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Full Length Research Paper

Possibilities of using preservatives in environmentally friendly furniture industry

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Impregnation of the wooden equipment used as furniture, decoration and building materials, outdoor effects and some kinds of air situations as a result of varnishing is studied in this work. Especially, the changes in the wooden material, varnish and impregnation material, used massively in furniture are studied according to seasons (spring, summer, autumn, winter) and months (3, 6, 9 and 12). According to the results, the highest retention in Scotch pine wood occurred in water repellent + polyurethane varnish (82.02 kg/m^3) and in chestnut tree wood occurred in water repellent + polyurethane varnish (9.80 kg/m^3). The highest brightness level is measured in the 9th month (52.56%) for Scotch pine and in the 12th month (67.94%) for chestnut tree. The highest percentage of colour change is measured in 4th season (67.07%) for Scotch pine and also in 4th season (55.95%) for chestnuts tree. The highest percentage of adherence resistance is measured in the 9th month (3.83%) for Scotch pine and in the 3, 6 and 9th months (3.66%) for chestnut. The highest rate of weight loss is measured as 0.99 g in Scotch pine while it is 0.66 g in chestnut tree.

Key words: Impregnation, wood , varnishes, weathering , color changes, gloss.

INTRODUCTION

Furniture is a “fashionable product” that changes constantly according to technical and economic conditions of our time. Designing models for customers in the aspect of aesthetics, endurance and functionality is very important for the production of furniture. Wood is used as raw material. Wooden plaques like scale and filamentous tables are highly preferred in the production of box shaped modular furniture (Altınok, 1987). Wood that can be used when it is solid or when it turns into composed products is one of the unique materials that is suitable for physical, mechanical, chemical or biochemical interference (Bozkurt and Göker, 1986). It also needs protection according to humidity of the place where it is used, its pH level, temperature and presence of dangerous micro organisms (Bozkurt et al., 1993). It should be impregnated by chemical substances in order to prevent damages that may happen to the wood (Yalınkılıç, 1993). Air conditions are the most dangerous things to the wood. Temperature, humidity, different wave lengths and severe gun light and their changes in the different times of the day according to seasons create negative effects on the furniture (Williams and Feist, 1993; Özen and Sönmez, 1996). It is proved that varnish only or impregnation has aesthetics and protective effects on furniture and as well as increasing their life span (Feist, 1990; Özen and Gözeneli, 1992). Williams and Feist (1991) at first exposed the wooden surfaces to the outside effects and then tried to determine the performance of varnish layers by exposing them to the outside effect after varnishing. Grantham and Black (1976) observed the different characteristics of varnish layers and wood protectors that are exposed to the external effects, having penetration ability. Wood has been regarded as having an engineering attraction with its natural structure, endurance and structural abilities.

On the contrary, wood is an enduring material and harmonious with the environment. It was used widely in the tombs of kings, and became fashionable in the 20th century (Feist, 1988). Impregnated wood has a wide use

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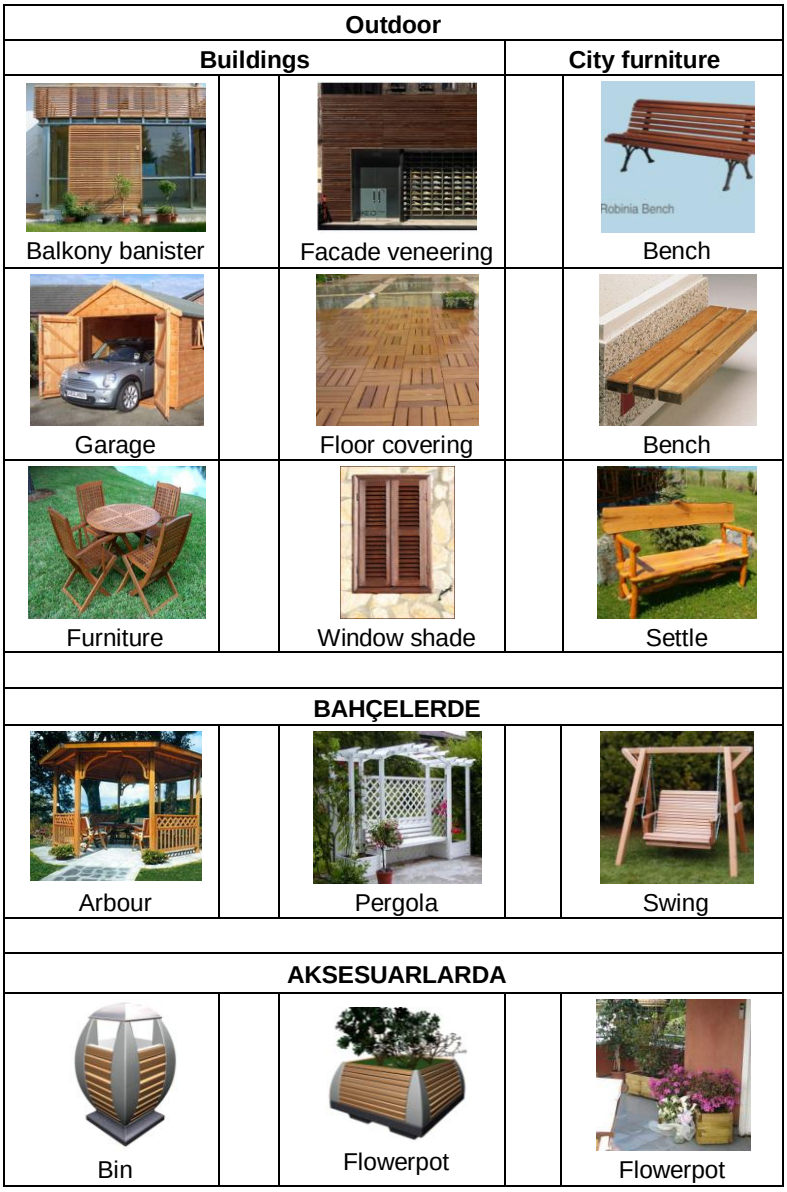


Figure 1. The places impregnation wood is used exterior.

area, both indoor and out door. Outdoor areas include kinder gardens, verandas, arbores, gazeboes, pagoda plate, stairs, garage, bridges, rubbish cans, ground material (around the pool) (Boxall and Hayes, 1984) (Figure 1). Indoor: it is used in vertical circulation places (wooden stairs), furniture (balcony chair or table), winter gardens, door, wooden flower beds and wet places (bathroom floor, bathtub, sauna) (Figure 2). The aim of this paper is to study the use of furniture and construction industry impregnated with varnish. The wood species were investigated by supporting the usability performance. By using the connection of wood-varnish-impregnation, its endurance against external and internal effects is researched.

MATERIALS AND METHODS

In the scope of the study, Scotch pine (*Pinus sylvestris* L.) and Anatolian chestnut tree (*Castenaea sativa* Mill.) wood were used. Tanalith-CBC (13%)-white spirit- celluloses thinner and polyurethane varnish are preferred because of the indoor and outdoor conditions.

Supplying and preparing the experiment materials

Tree types belong to East Black Sea Region (Table 1) panels that are chosen by samples method and whose yearly circles are roughly cut as 190 × 140 × 15 mm; they are acclimatized until their weight becomes stable in 20 ± 2°C and 60±5% humidity. Then, it is

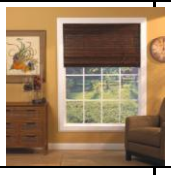
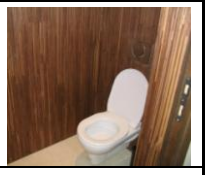
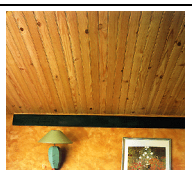
Interior				
Elements of spaces				**Wet spaces**
 Window		 Door		 Kitchen
 Stairs		 Ceiling		 Bathroom
 Curtain		 Fireplace		 wc
Furniture of Interiors				
 Chair		 Armchair		 Footstool
 Cabinet		 Table		 Bed
Furniture of ajar spaces				
 Chair		 Table		 Lounge chair
Materials of covering				
 Wall		 Floor		 Ceilling

Figure 2. The places impregnation wood is used interior.

Table 1. Cutting areas of wood specify.

Wood number	Forest working	Wood specify	Length (m)	Chest bore (cm)	High (m)
1	Çaykara	Pinus	25.00	40	1700
2	Pazar	Castanea	30.00	35	1400

set to original panel measure, which is 150 × 100 × 10 mm and ready for varnishing. Control and experiment samples are in the same humidity level. For every variation, one test and one control sample is taken and prepared for the impregnation after being recorded according to season of tree and varnish type (ASTM 358, 1978; TS 4755, 1986; Baysal, 1994; Var, 1994).

Preparation of impregnation solutions

Solutions that are used in the impregnation of experiment samples are chosen according to literature, and A total of three impregnation mixtures (two water repellent and variation pure mixture) are used. In these mixtures, light organic solutions (toluene, thinner, benzyl, white spirit) are used especially.

- Tanalith-CBC is decomposed in pure water and mixed up in room temperature (1.13%).
- Paraffin (2.1%).
- White spirit (79%).
- Varnish (synthetic varnish) (20%).
- Paraffin (3.1%).
- Celluloses thinner (79%).
- Varnish (polyurethane varnish) (20%).

The temperature of the prepared solutions is measured before and after the impregnation. pH and thickness of it is also measured before and after impregnation.

Impregnation method

In impregnation process, samples are kept in a solution vulnerable to air pressure for 60 min after applying vacuum equal to 60 cm/Hg for 60 min according to the basis stated in ASTM D- 1413-76 (1988). After recording the weight of every sample, they are kept in kiln dry places until they reach 105°C and weighted again in a sensitivity of 0.01 g. After impregnation, every impregnated sample is kept in a place where air circulation happens for 10 to 15 days for evaporation of the solutions.

1. Retention absorbed material quantity (kg/m^3)
$R_1=G_1xCx10$ (kg/m^3)
G_1=T2-T1
T_1=Sample weight before impregnation (g)
T2=Sample weight after impregnation (g)
V=Capacity of sample (cm^3)
C=Concentration (%)

2. Retention (In comparison with completely dry wood) quantity of dry material (%)
R_2=Moes-Moeox10 (%)
Moeö=Weight of the exactly dry wood before impregnation (g)
Moes=Weight of the exactly dry wood after impregnation (g) (Richardson, 1978)

Preparation of varnishes and varnishing the experiment sample

Varnishing the experiment samples is done according to industrial application and ASTM D-3023 (ASTM D 3023, 1988) by using viscometer in the measurements of Dyn/4 mm. In polyurethane varnish, 18sn/dyn Cup-4 mm/20°C, in synthetic varnish 18sn/dyn Cup -4 mm/20°C is determined.

Polyurethane varnish - Material used for filling: 100 g/m^2
Upper layer: 100 g/m^2
Synthetic varnish: Material used for filling:
Colourless: Transparent
Upper layer: 100 g/m^2 (3 layers)

Varnishing process is done according to the basis of varnishing the two sides of the panel equally. Experiment and control samples are put in experiment stand in a position such that their surface is turned to the South at 45°.

Determining the solid material and dry band thickness in varnishes

Sooth and transparent watch glass whose thickness is 4 mm is cut at the size of 100 × 100 mm^2. Its surface is cleaned with natural alcohol and then dried; its tare is determined with a scale that has a sensitivity of 0.01 g. After determining solid material, varnish is mixed in its package and then 1 g is taken and weighted. The agent of solid material is found to be 52% in synthetic varnish and 40% in polyurethane varnish. When the experiment device is on the smooth glass or sheet iron in a vertical position, indicator is placed on zero and the thickness of dry band is determined.

Methods used in the tests of experiment samples

Measuring the solidity

The solidity of the samples that are varnished and prepared for experiment is measured with pendulum solidity measurement device. While the device is placed on platform, layer solidities are determined according to pendulum oscillations waving with two marbles whose strength are 63±3.3 HRC and diaper is 5±0.005. Two pendulums are used in the measurement of solidity and oscillation; the beginning and ending points vary according to the type of pendulum. Oscillations from 12° to 4° for Pezos and from 6° to 3° for Koning are measured. After varnishes that are applied to the surfaces of samples are dried completely by acclimatizing them for 16 h in 23±2°C and in the humidity of 50±5 %, they are made ready for experiment (ASTM 4366, 1980; Özen and Gözeneli 1992).

Measuring the brightness

Brightness is measured with brightness measuring device (Gloss-metre). After completely drying and determining the thickness at the samples bands, they are prepared for experiments by acclimatizing them at 23±2°C and in an environment that has 50±24° humidity for16 h. Brightness measuring device is used in 60±2° while measuring is calibrated during and before any process. For daily calibration, black glass that is well varnished, with smooth surface

Table 2. Features of solutions.

Treatment chemicals	Thinner	Warmth (°C)	PH		Density (g/ml)	
Varnishes			**TB**	**TA**	**TB**	**TA**
Untreatment	-	-	-	-	-	-
Tanalıth - CBC	Pure water	23	3.05	3.05	1.08	1.08
WR+ Senthetic thinner	W. spirit	100	5.57	5.57	0.820	0.821
WR+ Cellulosicthinner	Cellulosic	100	5.06	5.06	0.880	0.880
Senthetic varnish	W. spirit	23	6.0	6.01	0.940	0.940
Polyürethane varnish	Cellulosic	23	6.0	6.66	1.010	1.010

WR, Water repellent; TB, treatment before; TA, treatment after.

whose reflection index is 1.567 and brightness determined to 100 for any geometric shape is used (ASTM 2244, 1990)

Colour change

Colour measurements are made with colour measuring devices according to ASTM D-2244 and white colour whose measuring device is calibrated as a=4.91; b=3.45; c=6.00; H=324.9.First, measurement happens when it is natural (in natural colour); second, one happens before the experiment when it is varnished and other measurements happen in different time periods. Experiment panels are cleaned one by one before the experiments (ASTM 2244, 1990).

Resistance of adherence to the surface

Adherence resistance to the surface of varnish layers that are applied to the wooden surfaces is determined after cutting the varnish layers in certain periods by pulling a band over the surface. The incisory used in the experiment is made of a special angel steel; and angle of its sharp side is 15 to 30° for the layers whose dry thickness is up to 50 micron. 11 sharp side and 1mm spaced incensories are used. Four layers whose dry layer thickness is between 50 and 125 micron, with 2 mm space and 6 sharp side incensories are used; and for the ones that are thicker than 120 micron razor blade, lancet and cutting like these are used (ASTM 3359,1976; TS 6884,1989).

Measuring the loss of weight

Weight of experiment samples that are impregnated and varnished is recorded before the outdoor effect and after outdoor effect with 0.01 gr sensibility along with control sample. Control and test sample are weighed one by one after keeping them in climatic conditions especially before the outdoor effect. Losses are measured as (gr) in varnished impregnation varnish and natural samples (ASTM 661, 1993; ASTM, 1972; Garlack and Sward, 1972).

Using statistical methods

All the date obtained in experiments are utilized with the help of a computer programme called “STATGRAF”, simple variance analyses, various variance analyses, and connection with data is observed with “Duncan test”. Moreover, regression analysis is made to understand the connection between the relative humidity and temperature levels.

FINDINGS

Findings related to features of impregnation solutions

Findings related to the features of solutions are given in Table 2 thus:

1. There has been no change in the rates of pH and density of solutions that are measured before and after impregnation.
2. The fact is the rate of pH in the Tanalith-CBC 13% solution is acidic and the negative effects of these solutions on the polysaccharides present in the wood increases the possibility of hydrolysis.
3. The fact is pH rates of the solutions used are close to neutral, showing that chemical substances in the wood are affected very low. Mixtures in impregnation process are used as individual processes.

Findings related to Scotch pine’s and chestnut trees’ retention rate

Findings about retention rate are given in Table 3 thus:

1. The highest retention happens in water repellent + polyurethane varnish (82.02 kg/m^3) for Scotch pine wood, while the lowest rate happens in water repellent + polyurethane varnish.
2. The highest rate materializes in water repellent + polyurethane varnish (9.80 kg/m^3) for Scotch pine tree while the lowest rate belongs to Tanalith-CBC (5.33 kg/$m^{3)}$.

Findings related to the percentage of retention in Scotch pine and chestnut

Findings related to the percentage of retention are given in Table 4. The highest percentage of retention for Scotch pine materializes in water repellent + synthetic varnish (42.33%); while for chestnut tree, it is water repellent + polyurethane varnish (9.22%) that has the highest percentage of retention.

Table 3. Retention rates (kg/m³).

Wood specify	Treatment chemicals	Retention (Kg/m^3)		
		AV	SD	Hg
Scoth pine	WR+Senthetic varnishes	56.13	7.00	b
	WR+Polyürethane	82.02	2.31	a
	Tanalıth-CBC	77.55	2.00	a
Chestnut	WR+Senthetic varnish	9.26	1.03	c
	WR+Polyürethane varnish	9.80	1.91	c
	Tanalıth-CBC	5.33	0.29	d

AV, Average; SD, standard deviation; Hg, homogeneity groups.

Table 4. Retention rates (%).

Wood pecify	Treatment chemicals	Retention (Kg/m^3)		
		AV	SD	Hg
Scoth pine	WR+Senthetic varnishes	42.23	10.64	a
	WR+Polyürethane	24.74	1.54	b
	Tanalıth-CBC	42.20	12.50	a
Chestnut	WR+Senthetic varnish	2.95	0.79	c
	WR+Polyürethane varnish	9.22	6.38	c
	Tanalıth-CBC	3.30	0.57	c

AV, Average; SD, standard deviation; Hg, homogeneity groups.

Table 5. Various variance analyze (testing of duncan) on strength.

Seasons/	Scoth pine		Chestnut		Chemicals	Scoth pine		Chestnut	
Months	AV	Hg	AV	Hg	Material	AV	Hg	AV	Hg
I S	48.83	cd	49.28	c	1-Naturel	18.88	d	19.77	e
II S	43.23	d	50.11	c	2-S.V.	37.95	c	37.66	d
III S	61.48	ab	58.63	ab	3-P.V.	80.03	a	81.04	a
IV S	53.16	bc	56.62	ab	4-WR+S.V.	34.98	c	38.31	d
3 M	41.56	d	61.94	a	5-WR+P.V.	53.70	b	70.92	b
6 M	58.09	abc	60.83	a	6-Tan+SV	57.85	b	55.31	c
9 M	49.70	cd	55.23	ab	7-Tan+.PV.	85.36	a	85.00	a
12 M	65.39	a	50.80	c	-	-	-	-	-

S, Seasons; M, months; SV, synthetic varnish; PV, polyurethane varnish.

Findings related to strength rate

Varnish-impregnation materials based on season and months that affect the strength level and also various similar analyses determining both types are given in Tables 5 and 6.

It is at the 12th month (65.33%) that the highest percentage is measured for Scotch pine tree and it is polyurethane varnish that has the highest rate considering the usage of chemical substances. For chestnut tree, it is at the 3rd and 6th months the highest percentage was recorded and it is Tanalith-CBC+ polyurethane varnish (85%) that has the highest percentage considering the chemical substances.

Results of brightness level (parallel to fibres)

Various similar analyses of both types are given in Tables 7 and 8. According to this situation, the highest

Table 6. Various variance analyze on chestnut and scoth pine.

VB	CT	SD	FD	Fh	ID
Scoth pine					
Chemicals treatment	3536.17	7	505.16	6.091	0.0001
Season-month	28131.79	6	4688.63	56.536	0.0000*
Estimate ratio	3483.16	42	82.93	-	-
Total	35151.13	55	-	-	-
Chestnut					
Chemicals treatment	11959.99	7	170.85	22.12	0.0520
Season-month	29206.77	6	4867.78	63.148	0.0000*
Estimate ratio	3237.59	42	77.08	-	-
Total	33640.31	55	-	-	-
Duncan testing of both types wood specify					
Wood specify	143.51	1	143.51	1.253	0.2657
Chemicals treatment	57179.89	6	9529.98	83.22	0.0000*
Season-month	2501.08	7	357.29	3.72	0.0052
Estimate ratio	11107.63	97	114.51	-	-
Total	70932.12	111	-	-	-

VR, Variance base; CT, checked total; SD, freedom degree; ID, ımportance degree.

Table 7. Various variance analyze (testing of duncan) on brightness.

Seasons/	Scoth pine		Chestnut		Chemicals	Scoth pine		Chestnut	
Months	AV	Hg	AV	Hg	Material	AV	Hg	AV	Hg
I M	40.15	bc	43.80	c	1-Naturel	3.41	c	2.83	d
II M	39.25	bc	51.16	bc	2-S.V.	39.25	a	76.05	a
III M	41.59	bc	47.83	bc	3-P.V.	60.45	a	59.71	bc
IVM	46.86	ab	54.10	b	4-WR+S.V.	56.57	a	52.36	c
3 Month	35.27	c	54.01	b	5-WR+P.V.	51.31	a	69.97	ab
6 Month	44.75	abc	55.69	b	6-Tan+SV	34.77	b	69.21	a
9 Month	52.56	a	66.45	a	7-Tan+.PV.	34.95	b	57.71	c
12 Month	44.46	abc	67.94	a	-	-	-	-	-

S, Seasons; M, months; SV, synthetic varnish; PV, polyurethane varnish.

percentage related to seasons and months materialized at the end of the 9th month (69.31%). The highest rate considering chemical substance materialized in water repellent + polyurethane varnish (68.74%). Big differences exist in chestnut tree related to seasons and chemical substances. According to this situation, the highest brightness level (76.19%) is measured at the end of the 9th month and the highest brightness level related to chemical substances (80.26%) materialized when synthetic varnish was used only.

Finding related to the changing colour angle

Impregnation material, varnished based on seasons and months that affect colour change in addition to similar analyses of both types are given in Tables 9 and 10.

In Tables 11 and 12, there is no big difference considering seasons and chemical substance for Scotch pine tree. Hence the highest level materialized at the end of the 4th season (67.01%). No difference has been spotted in chestnut tree according to seasons or chemical substances. It is found in Tanalith -CBC+ polyurethane varnish (58.02).

Findings related to adherence resistance

Varnish impregnation materials based on season and months that affect the changes of adherence of resistance

Table 8. Various variance analyze on chestnut and scoth pine.

VB	CT	SD	FD	Fh	ID
Scoth pine					
Chemicals treatment	1367.23	7	195.31	1.968	0.0826
Season-month	20459.21	6	3409.86	34.36	0.0000*
Estimate ratio	4168.11	42	99.24	-	-
Total	25994.56	55	-	-	-
Chestnut					
Chemicals treatment	3445.44	7	492.20	6.959	0.0000*
Season-month	28569.85	6	4761.64	67.31	0.0000**
Estimate ratio	2970.77	42	70.73	-	-
Total	34986.06	55	-	-	-
Duncan testing of both types wood specify					
Wood specify	4235.25	1	4235.25	32.02	0.0000*
Chemicals treatment	44285.21	6	7380.86	55.80	0.0000**
Season-month	3511.26	7	501.60	3.79	0.0011
Estimate ratio	12828.62	97	132.25	-	-
Total	64860.35	111	-	-	-

VR, Variance base; CT, checked total; SD, freedom degree; ID, importance degree.

Table 9. Various variance analyze (testing of duncan) on change of colour angle.

Seasons/	Scoth pine		Chestnut		Chemicals	Scoth pine		Chestnut	
Months	AV	Hg	AV	Hg	Material	AV	Hg	AV	Hg
I M	63.99	ab	54.50	a	1-Naturel	45.37	c	48.70	c
II M	61.97	ab	51.71	a	2-S.V.	56.91	b	53.30	abc
III.M	62.70	ab	53.72	a	3-P.V.	57.09	b	55.92	ab
IV.M	67.01	a	55.95	a	4-WR+S.V.	58.14	b	53.09	abc
3 Month	60.21	ab	55.08	a	5-WR+P.V.	65.22	ab	51.68	abc
6 Month	61.06	ab	53.95	a	6-Tan+SV	75.94	a	55.93	ab
9 Month	55.57	ab	50.37	a	7-Tan+.PV.	65.63	ab	58.02	a
12 Month	52.41	b	55.16	a	-	-	-	-	-

S, seasons; M, months; SV, synthetic varnish; PV, polyurethane varnish.

and in addition to various analyses of these two types are given in Tables 11 and 12.

There is a difference in Scotch pine tree related to chemical substances while there is no big difference related to season. In Tables 12 and 13, the highest level related to seasons is found at the end of the 9th month (3.83).

Finding related to loss of weight

Varnish- impregnation materials based on season and months that affect the loss of weight and in addition to various similar analyses of these two types are given in Tables 13 and 14. There is a big difference in Scotch pine tree considering the seasons and chemical substances.

DISCUSSION

The most important things in the impregnation of wooden material are not only the processes before it, but also the pressure, temperature applied in its process and periods. These things also cause a decline in the features of the resistance. In terms of strength, only polyurethane varnish or mixture of Tanalith-(BC+ polyurethane varnish) should not be used. In the first process, use Tanalith-(BC

Table 10. Various variance analyze on chesnut and scoth pine.

VB	CT	SD	FD	Fh	ID
Scoth pine					
Chemicals treatment	1061.90	7	151.70	1.24	0.3026
Season-month	4366.89	6	727.81	5.95	0.0001
Estimate ratio	5133.29	42	122.22	-	-
Total	10562.09	55	-	-	-
Chestnut					
Chemicals treatment	173.49	7	24.78	0.63	0.7245
Season-month	464.86	6	77.47	1.98	0.0896
Estimate ratio	1640.07	42	39.04	-	-
Total	2270	55	-	-	-
Duncan testing of both types wood specify					
Wood specify	1301.59	1	1301.59	14.46	0.0002
Chemicals treatment	3356.84	6	559.47	6.21	0.0000*
Season-month	752.75	7	107.53	1.19	0.3130
Estimate ratio	8728.92	97	89.98	-	-
Total	14140.11	111	-	-	-

VR, Varience base; CT, checked total; SD, freedom degree; ID, importance degree.

Table 11. Various variance analyze (testing of duncan) on resistance.

Seasons/	Scoth pine		Chestnut		Chemicals	Scoth pine		Chestnut	
Months	AV	Hg	AV	Hg	Material	AV	Hg	AV	Hg
I M	3.40	ab	3.38	a	1-Naturel	-	-	-	-
II M	3.27	b	3.52	a	2-S.V.	4.20	c	4.35	a
III M	3.46	ab	3.35	a	3-P.V.	4.49	a	4.16	ab
IV M	3.78	ab	3.66	a	4-WR+S.V.	4.19	ab	4.02	ab
3 Month	3.73	ab	3.66	a	5-WR+P.V.	4.20	ab	3.95	b
6 Month	3.59	ab	3.66	a	6-Tan+SV	3.90	b	4.07	ab
9 Month	3.83	a	3.37	a	7-Tan+.PV.	4.11	ab	4.08	ab
12 Month	3.74	ab	3.55	a	-	-	-	-	-

S, seasons; M, months; SV, synthetic varnish; PV, polyurethane varnish.

impregnation); and as second process, cover with polyurethane varnish. This increased the strength in Scotch pine tree and chestnut tree after outdoor effects. This increase is almost two times as much as the first condition (Williams and Feist, 1991; Feist, 1988; Sönmez, 1989; Rowell et al., 1981).

Brightness

Erosion on the surface decreases the layer brightness or the brightness increases in a vertical or horizontal way to the fibres according to the impregnation material and chemical structure of the varnish. After varnishing process, net filing the pores completely will cause a difference between vertical and horizontal measurement and this will have different effects on people based on the angle from which they see it (Yalınkılıç, 1993; ASTM D 3023, 1988).

Color

To understand the changes in colour tint, we utilize the (Ho) angle. Between (a) red and (b) yellow, Ho angle is a sign that shows the way the colour changes (ASTM 3359, 1976; ASTM 661, 1993).

Adherence

Adaptation of the varnish layer to tree's limited working

Table 12. Various variance analyze on chestnut and scoth pine.

VB	CT	SD	FD	Fh	ID
Scoth pine					
Chemicals treatment	1.88	7	0.268	1.163	0.3443
Season-month	121.66	6	20.27	87.66	0.0000*
Estimate ratio	9.714	42	0.2313	-	-
Total	133.25	55	-	-	-
Chestnut					
Chemicals treatment	0.9231	7	0.13	1.301	0.3802
Season-month	116.56	6	19.428	162.21	0.0000*
Estimate ratio	5.030	42	0.1197	-	-
Duncan testing of both types wood specify					
Wood specify	0.14501	1	0.1450	0.878	0.3611
Chemicals treatment	237.07	6	39.51	239.18	0.0000*
Season-month	1.720	7	0.245	1.488	0.1805
Estimate ratio	16.024	97	0.16519	-	-
Total	254.96	111	-	-	-

VR, variance base; CT, checked total; SD, freedom degree; ID, importance degree.

Table 13. Various variance analyze (testing of duncan) on loss of weight.

Seasons/	Scoth pine		Chestnut		Chemicals	Scoth pine		Chestnut	
Months	AV	Hg	AV	Hg	Material	AV	Hg	AV	Hg
I M	0.56	bc	0.41	ab	1-Naturel	2.94	a	2.35	a
II M.	0.65	abc	0.61	ab	2-S.V.	0.25	b	0.21	b
III M	0.54	bc	0.39	b	3-P.V.	0.22	b	0.26	b
IV M	0.90	a	0.66	a	4-WR+S.V.	0.23	b	0.20	b
3 Month	0.54	bc	0.41	ab	5-WR+P.V.	0.23	b	0.20	b
6 Month	0.77	ab	0.56	ab	6-Tan+SV	0.18	b	0.20	b
9 Month	0.39	c	0.53	ab	7-Tan+.PV.	0.11	b	0.15	b
12 Month	0.42	c	0.50	ab	-	-	-	-	-

S, Seasons; M, months; SV, synthetic varnish; PV,polyurethane varnish.

Table 14. Various variance analyze on chestnut and scoth pine.

VB	CT	SD	FD	Fh	ID
Scoth pine					
Chemicals treatment	1.455	7	0.2079	2.040	0.0722
Season-month	51.41	6	8.56	84.06	0.0000*
Estimate ratio	4.2813	42	0.1019		
Total	57.15	55			
Chestnut					
Chemicals treatment	0.49	7	0.071	1.635	0.1522
Season-month	31.53	6	5.25	120.74	0.0000*
Estimate ratio	1.82	42	0.043		
Total	33.85	55			

Table 14. Contd.

Duncan testing of both types wood specify					
Wood specify	0.3822	1	0.38	0.65	0.4280
Chemicals treatment	31.23	6	5.20	8.95	0.0000*
Season-month	1.78	7	0.25	0.44	0.8747
Estimate ratio	56.36	97	0.5810		
Total	89.767	111			

VR, variance base; CT, checked total; SD, freedom degree; ID, importance degree.

space depends mostly on elasticity (Özen and Sönmez, 1996; Feist, 1990; Özen and Gözeneli 1992). If there is no refraction in cutting place or varnish sawdust is cut like thin fibres, it shows that cohesion power of the varnish is high while its elasticity is normal .It is a very important parameter. That the least layers of weight took place in the impregnated and varnished samples demonstrated that the proceedings have been concluded with the best results.

Budakçı et al (2010) acrylic and polyurethane varnishes have been used in various types of wood, while the other needle-leafed woods with low bonding strength had positive results. In addition, there is the study of the bonding strength between layers of varnish wood-filler adhesion failure to intersect, where the maximum filling of solid layers of varnish on the last layer formed on the bonding strength was found to be ineffective. Sönmez and Budakçı (1998) reported the value of the highest bonding strength, in which varnish has been achieved three times in its implementation. Varnish cohesion between molecules on the surface with lower bond adhesion strength had an impact on postage-stamp values, based on the report of the effect of reduction. Söğütlü and Sönmez (2006) gave example of changing the tint of the color as desired, and selected coffee decorative applications, two-component varnishes colored with chemical paint beech wood material coated with little or no change in color (Söğütlü and Sonmez, 2006). Sönmez and Budakçı (1999) decrease the brightness of vessel fully filled cavities in the wood, in different directions from the surface to reflect light and reduce the severity of the described.

Decker et al. (2004) gave 30 mm thick coated, water-based UV-curing. At the end of the accelerated aging with the brightness of the hardness of PU-acrylate lacquer taurine being determined, the mechanism of decomposition of urethane (C-NH) maximum linkages shows that sensitivity has been reported.

Conclusion

According to the results, the highest retention in Scotch pine wood occurred in water repellent + polyurethane varnish (82.02 kg/m^3) and in chestnut tree wood, it occurred in water repellent + polyurethane varnish (9.80 kg/m^3). The highest brightness level is measured in the 9th month (52.56%) for Scotch pine and in the 12th month (67.94%) for chestnut pine. The highest percentage of colour change is measured in season IV (67.07%) for Scotch pine and also in season IV (55.95%) for chestnuts tree. The highest percentage of adherence resistance is measured in the 9th month (3.83%) for Scotch pine and in the 3, 6 and 9th months (3.66%) for chestnut. The highest rate of weight loss is measured as 0.99 g in Scotch pine while it is 0.66 g in chestnut tree.

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