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EFFECTS OF APPLYING WAX ON THE COLOUR, GLOSSINESS, AND WHITENESS INDEX VALUES OF AMERICAN BLACK CHERRY *(Prunus serotina)* WOOD

VPLIV NANOSA VOSKA NA BARVO, SIJAJ IN INDEKS BELINE LESA AMERIŠKE ČREMSE *(Prunus serotina)*

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Abstract / Izvleček

Abstract: In this study, the effects of applying wax on the colour, glossiness, and whiteness index (*WI**) values of American black cherry (*Prunus serotina* Ehrh.) wood were investigated. Wax was applied to wooden material surfaces using a brush in one, two, and three layers. Tests were then conducted on surfaces with and without wax. The results were statistically significant according to the multivariate variance analysis. It was determined that the application of wax led to a decrease in *L**, *h*°, and *WI** values on the wooden material surfaces (parallel and perpendicular to the fibres), while the *a**, *b**, and *C** parameters increased. In measurements parallel and perpendicular to the fibres, increases were observed in gloss values for two- and three-layer wax applications at 60° and 85°. The Δ*L** values were negative when wax was applied in one, two, and three layers, whereas the Δ*a**, Δ*b**, and Δ*C** values were positive. The Δ*E** values were determined as 8.41 for one layer of wax, 11.29 for two layers, and 11.59 for three layers. Given the similarity between the Δ*E** values of two and three layers of wax, it can be inferred that a third layer may not be necessary.

Keywords: American black cherry = *Prunus serotina*, wood, surface treatment, wax, colour, Glossiness, whiteness index

Izvleček: Proučevali smo vpliv nanosa voska na barvo, sijaj in indeks beline (*WI**) lesa ameriške čremse (*Prunus serotina* Ehrh.). Vosek je bil nanesen na površine lesa s čopičem v enem, dveh in treh slojih. Teste smo opravili na premazanih in nepremazanih površinah. Analiza variance je pokazala statistično značilne razlike v rezultatih. Medtem ko smo po nanosu voska opazili zmanjšanje vrednosti *L**, *h*° in *WI** v smereh vzporedno in pravokotno na vlakna, smo ugotovili, da so parametri *a**, *b** in *C** po nanosu narasli. Pri merjenju sijaja pri 60 in 85 stopinjah smo pri vzorcih z dvema in tremi plastmi voska opazili povečanje vrednosti pri merjenju vzporedno in pravokotno glede na smer lesnih vlaken. Vrednosti *ΔL** so bile negativne za voskane sisteme, nanesene v 1, 2 in 3 slojih, medtem ko so bile vrednosti *Δa**, *Δb** in *ΔC** pozitivne. Vrednost *ΔE** je po 1-slojnem voskanju znašala 8,41, pri 2-slojnem 11,29 in pri 3-slojnem 11,59. Glede na to, da so bile vrednosti *ΔE** po 2 in 3 nanosih voska podobne, lahko sklepamo, da 3. nanos voska ni potreben.

Ključne besede: ameriška čremsa = *Prunus serotina*, les, površinska obdelava, vosek, barva, sijaj, indeks beline

1 INTRODUCTION
1 UVOD

Waxes are esters resulting from the combination of long-chain carboxylic acids and alcohols. Apart from organic waxes like beeswax or carnauba wax, there are also naturally occurring fossil waxes sourced from petroleum or lignite. Additionally, synthetic variations such as hydrocarbon or amide waxes are available. These can undergo modifications through oxidation or other chemical processes (Illmann et al., 1983; Scholz et al., 2010).

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Waxes are commonly utilized within hot melt formulations to diminish surface tension and decrease melt viscosity. Certain wax varieties, such as microcrystalline waxes, bolster the hot melt by forming crystallites that withstand deformation under load. These are incorporated into formulations requiring relatively high yield strength, acting as additives to enhance overall performance (Pizzi & Kumar, 2019).

In recent times, growing attention to environmental protection has driven advances in the wax formulations used for protecting wood. These waxes boast low pollutant content and are sourced from renewable materials. As a result, they have gained widespread use as additives in wood preservation and waterproofing (Evans et al., 2005; Schultz et al., 2007; Niu & Song, 2021).

The literature reports the application of wax-based chemicals on various wood species, along with tests conducted on factors such as colour and glossiness (Peker et al., 2024a; b; c; Kaplan et al., 2024; Liu et al., 2022; Akçay, 2020; Çamlıbel & Ayata, 2024a; b; c). However, it has been observed that to date the application of wax on American black cherry wood has not been reported in the literature.

American black cherry (*Prunus serotina* Ehrh.) is one of the most important timbers in the furniture and interior design sectors worldwide, thanks to its appealing reddish-brown heartwood hue and delicate texture (Schardt, 2004). Historical accounts suggest that black cherry was brought from North America, where it is native, to South America and Europe by colonists during the 17th century. It gained commercial significance in Ecuador and was noted as an invasive species in numerous European countries (Starfinger et al., 2003; Popenoe & Pachano, 1922). Since the late 19th century, it has served as an auxiliary tree in forestry, primarily in Germany but also in the Netherlands (Eijsackers & Oldenkamp, 1976), Belgium (Van den Meersschaut & Lust, 1997; Godefroid et al., 2005) and Slovenia (Pintar et al., 2020).

Black cherry thrives across Eastern North America, adapting well to a diverse range of soils, especially in regions with cool and humid summers. While it commonly grows near sea level in Canada, it also thrives at elevations of 1520 meters or higher in the Appalachian Mountains (Hough, 1965).

The fruit of black cherry is a vital food source for numerous non-migratory birds, squirrels, deer, turkeys, mice, moles, and various other wildlife species. However, the leaves, branches, and bark of cherry trees contain cyanogenic glycoside, primarily in the form of prunasin, which releases cyanide when damaged (Horsley, 1981). Pets or livestock consuming wilted leaves may thus suffer illness or death due to cyanide poisoning (Kingsbury, 1964).

Black cherry seeds need a ripening period to facilitate germination (Grisez, 1974). Typically, this ripening process occurs on the forest floor during the winter months in natural settings. The typical trend is for seeds from a one-year crop to germinate in the subsequent three or more years (Marquis, 1975; Wendel, 1972). Late spring frosts have the potential to harm blossoms before they fully open, and occasionally frosts can cause a significant number of newly emerged fruits to fall from the stems before ripening (Hough, 1965).

Black cherry tree flowers are white, solitary, and arranged in umbel-like clusters. They are perfect flowers, pollinated by insects (Grisez, 1974). Various bee species, including honeybees, as well as several species of flies and a flower beetle, are known to visit the flowers for pollen and nectar (Forbes, 1973). The wood from this tree species is prized for its durability and excellent workability, making it highly sought after for furniture and cabinet production (Kitzmiller, 1968).

In this particular cherry wood (*Prunus serotina* Ehrh.), the ethanol-toluene-water solubility is determined as 3.10%, ethanol-toluene solubility as 2.02%, and ethanol-water solubility as 4.79% (Nzokou & Kamdem, 2005).

This study investigates the effects of applying wax in different numbers of layers on the colour, gloss, and whiteness index (*WI**) values of American black cherry (*Prunus serotina* Ehrh.) wood.

2 MATERIALS AND METHODS
2 MATERIAL IN METODE
2.1 WOOD MATERIAL
2.1 LES

American black cherry (*Prunus serotina* Ehrh.) wood was cut into samples with the dimensions of 100 mm x 100 mm x 15 mm. The samples were prepared following the TS ISO 13061-1 (2021) standard. For each group, five samples were prepared. The samples were created from specimens that were knot-free, crack-free, and without fungal decay.

2.2 WAX
2.2 VOSEK

A mixture of natural and synthetic waxes was used in this study. The properties of this wax were as follows: appearance: paste; colour: neutral; odour: characteristic; solubility in water: dispersible but not soluble; dry residue: 30%; pH value: 7.6. However, the producer of the mixture did not reveal the exact chemical composition of the waxes as this is considered a commercial secret.

2.3 APPLICATION OF WAX TO WOOD MATERIAL SURFACES
2.3 NANOS VOSKA NA POVRŠINO LESA

Initially, all samples were sanded with 120, 150, and 180 grit sandpapers. Subsequently, the surfaces of the samples were cleaned of dust using a compressor. The wax mixture consisting of natural and synthetic waxes was applied to wooden material surfaces in one, two and three layers with the help of a brush.

2.4 DETERMINATION OF GLOSSINESS PROPERTIES
2.4 DOLOČITEV SIJAJA

Glossiness assessments were performed at 20°, 60°, and 85° angles, both perpendicular and parallel to the fibres, employing an ETB-0833 model gloss meter device in accordance with the ISO 2813 (1994) standard.

2.5 DETERMINATION OF COLOUR PROPERTIES
2.5 DOLOČITEV BARVE

The samples' colour alteration was assessed utilizing a CS-10 (CHN Spec, China) apparatus, adhering to the ASTM D 2244-3 (2007) standard and employing the CIELAB colour model. The evaluations were conducted utilizing a CIE 10° standard observer and CIE D65 light source within an 8/d illuminating environment (8°/diffused illumination). Δ*E** colour difference visual assessment comparison criteria (DIN 5033, 1979) are provided in Table 1.

Table 1. Comparison criteria for evaluating Δ*E** values (DIN 5033, 1979).
Preglednica 1. Primerjalna merila za ocenjevanje vrednosti Δ*E** (DIN 5033, 1979).

Δ*E** values	Visual colour score difference
<0.20	Imperceptible
0.20 - 0.50	Very weak
0.50 - 1.50	Weak
1.50 - 3.00	Noticeable
3.00 - 6.00	Very noticeable
6.00 - 12.00	Strong
> 12.00	Very strong

The following formulas were used to determine the results of total colour differences.

$$C^* = \left[(a^*)^2 + (b^*)^2\right]^{0.5} \quad (1)$$

$$h^o = arctan\ (b^*/a^*) \quad (2)$$

$$\Delta C^* = \left(C^*_{treated\ experimental\ sample} - C^*_{untreated\ experimental\ sample}\right) \quad (3)$$

$$\Delta a^* = \left(a^*_{treated\ experimental\ sample} - a^*_{untreated\ experimental\ sample}\right) \quad (4)$$

$$\Delta L^* = \left(L^*_{treated\ experimental\ sample} - L^*_{untreated\ experimental\ sample}\right) \quad (5)$$

$$\Delta b^* = \left(b^*_{treated\ experimental\ sample} - b^*_{untreated\ experimental\ sample}\right) \quad (6)$$

$$\Delta H^* = \left[(\Delta E^*)^2 - (\Delta L^*)^2 - (\Delta C^*)^2\right]^{0.5} \quad (7)$$

$$\Delta E^* = \left[(\Delta L^*)^2 + (\Delta a^*)^2 + (\Delta b^*)^2\right]^{0.5} \quad (8)$$

Table 2. Results of Analysis of Variance.
Preglednica 2. Rezultati analize variance.

Dependent Variable	Sum of Squares	df	Mean Square	F	Sig.
Lightness (L^*)	668.258	3	222.753	2041.807	0.000*
Red (a^*) colour tone	203.047	3	67.682	1086.805	0.000*
Yellow (b^*) colour tone	8.533	3	2.844	15.691	0.000*
Chroma (C^*) value	90.189	3	30.063	195.355	0.000*
Hue ($h°$) angle	618.653	3	206.218	502.806	0.000*
Glossiness at ⊥20°	1.157	3	0.386	187.622	0.000*
Glossiness at ⊥60°	110.339	3	36.780	356.699	0.000*
Glossiness at ⊥85°	562.116	3	187.372	3967.878	0.000*
Glossiness at ‖20°	1.713	3	0.571	63.240	0.000*
Glossiness at ‖60°	172.093	3	57.364	1013.801	0.000*
Glossiness at ‖85°	1320.987	3	440.329	6940.387	0.000*
WI^* perpendicular to fibres	401.211	3	133.737	3933.441	0.000*
WI^* parallel to fibres	143.779	3	47.926	3877.180	0.000*
*: Significant					

The definitions of ΔC^*, Δa^*, ΔH^*, Δb^*, and ΔL^* are provided below (Lange, 1999):

Δa^*: Positive indicates the sample is redder than the reference, and negative indicates the sample is greener than the reference.

ΔL^*: Positive indicates the sample is lighter than the reference, and negative indicates the sample is darker than the reference.

Δb^*: Positive indicates the sample is more yellow than the reference, and negative indicates the sample is bluer than the reference.

ΔH^*: Represents the hue or shade difference.

ΔC^*: Represents the chroma or saturation difference. Positive indicates the sample is clearer and brighter than the reference, while negative indicates the sample is duller and hazier than the reference.

2.6 DETERMINATION OF WHITENESS INDEX (*WI**) CHARACTERISTICS
2.6 DOLOČITEV BELINE

In this study, measurements of whiteness index (WI^*) values were determined using the Whiteness Meter BDY-1 device and ASTM E313-15e1 standard, conducted in both parallel and perpendicular directions to the fibres.

2.7 CALCULATION OF TEST DATA
2.7 OBDELAVA PODATKOV

Standard deviations, maximum and minimum mean values, measurement values corresponding to the mean, homogeneity groups, multivariate analysis of variance, and percentage (%) change rates were calculated using a statistical programme and measurement values from the study.

3 RESULTS AND DISCUSSION
3 REZULTATI IN DISKUSIJA

The results of the analysis of variance are provided in Table 2. It is observed that the wax layer application factor was significant for all tests (Table 2).

The measurement results for the colour parameters are presented in Table 3. Upon examination of these results, it is observed that the highest L^* value (54.62) is found in the samples of the control experimental group, while the lowest result (44.49) is obtained in the group treated with three layers of wax. The highest decrease rate for the L^* value, at 18.55%, is observed in the samples treated with three layers of wax, while the lowest decrease rate, at 13.38%, is found in the samples treated with one layer of wax (Table 3).

Table 3. Measurement results for colour parameters.
Preglednica 3. Rezultati meritev barvnih parametrov.

Test	Wax Application	Number of Measurements	Mean	Change (%)	Homogeneity Group	Standard Deviation	Minimum	Maximum	Coefficient of Variation
*L**	Control	10	54.62	-	A*	0.33	54.14	55.06	0.61
	1 layer	10	47.31	↓13.38	B	0.17	47.02	47.66	0.37
	2 layers	10	44.77	↓18.03	C	0.19	44.49	45.05	0.43
	3 layers	10	44.49	↓18.55	C**	0.51	43.78	45.09	1.14
*a**	Control	10	10.48	-	D**	0.18	10.23	10.72	1.72
	1 layer	10	14.55	↑38.84	C	0.14	14.34	14.77	0.95
	2 layers	10	15.86	↑51.34	B	0.17	15.57	16.07	1.08
	3 layers	10	16.10	↑53.63	A*	0.41	15.51	16.70	2.55
*b**	Control	10	21.20	-	C**	0.36	20.49	21.82	1.71
	1 layer	10	22.09	↑4.20	AB	0.30	21.65	22.58	1.34
	2 layers	10	22.46	↑5.94	A*	0.27	21.96	23.00	1.20
	3 layers	10	21.79	↑2.78	B	0.66	21.12	23.05	3.03
*C**	Control	10	23.65	-	D**	0.39	22.90	24.32	1.64
	1 layer	10	26.46	↑11.88	C	0.22	26.08	26.86	0.85
	2 layers	10	27.50	↑16.28	A*	0.26	27.01	27.93	0.93
	3 layers	10	27.09	↑14.55	B	0.59	26.55	28.35	2.18
h°	Control	10	63.70	-	A*	0.29	63.29	64.26	0.45
	1 layer	10	56.63	↓11.10	B	0.52	55.98	57.27	0.92
	2 layers	10	54.77	↓14.02	C	0.40	54.40	55.45	0.72
	3 layers	10	53.54	↓15.95	D**	1.06	51.66	54.78	1.99
*: Indicates the highest value and **: Indicates the lowest value									

In the control experimental group, the lowest *a** value recorded was 10.48, while the group treated with three layers of wax showed the highest value at 16.10. Among the different wax application groups, the samples treated with three layers exhibited the highest increase rate for the *a** value, reaching 53.63%. Conversely, the samples treated with only one layer of wax demonstrated the lowest increase rate, standing at 38.84% (refer to Table 3).

The *b** value was at its lowest in the samples from the control experimental group, measuring 21.20, while the group treated with two layers of wax showed the highest value at 22.46. Among the various wax application groups, those treated with two layers experienced the most significant increase in the *b** value, reaching 5.94%. Conversely, the samples treated with three layers of wax exhibited the smallest increase rate, standing at 2.78%. The samples from the control experimental group yielded the lowest *C** value at 23.65, while the group treated with two layers of wax showed the least value at 27.51. Among the varied wax application groups, those treated with two layers exhibited the most substantial increase rate for the *C** value, reaching 16.28%. In contrast, the samples treated with only one layer of wax had the lowest increase rate, standing at 11.88%. The *h*° value peaked in the samples from the control experimental group, reaching 63.70, while it hit its lowest point in the group treated with three layers of wax, measuring 53.54. Among the wax application groups, the samples treated with three layers experienced the most significant decrease in the *h*° value, with a decrease rate of 15.95%. Conversely, the samples

Table 4. Results for Total Colour Differences.
Preglednica 4. Rezultati za skupne barvne razlike.

Wax Application	Δ*L**	Δ*a**	Δ*b**	Δ*C**	Δ*H**	Δ*E**	Colour Criterion (DIN 5033, 1979)
1 layer	-7.30	4.07	0.89	2.80	3.08	8.41	Strong (6.00 to 12.00)
2 layers	-9.85	5.38	1.26	3.84	3.97	11.29	
3 layers	-10.12	5.62	0.59	3.43	4.48	11.59	

treated with one layer of wax showed the smallest decrease rate, at 11.10% (see Table 3 for details).

The findings in the literature suggest that the application of wax on various types of wood, including olive, ebony Macassar, plum, and balau red, led to alterations in colour parameters, glossiness values, and whiteness index values (Peker et al., 2024 a; b; c; Kaplan et al., 2024). Moreover, investigations into European walnut, European maple, as well as beech, lime, poplar, and pine woods, have documented a reduction in the *L** value alongside an increase in the *a** and *b** values post-wax application (Liu et al., 2022; Akçay, 2020).

The results for total colour differences are provided in Table 4. One, two and three layers of wax resulted in negative Δ*L** values (darker than the reference), while the Δ*a** (redder than the reference), Δ*b** (yellower than the reference), and Δ*C** (clearer, brighter than the reference) values were positive. The Δ*E** values were determined as 8.41 for one layer of wax, 11.29 for two layers, and 11.59 for three layers, with the Δ*E** values for two and three layers of wax being very close to each other. The Δ*H** values were obtained as 3.08, 3.97, and 4.48 as the number of wax layers increased from one to three, respectively. Comparing the Δ*E** values obtained using the colour change criteria (DIN 5033, 1979), all three wax treatments fell under the "strong (6.0 to 12.0)" category (Table 4).

The measurement results for the whiteness index (*WI**) values are presented in Table 5. As the number of layers increased, the *WI** values decreased in both parallel and perpendicular directions to the fibres. The highest results for *WI** values in both parallel and perpendicular directions to the fibres were observed in the samples from the control experimental group (13.52 and 7.58, respectively), while the lowest results were found in the group treated with 3 layers of wax (5.48 and 2.94, respectively). The highest decrease rates for *WI** values in both directions were 59.47% and 61.21%, respectively, observed in the samples treated with 3 layers of wax, while the lowest decrease rates were 37.72% and 54.22%, respectively,

Table 5. Measurement results for whiteness index (*WI**) values.
Preglednica 5. Rezultati meritev vrednosti indeksa beline (WI*).

Test	Wax Application	Number of Measurements	Mean	Change (%)	Homogeneity Group	Standard Deviation	Minimum	Maximum	Coefficient of Variation
*WI** ⊥	Control	10	13.52	-	A*	0.32	13.00	13.90	2.39
	1 layer	10	8.42	↓37.72	B	0.08	8.30	8.50	0.94
	2 layers	10	6.08	↓55.03	C	0.12	5.90	6.20	2.02
	3 layers	10	5.48	↓59.47	D**	0.10	5.40	5.60	1.88
*WI** ‖	Control	10	7.58	-	A*	0.12	7.40	7.70	1.62
	1 layer	10	3.47	↓54.22	B	0.05	3.40	3.50	1.39
	2 layers	10	3.26	↓56.99	C	0.17	3.10	3.50	5.25
	3 layers	10	2.94	↓61.21	D**	0.05	2.90	3.00	1.76
*: Indicates the highest value and **: Indicates the lowest value									

Table 6. Measurement results for glossiness values.
Preglednica 6. Rezultati meritev za vrednosti sijaja.

Test	Wax Application	Number of Measurements	Mean	Change (%)	Homogeneity Group	Standard Deviation	Mini-mum	Maxi-mum	Coefficient of Variation
⊥20°	Control	10	0.20	-	C	0.00	0.20	0.20	0.00
	1 layer	10	0.10	↓50.00	D**	0.00	0.10	0.10	0.00
	2 layers	10	0.45	↑125.00	B	0.05	0.40	0.50	11.71
	3 layers	10	0.51	↑155.00	A*	0.07	0.40	0.60	14.47
⊥60°	Control	10	1.51	-	C**	0.09	1.40	1.60	5.80
	1 layer	10	1.71	↑13.25	C	0.09	1.60	1.80	5.12
	2 layers	10	4.75	↑214.57	B	0.14	4.60	4.90	2.85
	3 layers	10	5.09	↑237.09	A*	0.62	4.30	5.90	12.09
⊥85°	Control	10	0.25	-	C**	0.14	0.10	0.40	54.16
	1 layer	10	0.95	↑280.00	B	0.14	0.80	1.10	14.25
	2 layers	10	8.17	↑3168.00	A*	0.20	7.90	8.40	2.45
	3 layers	10	7.99	↑3096.00	A	0.33	7.40	8.30	4.19
|| 20°	Control	10	0.30	-	B	0.00	0.30	0.30	0.00
	1 layer	10	0.14	↓53.33	C**	0.05	0.10	0.20	36.89
	2 layers	10	0.65	↑116.67	A*	0.14	0.50	0.80	20.83
	3 layers	10	0.58	↑93.33	A	0.12	0.40	0.70	21.19
|| 60°	Control	10	1.96	-	C	0.27	1.60	2.30	13.86
	1 layer	10	1.75	↓10.71	C**	0.14	1.60	1.90	7.74
	2 layers	10	5.44	↑177.55	B	0.25	5.00	5.60	4.52
	3 layers	10	6.44	↑228.57	A*	0.27	6.00	6.80	4.22
|| 85°	Control	10	2.20	-	C	0.23	1.90	2.50	10.50
	1 layer	10	1.50	↓31.82	D**	0.08	1.40	1.60	5.44
	2 layers	10	11.86	↑439.09	B	0.13	11.80	12.10	1.07
	3 layers	10	14.50	↑559.09	A*	0.42	13.80	15.00	2.91
*: Indicates the highest value and **: Indicates the lowest value									

found in the samples treated with 1 layer of wax (Table 5).

The measurement results for glossiness values are provided in Table 6, and it can be seen that decreases in these were observed for samples with one layer of wax at 20°, both parallel and perpendicular to the fibres (reductions of 53.33% and 50.00%, respectively). Additionally, increases in glossiness values were observed for samples with two and three layers of wax at 60° and 85°, both parallel and perpendicular to the fibres (Table 6).

It was determined that the glossiness values changed compared to the control samples with application of wax. While a decrease was observed in glossiness values for samples with a single layer of wax compared to control samples at 60° and 85° parallel to the fibres (10.71% and 31.82%, respectively), a contrasting situation was observed for the same angular directions in samples with one layer of wax perpendicular to the fibres (13.25% and 280.00%, respectively). Additionally, glossiness values for all degrees parallel to the fibres were higher than those perpendicular to the fibres (Table 6).

4 CONCLUSION
4 ZAKLJUČKI

This study is important because it shows whether there is any negative interaction between the wood of a particular tree species and the wax coating used.

Furthermore, the following conclusions were derived from the results:

- Δ*L** values were negative for the samples with wax applied in one, two and three layers, while Δ*a**, Δ*b**, and Δ*C** values were positive. Δ*E** values were determined as 8.41 for one layer of wax, 11.29 for two layers, and 11.59 for three.
- It was found that the application of wax on wooden surfaces led to a decrease in *L**, *h*°, and WI* values (for both parallel and perpendicular directions), while the *a**, *b**, and *C** parameters increased.
- Multivariate analysis of variance results were significant for all tests.
- Increases in glossiness values were observed for both parallel and perpendicular directions to the fibres at 60° and 85° angles for surfaces treated with two and three layers of wax.
- The Δ*E** values for two and three layers of wax were very close to each other, suggesting that the application of a third layer may not be necessary.

5 SUMMARY
5 POVZETEK

Preučili smo učinke različnih nanosov voska na barvo, sijaj in vrednost indeksa beline (WI*) lesa ameriške vrste *Prunus serotina* Ehrh., s slovenskimi imeni ameriška čremsa (Pintar et al., 2020) in tudi pozna čremsa ali ameriška črna češnja (Brus, osebna komunikacija). Zaradi privlačnega rdečkasto-rjavega odtenka jedrovine in nežne teksture je ta vrsta lesa trenutno ena pomembnih uvoženih lesnih vrst za proizvodnjo pohištva in notranje opreme (Schardt, 2004).

Vzorce lesa ameriške čremse smo pripravili v dimenzijah 100 mm x 100 mm x 15 mm. Mešanica naravnih in sintetičnih voskov je bila s čopičem nanesena na površino lesa v 1, 2 in 3 slojih, kontrolni vzorci pa so bili brez površinske obdelave.

Na voskanih in nevoskanih površinah so bili opravljeni preskusi sijaja (ISO 2813, 1994), spremembe barve (ASTM D 2244-3, 2007) in indeksa beline (*WI**) v vzporedni in pravokotni smeri na vlakna (ASTM E313-15e1, 2015). Rezultate smo medsebojno primerjali.

Glede na rezultate analize variance je bilo ugotovljeno, da je bilo število nanesenih plasti voska pomembno za vse preskuse.

Pri pregledu rezultatov je bilo ugotovljeno, da je bila najvišja vrednost svetlosti barve (*L**) ugotovljena pri vzorcih kontrolne skupine, najnižja pa pri skupini, obdelani s tremi plastmi voska.

Največje zmanjšanje vrednosti *L**, 18,55 %, je bilo ugotovljeno pri vzorcih s tremi plastmi voska, najmanjše zmanjšanje, 13,38 %, pa pri vzorcih z eno plastjo voska.

V kontrolni skupini je bila najnižja zabeležena barvna vrednost, ki predstavlja rdeče-zeleno os v sistemu *a** 10,48, medtem ko je bila v skupini, obdelani s tremi plastmi voska, najvišja vrednost 16,10. Med skupinami z nanosom voska se je vrednost *a** najbolj povečala pri vzorcih s tremi plastmi, in sicer za 53,63 %, medtem ko se je pri vzorcih z eno plastjo povečala najmanj, in sicer za 38,84 %.

Barvna vrednost *b**, ki predstavlja rumeno-modro os v sistemu, je bila najnižja pri vzorcih kontrolne skupine in je znašala 21,20, najvišja pa pri skupini, obdelani z dvema plastema voska, in sicer 22,46. Vrednost *b** se je najbolj povečala pri vzorcih z dvema plastema voska, in sicer za 5,94 %, najmanj, za 2,78 %, pa pri vzorcih s tremi plastmi.

Kontrolna skupina je imela najnižjo vrednost kromatičnosti *C**, 23,65, skupina z dvema plastema voska pa najvišjo, 27,51. Med skupinami z nanosom voska se je vrednost *C** najbolj povečala pri vzorcih z dvema plastema, in sicer za 16,28 %, pri vzorcih z eno plastjo pa je bilo povečanje najmanjše, in sicer za 11,88 %.

Vrednost *h*° je bila najvišja pri 63,70 v kontrolni skupini, najnižja pa pri 53,54 v skupini, obdelani s tremi plastmi voska. Pri vzorcih s tremi plastmi se je vrednost *h*° najbolj zmanjšala, in sicer za 15,95 %, medtem ko se je pri vzorcih z eno plastjo zmanjšala najmanj, in sicer za 11,10 %.

Kar zadeva sijaj, je bilo pri vzorcih z enim slojem voska opaženo zmanjšanje pri 20 stopinjah, tako vzporedno kot pravokotno na vlakna. Naspro-

tno se je sijaj povečal pri vzorcih z dvema in tremi plastmi voska pri 60 in 85 stopinjah v obe smeri.

Uporaba voska je spremenila vrednosti sijaja v primerjavi s kontrolnimi vzorci. Pri vzorcih z enim slojem voska pri 60 in 85 stopinjah vzporedno z vlakni se je sijaj zmanjšal, pri istih vzorcih pravokotno na vlakna pa se je povečal. Vrednosti sijaja vzporedno z vlakni so bile višje kot pravokotno na vlakna.

Z večanjem števila plasti voska so se vrednosti beline WI^* v obeh smereh glede na vlakna zmanjševale. Vzorci kontrolne skupine so imeli najvišje vrednosti WI^* v obeh smereh, najnižje vrednosti pa so bile v skupini s tremi plastmi voska.

Najvišja stopnja zmanjšanja vrednosti WI^* je bila 59,47 % oziroma 61,21 % pri vzorcih s tremi plastmi voska, najnižja stopnja zmanjšanja pa 37,72 % oziroma 54,22 % pri vzorcih z eno plastjo voska.

Vrednosti spremembe barve ΔE^* so bile 8,41 za eno plast, 11,29 za dve plasti in 11,59 za tri plasti voska, pri čemer so bile vrednosti za dve in tri plasti zelo podobne. Vrednosti spremembe kota barvnega tona ΔH^* so bile 3,08, 3,97 in 4,48 za eno, dve in tri plasti voska.

Glede na podobnost vrednosti ΔE^* pri dvoslojnem in troslojnem nanosu voska lahko sklepamo, da tretji nanos voska morda ni potreben.

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