Perennial, 2026
Vol. 22 No. 2: 83-92
p-ISSN: 1412-7784

Available Online:
https://doi.org/10.24259/perennial.v22i2.49616
e-ISSN: 2685-6859

EVALUATION OF COMMERCIAL SUPERHYDROPHOBIC FINISHING MATERIALS ON TEAK (*Tectona grandis* Linn.F) AND MAHOGANY (*Swietenia mahagoni* Jacq) WOOD

Evaluasi Bahan Finishing Superhydrophobic Komersial pada kayu Jati (Tectona grandis Linn.F) dan Mahoni (Swietenia mahagoni Jacq)

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ABSTRACT

The use of wood outdoors as a construction and decorative material is increasing, requiring wood with high durability and more intensive treatment to extend its service life, one of which is the application of a finishing coat. This study aims to evaluate the quality of commercial superhydrophobic finishing materials, namely Woca Denmark's Exterior Wood Shield and Propan Ultran Lasur Laser EL-501, on teak (*Tectona grandis* Linn.F) and mahogany (*Swietenia mahagoni* Jacq) wood. The study was conducted using an experimental method with a completely randomized factorial design with two factors, namely wood type and finishing material type. The parameters tested included water absorption, wood dimensional stability (expansion and shrinkage), and wood surface wettability. Water absorption was tested based on the percentage of water uptake, dimensional stability was determined through the tangential/radial (T/R) expansion and shrinkage ratio, while surface wettability was tested using the sessile drop method through water contact angle measurement. The results of the study show that the application of finishing materials affects the improvement in the quality of teak and mahogany wood. The Propan Ultran Lasur Laser EL-501 finishing material produced the lowest water absorption value compared to Woca Denmark and the control. All treatments produced a T/R ratio value of less than 2.0, indicating that the stability of the wood dimensions was stable. In addition, wood that was finished showed lower moisture absorption properties compared to untreated wood.

Keywords: Finishing Materials; Superhydrophobicity; Water Absorption; Dimensional Stability; Wood Wettability

ABSTRAK

Penggunaan kayu di luar ruangan sebagai bahan konstruksi maupun dekorasi semakin meningkat, kondisi ini memerlukan kayu dengan ketahan tinggi sehingga dibutuhkan penanganan yang lebih untuk memperpanjang umur pakai kayu, salah satunya adalah dengan pengaplikasian lapisan bahan *finishing*. Penelitian ini bertujuan untuk mengevaluasi kualitas bahan *finishing superhydrophobic* komersial berupa *exterior wood shield* merk Woca Denmark dan Propan Ultran Lasur Laser EL-501 pada kayu jati (*Tectona grandis* Linn.F) dan mahoni (*Swietenia mahagoni* Jacq). Penelitian dilakukan dengan metode eksperimen menggunakan rancangan acak lengkap faktorial dengan dua faktor, yaitu jenis kayu dan jenis bahan *finishing*. Parameter yang diuji meliputi daya serap air, stabilitas dimensi kayu (pengembangan dan penyusutan), serta sifat keterbasahan permukaan kayu. Pengujian daya serap air diuji berdasarkan persentase *water uptake*, stabilitas dimensi ditentukan melalui nilai rasio pengembangan dan penyusutan tangensial/radial (T/R), sedangkan keterbasahan permukaan diuji dengan metode *sessile drop* melalui pengukuran sudut kontak air. Hasil penelitian menunjukkan bahwa aplikasi bahan *finishing* berpengaruh terhadap peningkatan kualitas kayu jati dan mahoni. Bahan *finishing* Propan Ultran Lasur Laser EL-501 menghasilkan nilai daya serap air paling rendah dibandingkan Woca Denmark dan kontrol. Seluruh perlakuan menghasilkan nilai rasio T/R kurang dari 2,0 yang menunjukkan stabilitas dimensi kayu tergolong stabil. Selain itu, kayu yang diberi bahan *finishing* menunjukkan sifat keterbasahan yang lebih rendah dibandingkan kayu tanpa perlakuan.

Kata kunci: Bahan Finishing; Superhidrofobik; Daya Serap Air; Stabilitas Dimensi; Wetabilitas Kayu

Submitted: 27 January 2026; Accepted: 29 October 2026

A. INTRODUCTION

Wood is a renewable material that is still widely used as a material for manufacturing various architectural design products (Fahrussiam *et al.* 2023). Wood has become one of the favorite interior materials for the public due to its environmentally friendly properties, ability to absorb heat well, ability to reduce noise, and unique aesthetic value (Dewi *et al.* 2020). The types of wood that are still widely used as raw materials for furniture are teak and mahogany. These two types of wood are in high demand because they have unique, elegant patterns, as well as attractive textures and colors (Putra *et al.* 2019, Listyanto *et al.* 2016).

However, as a biological product of trees, wood has several disadvantages, one of which is related to its hygroscopic properties. Therefore, efforts need to be made to improve the dimensional stability of wood, one of which is through a finishing process in the form of applying a coat of paint to the surface of the wood (Evans *et al.* 2015; Fahrussiam & Lestari 2023). There are several types of wood finishing materials available today, such as polish, polyurethane, nitrocellulose lacquer (NC), melamine, ultraviolet (UV) lacquer, oil-based, and water-based finishes. Each type of finishing material has different contents, levels of durability, and application methods (Seftianingsih 2018).

The type of finishing material that is still widely used in Indonesia is organic solvent-based finishing material, one of which is the well-known Propan brand. Propan paint has several advantages, such as UV resistance, mold and mildew resistance, excellent penetration into wood pores, easy to apply evenly, and no brush marks, with a VOC content of 600 g/l, which is still below the SNI standard. Referring to SNI 8406.6:2017 regarding transparent wood paint, the VOC value for transparent wood finish paint is a maximum of 750 g/l for organic solvent-based finish paint, while the VOC value for water-based finish paint is 130 g/l.

However, developments in the finishing materials industry in Europe have been able to reduce VOC content far below SNI standards, one example being the Danish brand Woca. One of the products released is an exterior wood shield, with very low VOC content of only 30 g/l. In addition to being low in VOC, this product is also branded as a superhydrophobic material that can prevent water from entering the wood. The advantages of Woca Denmark's exterior wood shield product have not been widely tested on commercial wood types such as mahogany and teak that grow in Indonesia. Therefore, this study aims to determine the water absorption, dimensional stability, and wettability of teak and mahogany wood after applying Woca Denmark's exterior wood shield and Propan Ultran Lasur Laser EL-501 paint.

B. METHODS

Preparation of Materials

Wood samples were made from tangential teak and mahogany boards measuring 100 cm x 20 cm x 2 cm (length x width x thickness). The moisture content of the boards was measured using a moisture meter. Boards with a moisture content of 12-15% were then sanded with 180-grit sandpaper in the direction of the wood grain (longitudinal). The finishing materials for testing were Propan ultran laser varnish EL-501 and Woca Denmark exterior wood shield. Propan ultran laser varnish EL-501 was diluted with Yori B thinner at a ratio of 90% paint to 10% thinner per 1L. Samples measuring 100 × 20 × 2 cm were prepared, with three replicates for each treatment. From each board, measurements were taken at three different positions—top, middle, and bottom—resulting in a total of nine observations per test for each treatment.

Application of Paint

The sanded board is then coated with two finishing materials using a brush on the front and back surfaces of the board. Use 16 ml of Woca Denmark paint and 35 ml of Propan paint per side of the board surface and apply 3 coats, ensuring that the paint is completely dry with an application interval of 8 hours. After the first coat is complete, the board surface is sanded again using 400-grit sandpaper.

Test Sample Cutting

The boards that have been coated with finishing materials are then cut with a circular saw into 20 cm x 12 cm x 2 cm pieces for testing the moisture content of the wood, while 3 cm x 3 cm x 2 cm pieces are used for testing the water absorption and dimensional stability of the wood.

Water Absorption Test of Wood

The water absorption capacity of wood is measured based on the percentage of water absorbed into the wood (water uptake). Test samples are weighed to determine their mass before immersion (B1), then immersed in water for 2, 6, 12, and 24 hours. After immersion, the immersed samples are weighed again (B2). Water absorption values can be calculated using the following equation

$$Water\ absorption\ = \frac{(B2-B1)}{B1}\ x\ 100$$

Dimensional Stability Test of Wood

The sample was soaked in water for 24 hours. After soaking, the surface of the sample was lifted and dried using tissue paper without pressing. Next, the dimensions of the sample were measured again in the longitudinal, tangential, and radial directions. These values were used to calculate the percentage of dimensional expansion. After the expansion test, the sample was air-dried to a moisture content of 12%. The dimensions of the air-dried sample were then measured in the longitudinal, tangential, and radial directions. These values were used to calculate the dimensional shrinkage. The expansion and shrinkage of dimensions are calculated using the following formula:

$$Swelling\ (\%) = \frac{Wet\ dimension - Initial\ dimension}{Initial\ dimensionl}\ x\ 100$$

$$Shrinkage\ (\%) = \frac{Initial\ dimension - Air - dried\ dimension}{Initial\ dimension}\ x\ 100$$

The anisotropy ratio is calculated from the ratio between tangential and radial shrinkage using the formula:

$$T/R\ = \frac{Tangential\ swelling}{Radial\ swelling}$$

Wettability Test of Wood

The sessile drop method is used in testing the wettability of wood. The sessile drop method is carried out by measuring the contact angle between water and the surface of wood that has been finished. Wood samples are placed on a flat table and 0.2 ml of water is dripped onto each test sample five times using a micropipette. A digital camera is placed parallel to the wood surface and the water dropping is recorded for 180 seconds. The video recording is cut every 10 seconds and the contact angle formed in each image is measured using the ImageG software.

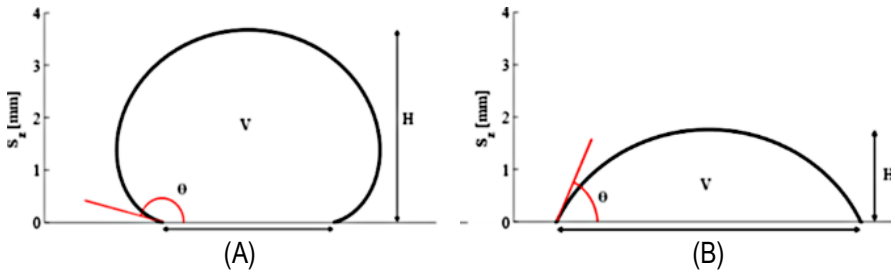


Figure 1. Hydrophobic (A) and hydrophilic (B) droplet schemes (Gibbons *et al.* 2020)

C. RESULTS AND DISCUSSION

Water Absorption of Wood

The water absorption value indicates the amount of water absorbed by the wood after undergoing the soaking process. The results of testing the water absorption of wood through the application of Woca Denmark and Propan Ultran Lasur Laser EL-501 finishing materials can be seen in Table 1.

Based on Table 1, it is known that all treatments showed an increase in water absorption value as the immersion time increased from 2 hours to 24 hours. In the control sample, the average water absorption of teak and mahogany wood had the highest values of 5.8% and 8.36% in the first 2 hours, respectively. The water absorption capacity of both species continued to increase to 19.84% and 22.16% after 24 hours of immersion, respectively.

In samples with Woca Denmark finishing, both species had average water absorption rates of 3.35% and 4.99% in the first 2 hours, increasing to 14.05% and 16.26% after 24 hours of immersion. Meanwhile, samples with Propan finishing material consistently had the lowest average water absorption values of 0.32% and 0.36% at 2 hours of immersion, increasing to 2.68% and 3.38% after 24 hours of immersion, respectively. The pattern of increase in wood water absorption for each treatment can be seen in Figure 2.

Table 1. Average water absorption rate (%)

Treatment	Observation Time (Hours)			
	2	6	12	24
JW	3.35	5.85	8.98	14.05
JP	0.32	0.77	1.39	2.68
JK	5.80	9.57	13.62	19.84
MW	4.99	7.83	10.87	16.26
MP	0.36	0.92	1.76	3.38
MK	8.36	11.96	16.07	22.16

Notes:
JW : Teak wood treated with Woca brand *finishing*
JP : Teak wood treated with Propan brand *finishing*
JK : Untreated teak wood (control)
MW : Mahogany wood treated with Woca brand *finishing*
MP : Mahogany wood with Propan brand *finishing* treatment
MK : Untreated mahogany wood (control)

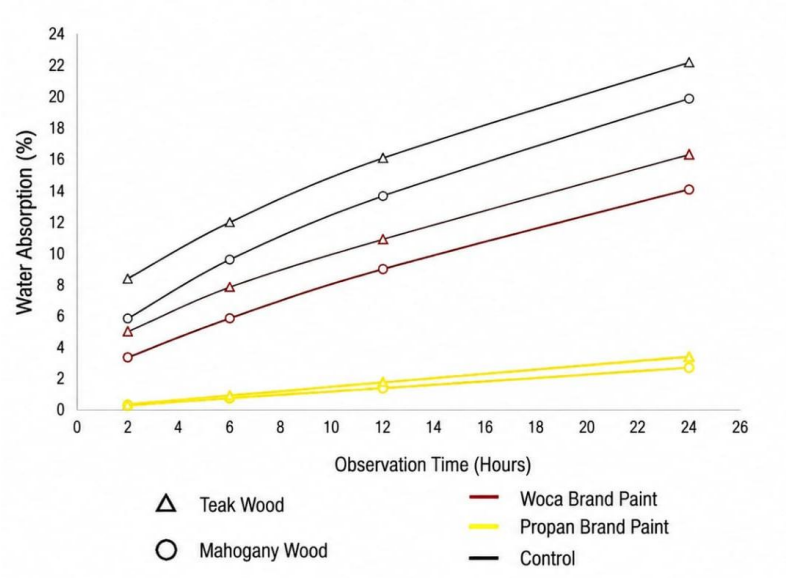


Figure 2. Water absorption test results chart

Based on Figure 2, it can be seen that water absorption increases as the immersion time increases from 2 to 24 hours. Overall, the control treatment for both teak and mahogany always showed the highest water absorption values. This shows that the application of coating materials can reduce water absorption in teak and mahogany. The Woca Denmark finishing treatment was in the middle category, and the Propan finishing treatment was consistently the lowest at every observation time. The results of the water absorption anova test can be seen in Table 2.

Table 2. Analysis of variance (ANOVA) test of water absorption capacity

Sources of Diversity	Degrees of Freedom	Sum of Squares	Mean Square	F	Sig.
Types of Wood	1	22.8	22.8	3.685	0.067
Types of Paint	2	1680.3	840.2	136.052	< 0.01
Wood Type x Paint Type	2	4.1	2.1	0.332	0.72
Error	24	148.2	6.2		

Note: A Sig. < 0.05 indicates a statistically significant difference at the 95% confidence level.

Based on Table 2, it is known that the type of wood does not have a significant effect on water absorption, as indicated by a p-value of 0.067 (α 0.05). Conversely, the paint type factor has a very significant effect on water absorption, with a p-value of 0.01. The interaction between wood type and paint type also has no significant effect on water absorption, as indicated by a p-value of 0.720. Thus, differences in water absorption are determined by the type of paint used.

Based on Table 3, the results of Duncan's multiple range test at a 95% confidence level show that each treatment has a different water absorption rate. These differences indicate that each treatment has a significant effect on the water absorption rate of wood. The control treatment, with an average water absorption rate of 21.00%, had the highest water absorption rate. This treatment was significantly different from the Woca Denmark and Propan finishing treatments. The Woca Denmark finishing material treatment had an average water absorption value of 15.15%, which was lower than the control treatment. Meanwhile, the Propan finishing material treatment had an average water absorption value of 3.03%, which was the lowest water absorption value and significantly different from the other two treatments.

Table 3. Duncan's test of water absorption capacity in wood

Types of Paint	Average Water Absorption (%)
Control	21.00^{c}
Woca	15.15^{b}
Propan	3.03^{a}

Note: Letters a, b, c indicate different results at a 95% confidence level.

The difference in water absorption values is influenced by the type of paint used. Both types of paint, Woca Denmark and Propan, applied to teak and mahogany samples have lower water absorption values than the control samples (without treatment). Iejavs (2021) states that the application of finishing materials in the form of paint coatings can significantly reduce water absorption on wood surfaces. Coating the surface with waterproof paint is effective in closing the pores of the wood, thereby reducing water penetration into the wood (Woesono *et al.* 2025).

Solvent-based coatings have much lower water absorption than water-based coatings (Gibbons *et al.* 2020). Organic solvent-based coatings generally produce a denser and more continuous film after evaporation and hardening. This dense structure is more effective at blocking water entry than water-based coatings, which tend to be more porous, especially in certain resin formulations (Iejavs *et al.* 2025). In addition, compared to water-based coatings, solvent-based coatings can spread more evenly in the pores of the wood surface before the film dries. This allows the coating to adhere better and fill the pore gaps. This makes the protective layer more solid, making it difficult for water to penetrate beneath the layer (De Meijer, 2009).

Wood Dimension Stability

Dimensional stability of wood indicates the ability of wood to maintain its size and shape when undergoing changes in moisture content. The parameters used to assess dimensional stability include wood swelling and shrinkage. Swelling and shrinkage indicate changes in wood volume due to water absorption and release. The results of dimensional stability testing through the application of Woca Denmark and Propan Ultran Lasur Laser EL-501 finishing materials are as follows:

1. Wood Swelling

The average swelling of teak and mahogany after 24 hours of soaking is presented in Table 4.

Table 4. Average wood development values

Treatment	Swelling (%)			Rasio T/R
	L	T	R	
JW	0.77	1.65	1.18	1.40
JP	0.52	0.96	0.73	1.31
JK	1.00	2.14	1.47	1.45
MW	0.84	1.33	0.92	1.45
MP	0.62	1.08	0.82	1.32
MK	1.05	2.03	1.37	1.48

Based on Table 4, it is known that the T/R ratio value in all treatments ranges from 1.31 to 1.46, indicating that wood swelling in the tangential direction (T) is greater than in the radial direction (R). This pattern is consistent with the general characteristics of wood, where the tangential direction tends to experience greater dimensional changes than the radial direction due to the orientation of the fibers and the anatomical pattern of the wood. Basri *et al.* (2009) stated that tangential shrinkage is greater than radial shrinkage due to the presence of radial rays in the radial walls, as well as differences in the amount of cell wall substances in the radial and tangential directions.

The MK treatment had the highest T/R ratio of 1.46, followed by JK with a ratio of 1.45. A higher T/R ratio indicates that the wood in that treatment experienced greater dimensional instability. Conversely, the JP treatment shows the lowest T/R ratio of 1.31, followed by MP with a ratio of 1.32. A lower T/R ratio indicates that wood swelling in both directions is more balanced, so that wood in this treatment has better dimensional stability than other treatments.

All treatments produced a T/R ratio value of 1.5, indicating that each treatment produced stable wood dimensions. This is in accordance with Bowyer *et al.* (2007), who stated that if the T/R ratio of a wood species is less than 2 or close to 1 (T/R ≤ 2), then the wood has stable dimensions. To determine whether each treatment produced a significant difference in the T/R ratio of wood swelling, an ANOVA test was conducted at a 95% confidence level.

Table 5. Analysis of variance (ANOVA) test of T/R ratio in wood development

Source of Variations	Degrees of Freedom	Sum of Squares	Median Square	F	Sig.
Types of Wood	1	0.112	0.112	0.845	0.367
Types of Paint	2	1.076	0.538	4.044	0.031
Wood Type x Paint Type	2	0.785	0.392	2.950	0.072
Error	24	3.192	0.113		

Based on Table 5, it is known that the type of paint has a significant effect on wood expansion after 24 hours of immersion with a Sig. of 0.05, so that each type of paint gives a different expansion response. The type of wood does not provide a significant difference with a p-value of 0.367 (> 0.05). The interaction between wood type and paint type also did not have a significant effect, as indicated by a p-value of 0.072 (> 0.05). The variation in expansion was caused by differences in the types of paint used, so a Duncan test was conducted at a 95% confidence level.

Table 6. Results of Duncan's T/R ratio test in wood swelling

Types of Paint	Average Wood Swelling (%)
Control	1.47[b]
Woca	1.42[b]
Propan	1.32[a]

Based on Table 6, the results of Duncan's multiple range test at a 95% confidence level show that the types of paint are grouped differently from one another. The table shows that wood with control treatment has an average T/R swelling ratio of 1.47, while wood with Woca finishing treatment has an average T/R swelling ratio of 1.42 with the same letter (b). This indicates that the two types of paint do not significantly differ in their effect on wood swelling. Meanwhile, wood treated with Propan finishing material has an average T/R swelling ratio of 1.32 with a different letter (a), which indicates a significant difference compared to untreated wood (control) and wood treated with Woca finishing material. Thus, Propan produces a significantly lower wood swelling value than the other two types of paint.

2. Wood Shrinkage

The average shrinkage of teak and mahogany after air drying is presented in Table 7.

Table 7. Average wood shrinkage values

Treatment	Shrinkage (%)			Rasio T/R
	L	T	R	
JW	0.55	1.31	0.92	1.42
JP	0.51	0.95	0.68	1.39
JK	0.95	1.80	1.19	1.51
MW	0.50	1.09	0.71	1.53
MP	0.73	1.27	0.84	1.51
MK	0.93	2.01	1.21	1.66

Based on Table 7, it is known that the T/R ratio value in all treatments ranges from 1.39 to 1.66, indicating that wood shrinkage in the tangential (T) direction is greater than in the radial (R) direction. The MK treatment had the highest T/R value of 1.66, followed by JK with a T/R shrinkage ratio of 1.51. A higher T/R value indicates that the wood in that treatment experienced greater dimensional instability. Conversely, the JP treatment showed the lowest T/R shrinkage ratio of 1.39,

followed by MP with a T/R shrinkage ratio of 1.51. A lower T/R ratio indicates that the shrinkage of wood in both directions is more balanced, so that the wood in this treatment has better dimensional stability than the other treatments. All treatments produced a T/R shrinkage ratio value of 2.0, indicating that each treatment produced stable wood dimensions. If the shrinkage value obtained ranges from 1.0 to 2.0, then the value is classified as good (Basri, *et al.* 2000). To determine whether each treatment made a significant difference to the T/R shrinkage ratio of the wood, an ANOVA test was conducted at a 95% confidence level.

Table 8. Analysis of variance (ANOVA) test of T/R ratio in wood shrinkage

Source of Variations	Degrees of Freedom	Sum of Squares	Median Square	F	Sig.
Types of Wood	1	0.191	0.191	2.440	0.131
Types of Paint	2	0.119	0.059	0.756	0.840
Wood Type x Paint Type	2	0.193	0.097	1.232	0.310
Error	24	1.882	0.078		

Based on Table 8, it is known that each treatment did not have a significant effect on wood shrinkage after air drying with a Sig. > 0.05.

Wood Surface Wettability

The wettability of painted wood surfaces was analyzed by measuring the contact angle. The contact angle is used to indicate the surface's ability to repel or absorb water, which is generally related to the hydrophobicity of the surface. A high contact angle value indicates that the surface has hydrophobic tendencies, meaning that water does not spread easily, thus forming a larger angle. Conversely, a low contact angle value indicates that the surface has hydrophilic tendencies and is easily penetrated by water. A surface is categorized as hydrophobic if the contact angle is above 90°, while a value below this limit indicates hydrophilic characteristics (Gibbons *et al.* 2020). The results of contact angle testing using Woca Denmark and Propan Ultran Lasur Laser EL-501 finishing materials are as follows:

Table 9. Average wood contact angle per 10 seconds (°)

No	Observation Time (s)	JW	JP	JK	MW	MP	MK
1	0	111.0	72.3	79.8	106.5	64.1	75.9
2	10	110.3	70.0	46.7	104.7	63.2	58.8
3	20	109.2	67.7	40.9	103.4	62.5	50.6
4	30	108.1	66.5	37.8	102.1	62.1	45.8
5	40	106.7	64.9	36.7	101.5	61.7	42.1
6	50	106.3	64.2	35.2	100.7	61.2	38.5
7	60	105.3	63.4	33.4	100.2	60.8	36.3
8	70	104.4	63.0	32.7	99.0	60.4	34.8
9	80	103.2	62.7	31.9	98.4	59.9	32.7
10	90	102.7	62.1	31.2	97.6	58.9	31.3
11	100	101.9	61.6	30.6	97.2	58.6	30.1
12	110	101.3	61.1	29.9	96.3	58.1	28.9
13	120	100.5	60.6	29.5	95.7	57.6	28.4
14	130	100.2	59.8	28.4	95.1	57.4	27.5
15	140	99.8	59.4	27.6	94.6	57.0	27.4
16	150	99.1	58.6	26.8	93.9	56.4	26.0
17	160	98.8	58.2	26.0	93.1	56.0	25.6
18	170	98.4	58.1	25.2	91.7	55.9	25.1
19	180	98.1	57.6	24.5	90.8	55.6	24.4

Based on Table 9. it is known that all treatments have different contact angles at each observation time. At 0 seconds, the highest contact angles for both species were found in samples with Woca Denmark finishing materials, with JW at 111.0° and MW at 106.5°. This was followed by the control samples with contact angles of JK 79.8° and MK 75.9°, while the lowest contact angles were found in samples treated with Propan finishing material, with JP 72.3° and MP = 64.1°. After 180 seconds, the contact angles of all treatments decreased, with the JW contact angle decreasing to 98.1°, the MW contact angle to 90.8°, the JK contact angle to 24.5°, the MK

contact angle to 24.4°, the JP contact angle to 57.6°, and the MP contact angle to 54.9°. This decrease indicates that all types of wood become easier to wet over time, with JK and MK experiencing the greatest decrease, while JW and MW continue to show relatively higher contact angles throughout the observation. According to Wardani *et al.* 2019, a layer is said to be hydrophobic if it has a contact angle formed between the surface layer and the liquid > 90^{o}. If the contact angle formed is 90^{o}, then the layer can be said to be hydrophilic.

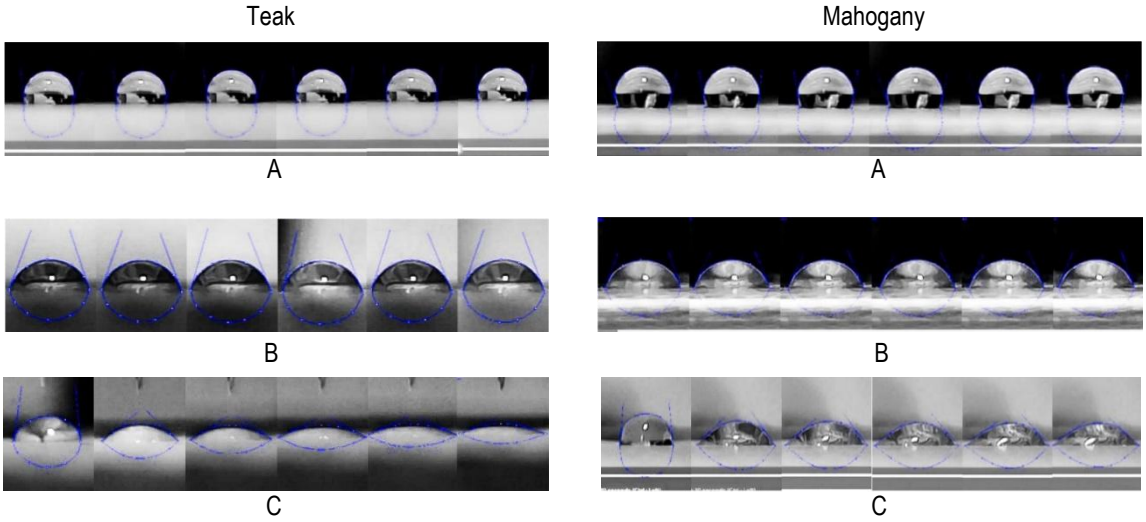


Figure 3. Contact angle at measurement times of 0 seconds to 50 seconds with Woca Denmark finishing material on teak (A) and mahogany (A), Propan finishing material on teak (B) and mahogany (B), and untreated teak (C) and mahogany (C).

Based on Figure 3, it can be seen that there are differences in the shape of water droplets on wood surfaces that have been treated with different finishing materials. The Woca Denmark finishing material applied to teak and mahogany wood boards produced water droplets in the shape of a 3/4 circle with an average contact angle of 100.7° within 180 seconds of observation. The Propan brand finishing material produced a smaller average contact angle of 61° with water droplets shaped like 1/3 of a circle. Meanwhile, on wood surfaces without finishing material treatment, there was a significant change in the shape of water droplets at each observation time with an average contact angle of 35.4°.

Referring to Yuan & Lee (2013), the treatment of Woca Denmark finishing materials showed low wettability values on both types of wood, as indicated by contact angle values > 90^{o} at each observation time. Meanwhile, the treatment with Propan finishing material and the control showed high wettability values on both types of wood, as indicated by contact angle values of 90^{o} at each observation time.

The pattern of contact angle decrease for each treatment can be seen in Figure 4.

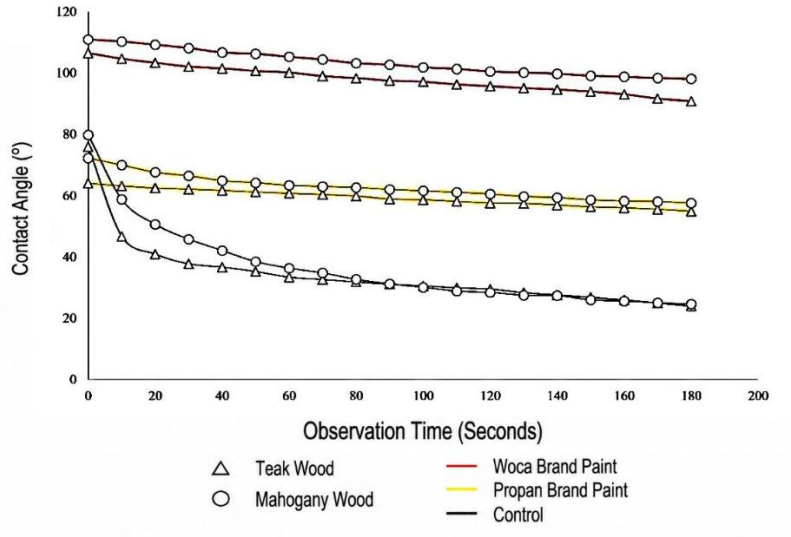


Figure 4. Graph of contact angle measurement results on wood

Based on Figure 4, it shows a pattern of decreasing contact angle as the observation time increases. This decrease in contact angle indicates an increase in the ability of water to wet the wood surface, with the wood surface becoming increasingly hydrophilic over time. The Propan brand finishing material produced the most stable contact angle, followed by the Woca Denmark brand finishing material, while the untreated sample showed a significant decrease in contact angle at observation times of 0 seconds to 180 seconds. The slope of the contact angle change curve based on the time function is related to the properties of the wood surface (Tang *et al.* 2012). Both Woca Denmark and Propan finishing materials can cover the pores of the wood so that water is not easily absorbed into the wood. Meanwhile, untreated samples have pores that are still open so that water can be easily absorbed into the wood (Cahyono *et al.* 2017).

D. CONLUSION

The conclusions drawn from this study are, Propan Ultran Lasur Laser EL-501 finishing material produces lower water absorption in both teak and mahogany (2.68% - 3.38%) compared to Woca Denmark (14.05% - 16.26%) after 24 hours of immersion, respectively.Teak and mahogany wood treated with Woca Denmark and Propan Ultran Lasur Laser EL-501 finishing materials have stable dimensional stability with a T/R ratio of 2.0 in each treatment. Although Woca Denmark exhibits higher initial hydrophobicity, its coating layer appears to degrade during the 24 h immersion, leading to a loss of barrier performance and facilitating water penetration. In contrast, the Propan Ultran Lasur Laser EL-501 demonstrates greater stability and maintains its integrity, thereby more effectively restricting liquid ingress despite its lower contact angle.

AUTHOR'S DECLARATION

- Conflicts of Interest: None.
- We here by confirm that all the Figures and Tables in the manuscript are ours. Furthermore, any Figures and images, that are not ours, have been included with the necessary permission for republication,which is attached to the manuscript.
- No animal studies are present in the manuscript.
- No human studies are present in the manuscript.
- No potentially identified images or data are present in the manuscript.

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