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WEATHERING PERFORMANCE OF A WOOD SURFACE COATED WITH ACRYLIC RESIN CONTAINING UV ABSORBER

This study examines the effects of a 15-month natural weathering test (Uzungöl and Hıdırnebi Plateaus) on wood materials. In this study, samples of oriental beech (Fagus Orientalis L.) and Scots pine (Pinus sylvestris L.) with six different protection methods were used. The roughness increase, colour and visual--macroscopic changes occurred on the surfaces of treated and untreated wood samples, exposed to outdoor conditions, were compared. The impregnation and heat-treated oriental beech and Scots pine were coated with acrylic resin containing UV absorbance. The results showed that the coating system increased the visual and physical performance of wood samples in outdoor conditions.

Keywords: coating, impregnation, heat treatment, micronized copper quaternary (MCQ), surface degradation, UV absorbance

Introduction

Nowadays, mountain tourism in the Eastern Black Sea region is gaining popularity and national recognition. Moreover, wooden houses provide a unique housing alternative that does not involve destroying the natural beauty of the mountains [Atasoy et al. 2009]. However, wooden mountain houses are problematic due to the fact that wooden materials used under external environmental conditions are subject to degradation due to UV light, moisture, temperature variations, wind and atmospheric factors (oxygen, air polluting gases – sulphur dioxide, nitrogen dioxide, etc.) [Özgenç 2014].

Different methods have been suggested to make wood more resistant against surface degradation and colour changes. These methods include: impregnation, heat treatment, chemical modification applications, and certain surface coatings. Treatment with copper and chrome containing materials especially, protects wood against degradations in outdoor conditions [Williams 2005; Zahora 2013; Ozgenc and Yildiz 2014]. According to the studies performed, the protective effect of the alkali copper quaternary (ACQ) material, which is a new generation

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wood preservation material, against outdoor conditions was found to be lower than that of the copper chromed arsenate (CCA) material [Temiz et al. 2005]. The effect of new generation copper based micronized copper quaternary (MCQ) preservative in slowing down the deterioration of wood under outdoor conditions was found to be higher than that of ACQ preservative [Ozgenc et al. 2012]. The reason is that the amount of copper washed out from ACQ-treated Scots pine-wood was significantly higher when compared to the MCQ material [Cooper and Ung 2009]. Several advanced applications were examined to prevent the washing-out of the copper from the wood. According to McIntyre [2010], the washing-out rate significantly dropped when MCQ-impregnated wood was subjected to surface coating.

Heat treatment, which is another protective method, ensures a decrease in free hydroxyl groups and makes the wood less hygroscopic. A significant decrease in fractures due to UV light and rain occurs as a result of increased dimensional stabilization in heat-treated wood surfaces [Kocaefe et al. 2008; Srivinas and Pandey 2012]. Research conducted found that heat treatment is not sufficient to preserve the wood in outdoor conditions [Scholz et al. 2010; Hochmańska et al. 2014]. Therefore, various surface coatings such as polyurethane varnish, polyester varnish, acrylic resin, UV absorbance containing surface coating materials were being applied to the heat treated wood surfaces [Saha et al. 2011a; 2011b]. High degrees of resistance to physical and chemical changes under outdoor conditions were obtained by applying surface coatings to heat-treated wood [Saha et al. 2013].

The aim of this study was to identify the performance of the new generation wood preservative with micronized copper formulation, heat treatment and surface coating methods in wood types frequently used for mountain house construction in the Eastern Black Sea region. This study compared the resistance of wood protection and surface-coating methods applied to Scots pine and oriental beech wood species under outdoor conditions.

Materials and methods

Preparation samples and pre- treatment process

Defect-free samples with dimensions of 300 mm in length by 70 mm in width and 20 mm in depth from the sapwood of two species, oriental beech (*Fagus orientalis* L.) and Scots pine (*Pinus sylvestris* L.) were conditioned in a climate room of 21°C and relative humidity of 65% until a moisture content of 12% was reached. Later samples were lightly sanded with 120 grit sandpaper. Samples were treated with a water-based wood preservative and micronized copper containing a copper-based fungicide, which is an organic co-biocide. The commercial company, Osmose Inc., supplied the chemicals. Four samples from each species were treated with MCQ with a concentration of 1%. Each wood sample was impregnated inside a laboratory type tank by the full-cell method.

The procedure involved applying an initial pressure of 700 mm Hg in a vacuum for 15 minutes, and 8 bars for the following 45 minutes. All specimens were lightly wiped with a paper napkin to remove any excess solution from their surface and weighed at an accuracy of 0.01 g to determine the retention value of the chemical in the samples [AWPA U1-09].

Two species of sapwood were conditioned in a climate room with a temperature of 21°C and a relative humidity of 65% until they reached a moisture content of about 12%. Heat treatment was then applied to four samples from each species in an oven. The temperature was controlled with a ±1°C sensitivity, at two different temperatures (oriental beech at 190°C for 90 min. and Scots pine at 212°C for 90 min.) under a steam atmosphere (ThermoWood process) in an industrial plant, in Novawood, Gerede, Turkey. Table 1 displays the retention ratio of MCQ-treated wood following the impregnation process and the mass loss percentage of wood following the heat-treatment process.

Table 1. Retention ratio of MCQ treated and mass loss on the thermal treated wood samples

Outdoor test	Retention (kg/m^3)		Mass loss of thermal treated wood (%)	
	Oriental beech	Scots pine	Oriental beech	Scots pine
Uzungöl plateau	4.1 (0.7)	4.0 (0.9)	14.5 (1.1)	17.4 (0.8)
Hıdırnebi plateau	4.08 (0.8)	4.3 (1.2)	14.7 (0.9)	17.3 (1.0)

Note: Values in parentheses are standard deviations.

Formulation of the coating systems

The water-based impregnation agent, having active ingredients of 1.20% propiconazole, and 0.30% iodopropynylbutylcarbamate, was used as a primer for the protection of the samples against biological deterioration, including soft rot and blue stain. The primer was applied to the samples at a spread of 120 g/m^2 using a brush. Two types of absorbers, the UV screener the UVA of hydroxyphenyl-striazines class as an organic UV absorber (UV1) and TiO_2 as an inorganic UV absorber (UV2) were used. Commercially produced finishing, having acrylic resin, a copolymer dispersion of methylacrylate/methylmethacrylate/butylacrylate, was used as a topcoat for the specimens. A small amount of defoamer and 2,2,4-trimethyl-1,3-pentandiolemonoisobutyrate, texanol as a coalescending agent was added in the topcoat formulation to reduce the effect of other additives on the photostabilization performance. Three layers of topcoats were also applied to each sample at a spread rate of 100 g/m^2 by brush. Later, the specimens were sanded with a 240 grit size of sandpaper and kept at room temperature for two days before applying the second layer of topcoat. The sample variations are given in table 2.

Table 2. The wood samples prepared for each variation

Code	Methods	Amount
1	Control: Untreated samples	4
2	MCQ-treated + Clear-coat (organic UV absorber)	4
3	MCQ-treated + Clear-coat (inorganic UV absorber)	4
4	Heat-treated + Clear-coat (organic UV absorber)	4
5	Heat-treated + Clear-coat (inorganic UV absorber)	4
6	Clear-coat (organic UV absorber)	4
7	Clear-coat (inorganic UV absorber)	4

Natural weathering test

Wood samples were prepared by removing moisture to prevent decay and painting them with 2-Epoxy white paint in sections as shown by the EN 927-3 standard. Then, the wood samples were stored for approximately 2 weeks in an environment with a temperature of 20°C and a relative humidity of 65 ±5% prior to the weathering test.

Natural weathering test were placed in plateaus of various altitudes, and then the control and test wood samples were placed, according to EN 927-3 standard, in the experimental stand placed on the Uzungöl and Hıdırnebi plateaus in Trabzon, Turkey. The weathering test continued for 15 months.

According to data obtained from the Department of Meteorology, Ministry of Forestry and Water Affairs of Turkey:

- the average annual air temperature for the Uzungöl plateau is 8°C, moisture is 80%, precipitation is 75 mm, and wind velocity is 3.30 m/s; and
- the annual average air temperature for the Hıdırnebi plateau is 5°C, moisture 60%, precipitation is 60 mm, and wind velocity is 5.80 m/s.

Surface colour and roughness measurement

Colour measurements were conducted with a Konica Minolta CM-600d instrument according to the ISO 7724 standard. Measurements were conducted at the end of a UV irradiation step to provide consistent specimen conditions. Eight replicates were used for each sample to evaluate colour change.

The Mitutoyo Surfest SJ-301 instrument was used for surface roughness measurements. The Ra and Rz roughness parameters were measured to evaluate surface roughness of the wood samples' surfaces according to DIN 4768.

Surface macroscopic evaluation

General images for surface erosions of control and test wood samples subjected to the natural weathering test were evaluated in accordance with the ASTM D 662-93 standard. Test and control samples were examined after the weathering test and a point scale of 10 (flawless surface with no erosion) to 0 (surface with high level of erosion) was used. According to the scale, a wood sample with no erosion on its surface after the weathering test was evaluated as a 10. However, a cracked wood surface was evaluated as a 0.

Statistical evaluations

The results of the surface colour and roughness analyses were evaluated on the basis of the mean values, standard deviations, and by statistics using Duncan's test (Statistica 13.0). Linear correlations (Microsoft Excel) were then determined between the colour changes and different treatment methods for wood samples.

Results and discussion

Colour change

As can be observed from table 3, according to the results of the weathering test in the Hıdırnebi and Uzungöl plateaus, colour changes on the wood surface coated by acrylic resin containing UV absorber are much lower in comparison to the control samples. It is determined that the colour changes at the wood samples subjected to external environmental conditions in the Uzungöl and Hıdırnebi plateaus are rather similar. The similarity of the discolouring results of wood samples left in two plateaus with different conditions is approved by the Duncan's Test.

Table 3 shows that, the highest colour stabilization was found in wood samples coated by acrylic resin containing UV absorber after the pre-treatment procedures (MCQ impregnation and heat treatment). According to some studies, the colour stabilization increases and deformations like cracks, splitting, wearing decrease at wood surfaces under external environmental conditions with applied coating after thermal treatment. [Srivinas and Pandey 2012]. Coating the surface of heat-treated wood with a weather resistant coating material significantly prevents colour changes [Saha et al. 2011a; Saha et al. 2013]. Temiz et al. [2005] found that colour stabilization of wood impregnated with copper-containing materials under weathering conditions increased.

However, some amount of copper was washed away from the wood surface by rain. The MCQ material developed on the basis of the micronized copper system, was found to have a significantly lower washing-out rate [Barnes et al. 2008; Zahora 2013]. Ozgenc et al. [2012] found that the application of water resistant acrylic resin with UV absorbance onto wood impregnated with copper--containing preservative material improves colour stabilization.

When compared to the Scots pine, colour changes occurring in the control samples of oriental beech, which has a more dense structure, were found to be lower. Colour change values of oriental beech and Scots pine samples coated with acrylic resin with UV absorbance were lower than the control samples [Nowaczyk-Organista 2009]. According to the colour change results, optimal colour stabilization was achieved with the pre-treated wood coated with acrylic resin containing an inorganic UV absorber at the Hıdırnebi and Uzungöl plateaus. Colour change values in wood samples coated with acrylic resin containing organic UV absorber were found to be significantly higher than those in samples coated with acrylic resin containing inorganic UV absorbance.

As can be seen from table 3, Δa^*, Δb^*, ΔL^* and ΔE^* colour change parameters were provided for test and control samples exposed to a 15-month weathering test in the Hıdırnebi and Uzungöl plateaus. It was determined that the surfaces in control samples became darker, indicating negative lightness stability (ΔL^*) values during the weathering test and similar results are obtained in some studies available in literature [Ozgenc et al. 2013; Hochmańska et al. 2014; Reinprecht and Hulla 2015]. The lowest values of ΔL^* were obtained on untreated wood samples. The (ΔL^*) values of Oriental beech test samples tests in Hıdırnebi and Uzungöl plateaus were positive. The highest (ΔL^*) values were obtained from heat-treated oriental beech samples coated with acrylic resin containing organic UV absorber and non-treated samples coated with acrylic resin containing an organic UV absorber. As for the Scots pine wood, while heat-treated samples coated with acrylic resin containing the organic UV absorber and non-treated samples coated with acrylic resin containing organic UV absorber had positive and highest (ΔL^*) values, other test samples had low and negative (ΔL^*) values.

Positive values of Δb^* indicate an increment of yellow colour and negative values indicate an increase of blue colour. Positive values of Δa^* indicate a tendency of the wood surface to go a reddish colour while negative values mean a tendency for it to go greenish [Ozgenc et al. 2013]. After the weathering test, the (Δa^*) values of the test and control samples were found to be different to each other value. As for the Scots pine wood, test samples excluding the samples subjected to pre-treatment with MCQ had negative (Δa^*) values. The (Δa^*) values of heat-treated Scots pine wood coated with acrylic resin containing an organic UV absorber and non-treated samples coated with acrylic resin containing organic UV absorber were found to have a positive value and were significantly high. The (Δb^*) values were found to have a positive value in the control samples and oriental beech samples coated with acrylic resin containing organic UV absorber, and a negative value in Scots pine except for samples coated with acrylic resin containing organic UV absorber (table 3).

Table 3. Colour change parameters of test and control wood samples exposed to weathering test

Beech	*ΔL*	*Δa*	*Δb*	*ΔE*	*X*	Pine	*ΔL*	*Δa*	*Δb*	*ΔE*	*X*
						Uzungöl					
1	-16.8 (5.2)	-5.2 (0.8)	-11.2 (1.0)	21.0 (4.2)	c	1	-34.0 (4.0)	-2.9 (1.4)	-15.6 (1.8)	37.7 (3.1)	c
2	7.8 (1.1)	-5.2 (1.3)	16.4 (1.8)	19.0 (1.1)	a	2	-12.0 (0.6)	2.3 (3.7)	9.3 (0.7)	15.6 (0.7)	b
3	3.8 (0.9)	-1.6 (0.9)	6.3 (1.4)	7.7 (2.7)	b	3	-11.1 (3.5)	3.1 (0.7)	-4.5 (2.0)	12.4 (3.8)	b
4	18.2 (1.0)	-6.0 (0.1)	2.4 (0.9)	19.4 (0.9)	a	4	22.1 (2.3)	-6.2 (0.5)	4.3 (2.8)	23.5 (2.6)	a
5	9.8 (3.3)	-6.3 (1.1)	-0.7 (0.4)	11.7 (3.4)	b	5	-7.4 (3.9)	-0.8 (0.8)	-10.8 (5.2)	13.2 (6.5)	b
6	14.3 (4.4)	-4.7 (0.4)	5.0 (4.0)	16.2 (5.0)	a	6	18.5 (0.8)	-5.6 (1.0)	8.3 (1.0)	21.1 (0.7)	a
7	9.8 (0.1)	-5.4 (0.2	1.7 (0.6)	11.3 (0.1)	b	7	-8.8 (0.4)	0.5 (0.2)	-10.9 (1.1)	14.0 (1.1)	b
						Hıdırnebi					
1	-18.8 (1.9)	-7.2 (1.4)	-17.2 (1.9)	26.5 (2.0)	c	1	-25.3 (4.3)	-5.1 (1.0)	-13.8 (2.5)	32.0 (3.7)	c
2	13.4 (0.3)	-6.7 (0.6)	14.7 (1.3)	11.6 (0.7)	b	2	-5.0 (1.2)	1.3 (0.9)	6.5 (1.1)	8.4 (1.0)	b
3	7.1 (2.8)	-0.5 (1.4)	9.0 (3.2)	11.6 (4.6)	b	3	-6.3 (1.1)	4.0 (0.7)	-3.3 (1.0)	8.2 (2.2)	b
4	24.7 (1.0)	-6.7 (0.6)	2.7 (1.7)	25.7 (2.9)	c	4	25.3 (0.7)	-6.7 (0.5)	3.6 (1.3)	26.7 (0.7)	a
5	17.7 (1.4)	-7.9 (0.5)	-2.1 (0.8)	19.5 (1.4)	a	5	-2.0 (1.4)	-1.0 (0.3)	-13.8 (0.5)	14.1 (0.7)	b
6	21.8 (0.8)	-5.6 (0.8)	7.4 (1.5)	23.7 (0.9)	c	6	26.2 (4.2)	-6.1 (0.7)	9.9 (3.6)	28.7 (5.0)	a
7	15.1 (0.9)	-7.0 (0.7)	-2.1 (0.5)	19.5 (1.0)	a	7	-2.4 (1.4)	-1.3 (0.3)	-11.7 (0.5)	12.1 (0.7)	b

*Mean values from 4 samples; Values in parentheses are standard deviations; *X*: Duncan's test in relation to the reference at the 99.9% significance level (a), the 95% significance level (b), and without an evident significant difference at $p \geq 0.05$ (c).

Surface roughness

Surface roughness values of oriental beech and Scots pine wood samples before and after the weathering test are given in table 4. When compared to the Scots pine wood, the increase in surface roughness values of oriental beech control samples after the weathering test was found to be quite high [Feist 1990].

During the weathering tests, the wood surface rapidly absorbs rain and the relative humidity and encloses these within the wood cell walls with a capillary movement [Reinprecht and Hulla 2015]. Moreover, rain and the relative humidity result in an increase of the wood surface roughness and reaction products and the removal of carbohydrates through hydrolization [Williams 2005]. Therefore, coating of wood surfaces with water resistant materials significantly prevents the increase in surface roughness [Evans et al. 2008].

As can be seen from table 4, the post-weathering test change in surface roughness values of wood samples coated with acrylic resin containing UV absorber is quite low. Similar studies report that coating the wood surfaces with water resistant surface coatings and MCQ treatment significantly reduces surface erosion and increases the surface roughness under outdoor conditions [Freeman and McIntrye 2008].

Macroscopic evaluation

Due to factors such as the region's altitude, climate conditions, air pollution, etc. differ in the two pilot regions selected for the weathering test, the visual evaluation points of samples were found to be different as well. As shown in figure 1 and 2, before the weathering test, the visual evaluation of the test and control wood samples is quite high.

After the weathering test, the visual evaluation performance of test and control samples from the Hıdırnebi plateau was found to be higher in comparison to those from the Uzungöl plateau (fig. 3 and 4). The reason is that when compared to the Hıdırnebi plateau, samples from the Uzungöl plateau were found to have a denser pollution. Moreover, non-treated wood samples coated with acrylic resin containing UV absorber were found to have deformations on their sides after the weathering. The dirt layer forming on the wood surface coated with water resistant acrylic resin containing UV absorber can be cleaned with a slightly damp cloth [Nowaczyk-Organista 2008; Xie et al. 2008; Nejad 2011].

Table 4. Surface roughness values of test and control wood samples before and after weathering

Beech	Before weathering			After weathering			Pine	Before weathering			After weathering		
	Ra	*Rz*	*X*	*Ra*	*Rz*	*X*		*Ra*	*Rz*	*X*	*Ra*	*Rz*	*X*
Uzungöl													
1	9.1 (3.0)	60.5 (14.7)	c	19.7 (3.8)	130.9 (17.1)	c	1	6.6 (1.5)	9.4 (9.4)	c	13.3 (3.3)	170.4 (11.2)	c
2	3.4 (0.8)	16.6 (2.5)	b	3.5 (0.8)	18.4 (2.9)	b	2	2.7 (0.5)	14.1 (2.6)	b	2.8 (0.9)	15.2 (2.0)	b
3	3.6 (0.8)	12.9 (0.9)	a	3.6 (0.8)	18.5 (2.4)	b	3	4.0 (0.9)	20.4 (2.7)	a	4.1 (1.2)	21.2 (3.0)	b
4	3.3 (0.6)	17.0 (2.6)	b	3.3 (0.9)	19.1 (3.6)	b	4	2.6 (0.3)	13.5 (3.2)	b	2.9 (1.1)	16.2 (3.0)	b
5	3.0 (0.5)	16.4 (2.5)	b	3.3 (0.9)	18.5 (3.2)	b	5	3.6 (1.3)	18.2 (4.2)	b	4.0 (1.5)	21.2 (4.7)	b
6	4.0 (1.7)	16.0 (3.6)	a	4.3 (1.7)	23.6 (3.6)	a	6	3.5 (0.8)	18.1 (2.8)	a	3.9 (0.8)	20.1 (3.8)	a
7	1.9 (0.6)	11.4 (2.4)	b	2.5 (0.8)	14.7 (2.7)	b	7	2.5 (1.3)	12.8 (2.2)	b	2.7 (0.8)	16.1 (2.5)	b
Hıdırnebi													
1	5.7 (1.9)	50.0 (10.3)	c	18.5 (2.7)	119.6 (18.6)	c	1	5.3 (2.0)	14.3 (11.7)	c	10.2 (2.0)	131.3 (10.2)	c
2	3.1 (0.6)	15.5 (2.9)	b	3.5 (0.6)	16.6 (4.3)	b	2	3.4 (0.7)	16.9 (4.2)	b	5.3 (2.3)	17.8 (5.5)	b
3	2.9 (0.6)	15.2 (3.7)	b	3.2 (1.1)	17.8 (5.3)	b	3	3.4 (0.8)	17.3 (4.3)	b	4.0 (1.0)	19.9 (4.8)	b
4	3.0 (1.1)	16.4 (5.3)	a	3.5 (0.9)	19.2 (6.1)	a	4	1.9 (0.6)	12.0 (3.4)	b	2.4 (0.9)	13.7 (3.6)	b
5	2.5 (0.8)	17.1 (4.3)	b	3.5 (0.7)	18.4 (4.3)	b	5	3.1 (1.1)	17.4 (4.9)	b	4.1 (1.8)	18.8 (6.5)	b
6	3.2 (1.7)	18.1 (4.2)	a	3.4 (0.8)	21.1 (3.5)	a	6	3.3 (0.7)	17.7 (4.1)	a	3.5 (1.7)	19.7 (4.8)	a
7	3.1 (1.0)	15.7 (4.6)	a	3.3 (1.1)	18.0 (5.9)	a	7	3.2 (1.2)	16.8 (4.3)	b	3.3 (1.2)	17.7 (5.3)	b

*Mean values from 4 samples; Values in parentheses are standard deviations; *X*: Duncan's test in relation to the reference at the 99.9% significance level (a), the 99% significance level (b), the 95% significance level (c), and without an evident significant difference at $p \geq 0.05$ (d).

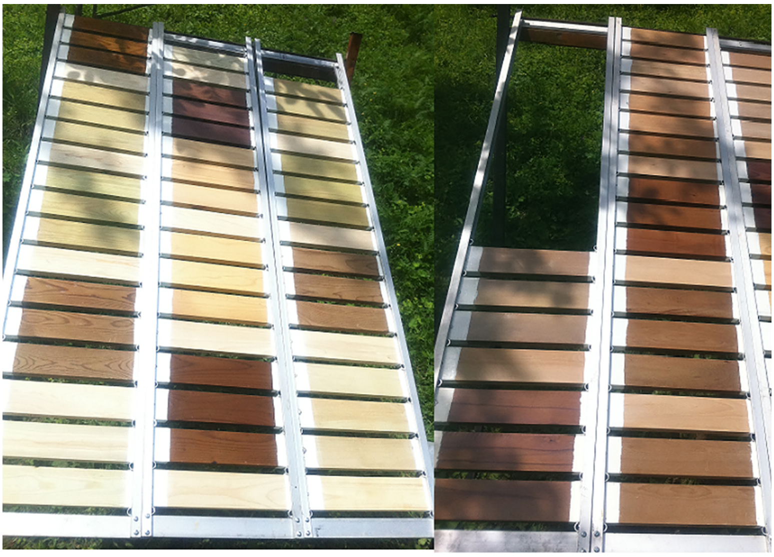

Fig. 1. The control and test samples before weathering in the Uzungöl plateau

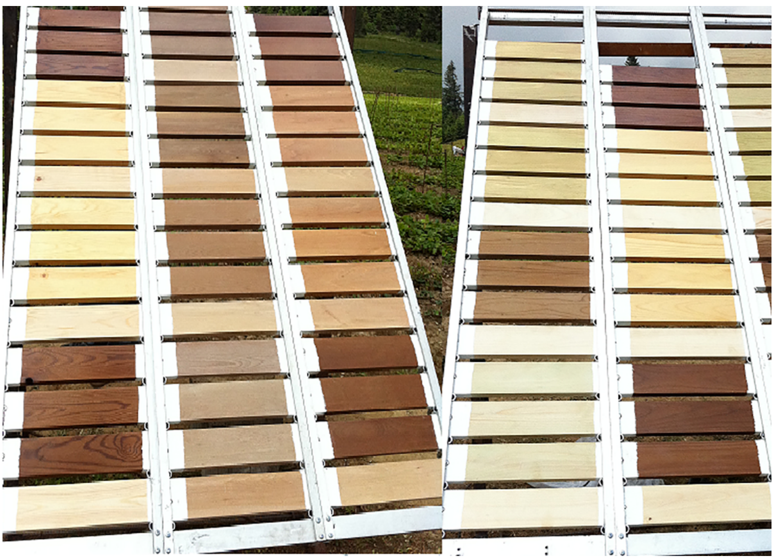

Fig. 2. The control and test samples before weathering in the Hıdırnebi plateau

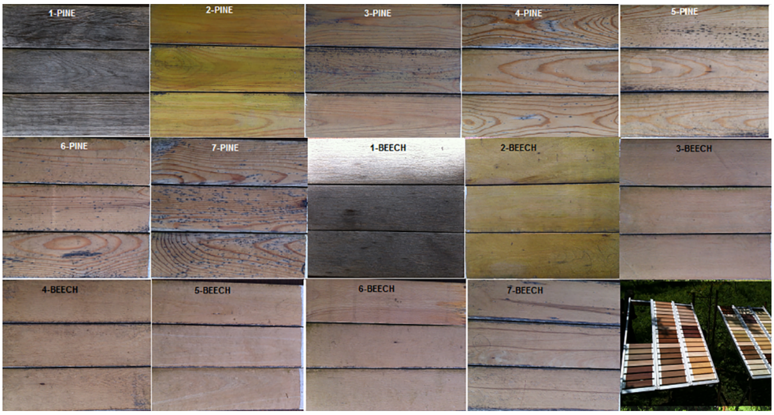

Fig. 3. The control and test samples after weathering in the Uzungöl plateau

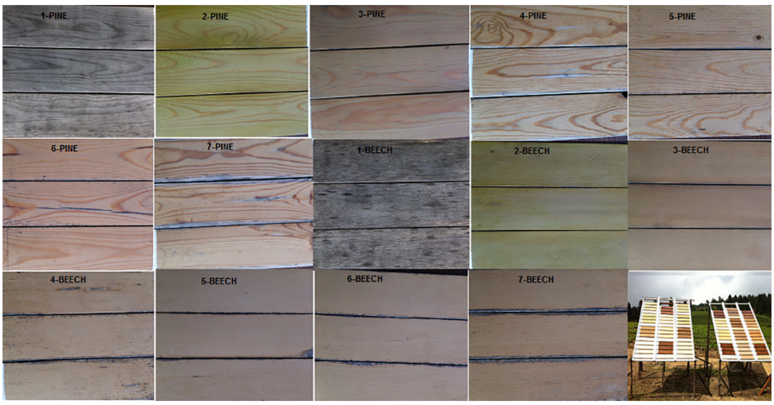

Fig. 4. The control and test samples after weathering in the Hıdırnebi plateau

As shown in table 5, according to the evaluation performed as per the ASTM D 662-93 standard, the highest point is 10, which means that a sample surface has no visible erosion. In comparison to the control samples, macroscopic evaluation of wood surfaces coated with acrylic resin containing UV absorber received quite high points [Ozgenc and Yildiz 2016] (table 5). It can be seen from Table 5 that especially wood samples coated with acrylic resin containing UV absorber after MCQ impregnation treatment received quite high visual evaluation points. Other studies also show that the application of acrylic resin containing UV absorber on the wood surfaces yields high performance under outdoor conditions [Custódio and Eusébio 2006]. According to previous studies, the coating treatment with water repelling transparent acrylic resin does not provide effective protection against photo-degradation in weathering conditions. However, high durability performance of wood surfaces coated with acrylic resin organic or inorganic UV absorber was determined [Schaller et al. 2008; Forsthuber et al. 2013].

Table 5. Macroscopic evaluation of test and control wood samples after natural weathering

Test and control samples	Oriental Beech		Scots Pine	
	Uzungöl	Hıdırnebi	Uzungöl	Hıdırnebi
1	2	4	3	4
2	7	9	7	8
3	8	9	6	7
4	6	6	5	6
5	6	6	5	7
6	5	5	4	6
7	6	6	5	7

Note: A point scale of 10 (flawless surface with no erosion) to 0 (surface with high level of erosion) according to ASTM D 662-93 standard.

Conclusions

A fairly high preservation is obtained against external environmental conditions of wood surfaces treated with UV absorber containing acrylic resin. The application of UV absorbing acrylic resin to wood surfaces subjected to MCQ impregnation and heat treatment improves colour stability and significantly prevents the increase in surface roughness. While the UV absorption rate is low in control wood surfaces under the effect of UV light and rain, there was a small change in the UV absorption rates in wood samples coated with UV absorbing acrylic resin. Several differences were identified during an examination of organic and inorganic UV absorbing substances in terms of resistance to natural weather conditions.

Wood samples coated with acrylic resin with inorganic UV absorbance after MCQ impregnation treatment yielded especially good results in terms of colour stability, roughness values and macroscopic evaluation. As for the wood samples coated with inorganic UV absorbance acrylic resin after preservative treatment, the decrease in UV absorption after the weathering test was found to be the smallest. After the natural weathering test, especially due to factors such as air pollution, degradation occurring in wood samples from the Uzungöl plateau was higher in comparison to those from the Hıdırnebi plateau. According to the macroscopic evaluation, the acrylic coating systems including UV absorbers completely eliminate erosion such as the formation of cracks, tears and fibre stand-up on wooden surfaces.

It is thought that experimentations shall be conducted by applying various water resistant surface-coating systems on wood with and without preliminary preservative treatment against degradation occurring under outdoor conditions. It is suggested that research on the durability of wood samples subjected to various surface coating systems with and without preliminary preservative treatment under natural weather conditions should be conducted as a continuation of this study.

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List of standards

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DIN 4768:1990 Determination of values surface roughness parameters Ra, Rb, Rmax using electrical contact (stylus) institute
EN 927-3:2013 Paints and varnishes – Coating materials and coating systems for exterior-Part 3: Natural weathering test
ISO 7724:1984 Paints and varnishes – Colorimetry

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