to alterations in vessel structure and dimensions. Finally, in contrast to the result of the present study, Suri *et al*. (2021) observed in his study a similar trend, vessel lumen area and diameter of *Gmelina arborea* and *Melia azedarach* wood increased as temperature rose in both radial and tangential directions.

In terms of fiber morphology, this study shows that as the temperature increased, the fiber width and lumen diameter increased. However, the fiber wall thickness and fiber length decreased as the temperature

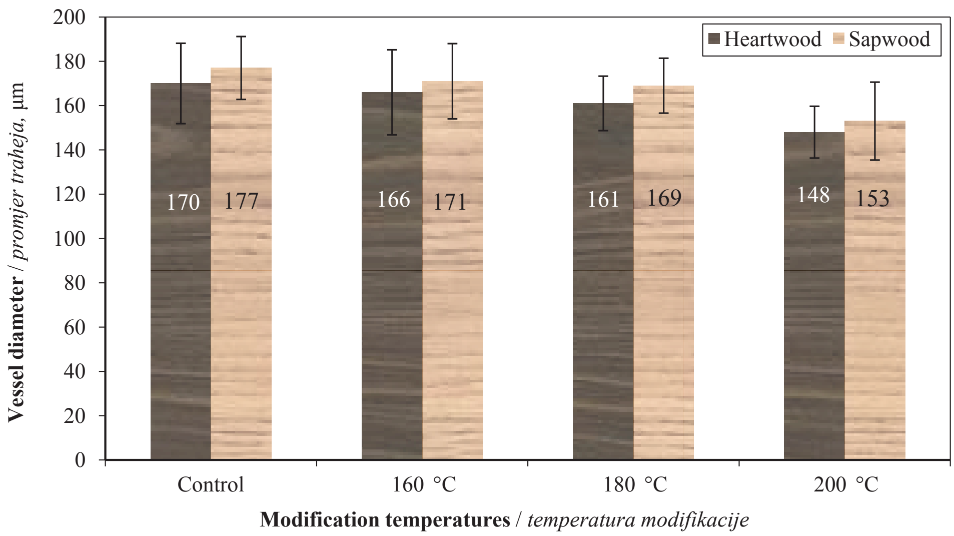


Figure 5 Measurement of Vessel diameter of thermally modified *Daniellia oliveri* (Rolfe) Hutch and Dalziel
Slika 5. Rezultati mjerenja promjera traheja toplinski modificiranog drva *Daniellia oliveri* (Rolfe) Hutch i Dalziel

increased as shown in Table 1. Similar results were obtained for vessel diameter, as temperature increased vessel diameter decreased (Figure 5). This result is in agreement with several other studies by scholars. Garcia and Lopez (2022) found that changes in fiber morphology induced by heat treatment can affect the mechanical performance of wood, including its tensile strength and modulus of elasticity. They observed that while heat treatment may lead to a decrease in fiber length and diameter, it can enhance the mechanical stability of wood fibers, thereby contributing to improved overall mechanical properties.

Furthermore, Chen and Wang (2021) explored the effects of heat treatment parameters on the fiber morphology of wood. They observed that higher temperatures and longer treatment durations resulted in more pronounced changes in fiber morphology, including greater reductions in fiber diameter. This observation suggests that the intensity and duration of heat treatment play crucial roles in influencing the extent of alterations in fiber morphology.

Moreover, Garcia and Lopez (2022) investigated the impact of heat treatment on fiber morphology across different wood species. Their research revealed that the response of fiber morphology to heat treatment varies among different species, with some species exhibiting more significant changes in fiber dimensions compared to others. This variation is attributed to differences in the composition and structure of wood fibers across species, which influence their susceptibility to heat-induced alterations.

Finally, Cabezas-Romero *et al*. (2021) conducted an investigation on the effects of the thermal modification process on the microstructure of *Pinus radiata* juvenile wood and revealed that the cell wall thickness decreased as treatment temperature increased, whereas the average lumen diameter increased slightly as temperature increased. This result is comparable to the present study.

4 CONCLUSIONS
4. ZAKLJUČAK

Wood preservation is a crucial component of effectively and efficiently prolonging the service life of wood when used in the furniture and construction industry. However, when preservatives are improperly handled, they turn out to be detrimental to both the users and the environment. In order to curb this menace associated with the use of these preservatives, alternatives and eco-friendly treatments are being sought. The present study therefore sets out to assess the anatomical properties of *Daniellia oliveri* (Rolfe) Hutch & Dalziel wood thermally modified at various temperatures for three hours. Thermal modification is a reliable and environmentally friendly method for improving the properties of wood. The reduction in vessel diameter, noticed in modified *Daniellia oliveri* (Rolfe) Hutch & Dalziel wood that has implications on its use, was found in modified specimens block lumens and prevents much intake of moisture when in service. Also, when thermally modified, reduction in vessel diameter could bring about reduction in moisture absorption improving dimensional stability of *Daniellia oliveri* (Rolfe) Hutch & Dalziel wood. Therefore, heat treatment may be recommended to improve the utilization of lesser-known timber species such as *Daniellia oliveri* (Rolfe) Hutch & Dalziel. In conclusion, the results of this study highlight the need for a deeper anatomical understanding of thermal modification processes, particularly for *Daniellia oliveri* wood as a lesser-known species, to optimize their utilization and maintain quality standards. The study further bridges a critical gap, contributing to the development of environmentally friendly and effective thermal modification methods for sustainable wood applications. Future research should prioritize exploring effective techniques for assessing crack development and investigating alternative methods for analyzing cellular structures, such as gray-scale image analysis or pixel-based measurements.

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