Assessment of the Combined Charring and Coating Treatments as a Wood Surface Protection Technique – Supplemental Material

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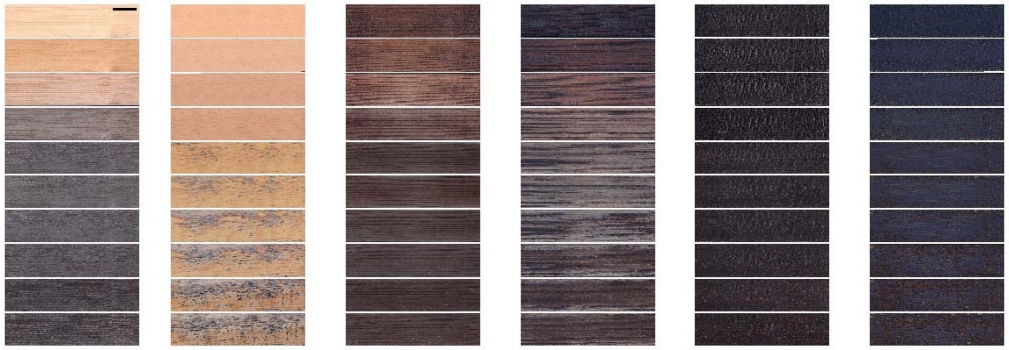
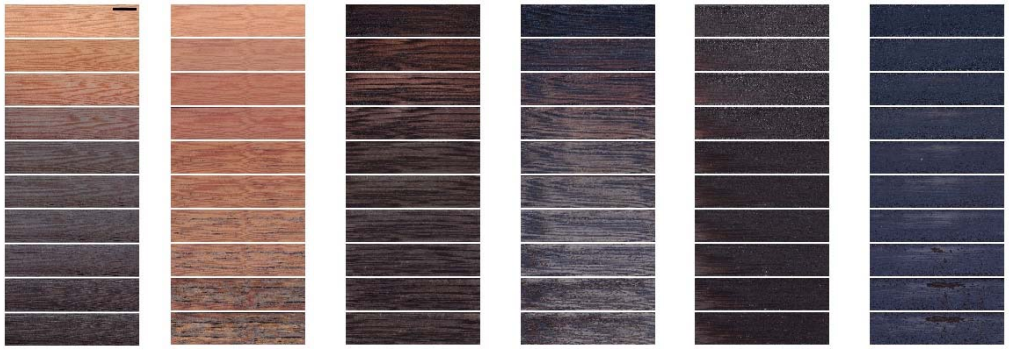
Supplemental Results to Changes Caused by the Natural Weathering

1. Images of Samples

The images of the samples before the exposure to natural weathering and the images of samples taken in each monitoring period are shown in Table S1.

Table S1. The images of the samples before the exposure to natural weathering and the images of samples taken in each monitoring period. The length of the scale bars is 50 mm.

Time of weathering	Spruce wood samples					
	S	S+Co	Ch+B	Ch+B+Co	Ch	Ch+Co
Before 3 months 6 months 9 months 12 months 15 months 18 months 21 months 24 months						
Time of weathering	**Larch wood samples**					
	S	S+Co	Ch+B	Ch+B+Co	Ch	Ch+Co
Before 3 months 6 months 9 months 12 months 15 months 18 months 21 months 24 months						

2. Observations Detected in Visual Assessment of Samples by the Period of Monitoring

2.1. Cracking

Cracking was evaluated according to the SIST ISO 4628-4 [38] standard. The results are presented in Table S2.The assessment consisted of the following three parts:

I. The first assessment defines the extent of cracking:
   - 0 – none,
   - 1 – less than a few,
   - 2 – a few,
   - 3 – medium,
   - 4 – medium dense and
   - 5 – dense.

II. The second assessment defines the size of cracking:
   - 1 – visible only at 10× magnification,
   - 2 – barely visible to the naked eye,
   - 3 – distinctly visible to the naked eye,
   - 4 – large cracks up to 1 mm wide and
   - 5 – very large cracks over 1 mm wide.

III. The third assessment defines the depth of cracking:
   - a – superficial cracks, the top layer is not completely cracked,
   - b – the top layer is completely cracked, the bottom layer mostly undamaged, or
   - c – the entire coating system is cracked.

Table S2. The results of visual assessment of cracking by month of inspection.

Wood type	**Surface treatment**	**Cracking by month**								
		1	3	6	9	12	15	18	21	24
Spruce	S+Co	0-0-0	0-0-0	1-2-b	2-3-c	2-3-c	3-3-c	3-4-c	3-4-c	3-4-c
	Ch+B+Co	0-0-0	0-0-0	1-2-b	2-3-c	3-3-c	5-5-c	5-5-c	5-5-c	5-5-c
	Ch+Co	5-4-c	5-4-c	5-4-c	5-4-c	5-5-c	5-5-c	5-5-c	5-5-c	5-5-c
Larch	S+Co	0-0-0	0-0-0	1-1-a	3-3-c	3-3-c	4-4-c	4-4-c	5-5-c	5-5-c
	Ch+B+Co	0-0-0	0-0-0	0-0-0	2-2-b	2-2-b	2-2-b	3-3-c	3-3-c	3-3-c
	Ch+Co	5-4-c	5-4-c	5-4-c	5-4-c	5-4-c	5-4-c	5-5-c	5-5-c	5-5-c

2.2. Flaking

Flaking was evaluated according to the SIST ISO 4628-5 [39] standard. The results are presented in Table S3. The assessment consisted of the following three parts:

I. The first assessment defines the total size of the flaked surface:
   0 – no flaking,
   1 – flaked at least 0.1% of the surface,
   2 – flaked from 0.3% to 1% of the surface,
   3 – flaked from 1% to 3% of the surface,
   4 – flaked from 3% to 15% of the surface and
   5 – flaked at least 15% of the surface.

II. The second assessment defines the average length of flaked surface:
   1 – up to 1 mm,
   2 – up to 3 mm,
   3 – up to 10 mm,
   4 – up to 30 mm and
   5 – above 30 mm.

III. The third assessment defines the place of flaking:
   a – the top layer flakes from the bottom layer, or
   b – the entire coating system flakes from the substrate.

Table S3. The results of visual assessment of flaking by month of inspection.

Wood type	**Surface treatment**	**Flaking by month**								
		1	3	6	9	12	15	18	21	24
Spruce	S+Co	0-0-0	0-0-0	0-0-0	1-1-b	3-2-b	5-3-b	5-3-b	5-4-b	5-4-b
	Ch+B+Co	0-0-0	0-0-0	0-0-0	2-3-b	2-3-b	4-4-b	5-5-b	5-5-b	5-5-b
	Ch+Co	1-2-b	2-3-b	3-3-b	3-3-b	4-4-b	4-4-b	5-5-b	5-5-b	5-5-b
Larch	S+Co	0-0-0	0-0-0	0-0-0	0-0-1	2-2-b	3-3-b	4-4-b	5-5-b	5-5-b
	Ch+B+Co	0-0-0	0-0-0	0-0-0	2-2-b	2-2-b	2-2-b	4-3-b	4-3-b	4-3-b
	Ch+Co	0-0-0	0-0-0	2-2-b	2-2-b	3-2-b	3-2-b	4-3-b	5-3-b	5-3-b

2.3. Disfigurements Caused by Fungal or Algal Growth

The intensity of disfigurements was evaluated according to the SIST EN 16492 [40] standard. The results are presented in Table S4. According to the standard, for moulding any staining of the biological origin of the film and/or the substrate was considered, while the cause of the staining (whether it is mould, blue-stain fungi or something else) was not considered. The assessment was visually evaluated with the following grades:

0 – unchanged, i.e. no visible growth,
1 – very slight, i.e. just visible growth,
2 – slight, i.e. clearly visible growth,
3 – moderate, i.e. very clearly visible growth,
4 – considerable, i.e. pronounced visible growth and
5 – very marked visible growth.

Table S4. The results of visual assessment of disfigurements caused by fungal or algal growth by month of inspection.

Wood type	Surface treatment	Disfigurement by microorganisms by month								
		1	3	6	9	12	15	18	21	24
Spruce	S+Co	0	0	1	2	3	4	4	4	4
	Ch+B+Co	0	0	0	0	0	0	0	0	0
	Ch+Co	0	0	0	0	0	0	0	0	0
Larch	S+Co	0	0	0	1	2	3	4	5	5
	Ch+B+Co	0	0	0	0	0	0	0	0	0
	Ch+Co	0	0	0	0	0	0	0	0	0

References

38. *SIST ISO 4628-4; Paints and varnishes—Evaluation of Degradation of Coatings—Designation of Quantity and Size of Defects, And of Intensity of Uniform Changes in Appearance—Part 4: Assessment of Degree of Cracking. International Organization for Standardization, Geneva, Switzerland; 2016.*
39. *SIST ISO 4628-5*; Paints and Varnishes—Evaluation of Degradation of Coatings—Designation of Quantity and Size of Defects, and of Intensity of Uniform Changes in Appearance—Part 5: Assessment of Degree of Flaking. International Organization for Standardization, Geneva, Switzerland; **2016**.
40. *SIST EN ISO 16492*; Paints and Varnishes—Evaluation of the Surface Disfigurement Caused by Fungi and Algae on Coatings. European Committee for Standardization, Brussels, Belgium; **2014**.