



SURFACE DEGRADATION OF WOOD EXPOSED TO EXTERNAL CONDITIONS IN SOUTH AFRICA

Hout Bay House research project in the cooperation with Czech University of Life Sciences in Prague

RESEARCH: The presented part of the research at Hout Bay House is focusing on wood degradation. Wood is an organic material and when is exposed outdoors, it is subjected to process called weathering - combination of factors (mainly UV light and moisture) under which wood degrades. It is important to differ between surface and structural degradation. The surface degradation affects visual properties of wood. On the other hand the structural degradation can cause more serious damages. It can be avoided by proper construction solution (roof overhangs, ventilated air gaps etc.). In the case of this study only the surface degradation of wood is examined. The whole process of wood degradation can not be stopped but it can be decreased by using proper surface treatment.

TEST SAMPLES: Siberian larch wood and thermally modified pine wood are used for the wooden façade of Hout Bay House. To increase the wood protection the 2 layers of natural oil woodstain UV OSMO were used. The test samples are exposed in special stands facing north in the inclination of 45° according to European standards. The degradation process of wooden facade is regularly evaluated both visually and using modern testing equipment.



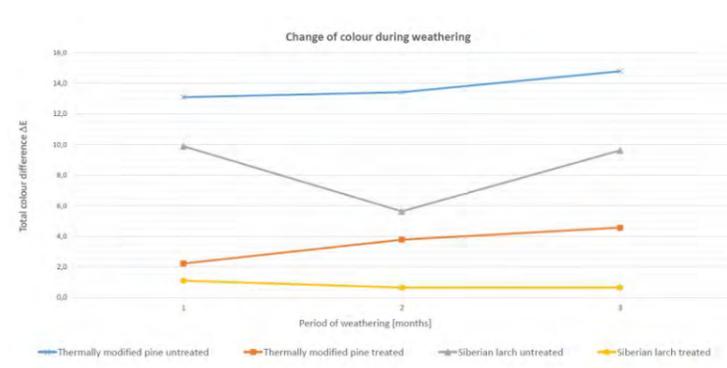
COLOUR CHANGES: Total colour changes (ΔE^*) related to the state before the exposure outdoors and measured using the spectrophotometer:



Test samples	1 month	2 months	3 months
Thermally modified pine untreated	13,10	13,42	14,80
Thermally modified pine treated	2,22	3,77	4,57
Siberian larch untreated	9,89	5,63	9,62
Siberian larch treated	1,10	0,64	0,65

Quick evaluation of the colour changes using the following table:

$0,2 < \Delta E^*$	invisible colour difference
$0,2 < \Delta E^* < 2$	little colour difference
$2 < \Delta E^* < 3$	colour change visible with the high quality filter
$3 < \Delta E^* < 6$	colour change visible with the meidum quality filter
$6 < \Delta E^* < 12$	high colour differences
$\Delta E^* > 12$	different colour

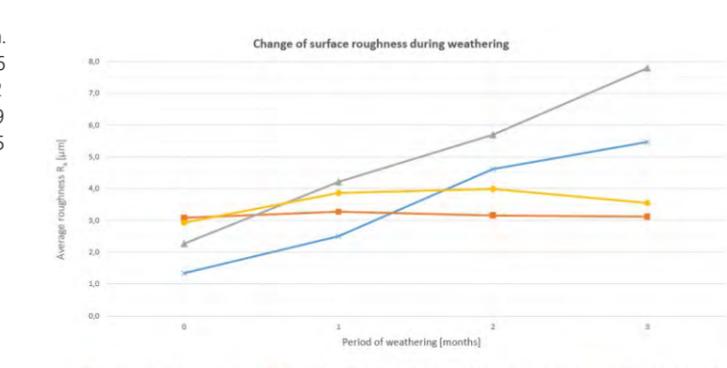


The graph shows a trend where surface treated samples showed only low colour changes on the surface during a three months of outdoor exposure. In the contrary, high colour changes were observed even after 1 month of exposure on the surface of untreated wood (both thermally modified pine and Siberian larch). The total colour difference of thermally modified pine increased during exposure. Regarding the untreated Siberian larch it is possible to observe the trend of large increase in the colour difference in the first month and the drop after other two months. This is due to the degradation of lignin and extractives caused especially by UV radiation. Thus disturbed photodegradation products are washed out from the wood surface and significantly affect the colour change, which can be seen on the attached photos (colour turns yellow first, than gradually darkens and turns gray).

ROUGHNESS CHANGES: changes of arithmetic average roughness (ΔR_a^*) after the period of outdoor exposure measured by the contact profilometer:



Test samples	0 m.	1 m.	2 m.	3 m.
Thermally modified pine untreated	1,34	2,50	4,61	5,46
Thermally modified pine treated	3,08	3,27	3,16	3,12
Siberian larch untreated	2,27	4,21	5,69	7,79
Siberian larch treated	2,93	3,86	3,99	3,55



The similar trend as in the case of colour can be observed in the case of roughness changes - surface treated samples show a slight increase in the roughness during the 3 months of exposure. For untreated wood species a high increase in surface roughness can be observed. Increased surface roughness is related to the leaching products of photodegradation reactions (lignin, extractives, as well as hemicellulose), which can lead to the tearing of cellulose fibers exposed on the wood surface. Weathering also causes a surface erosion, which is more apparent in the less resistant earlywood, and a plastic structure typical especially for softwoods. In general, all the minor increases or decreases can be caused by high variability of wood.

VISUAL APPEARANCE: visual appearance of the samples after 8 months of exposure:

