Fungal and bacterial colonies growing on wood surfaces

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Research Context

SW

NE

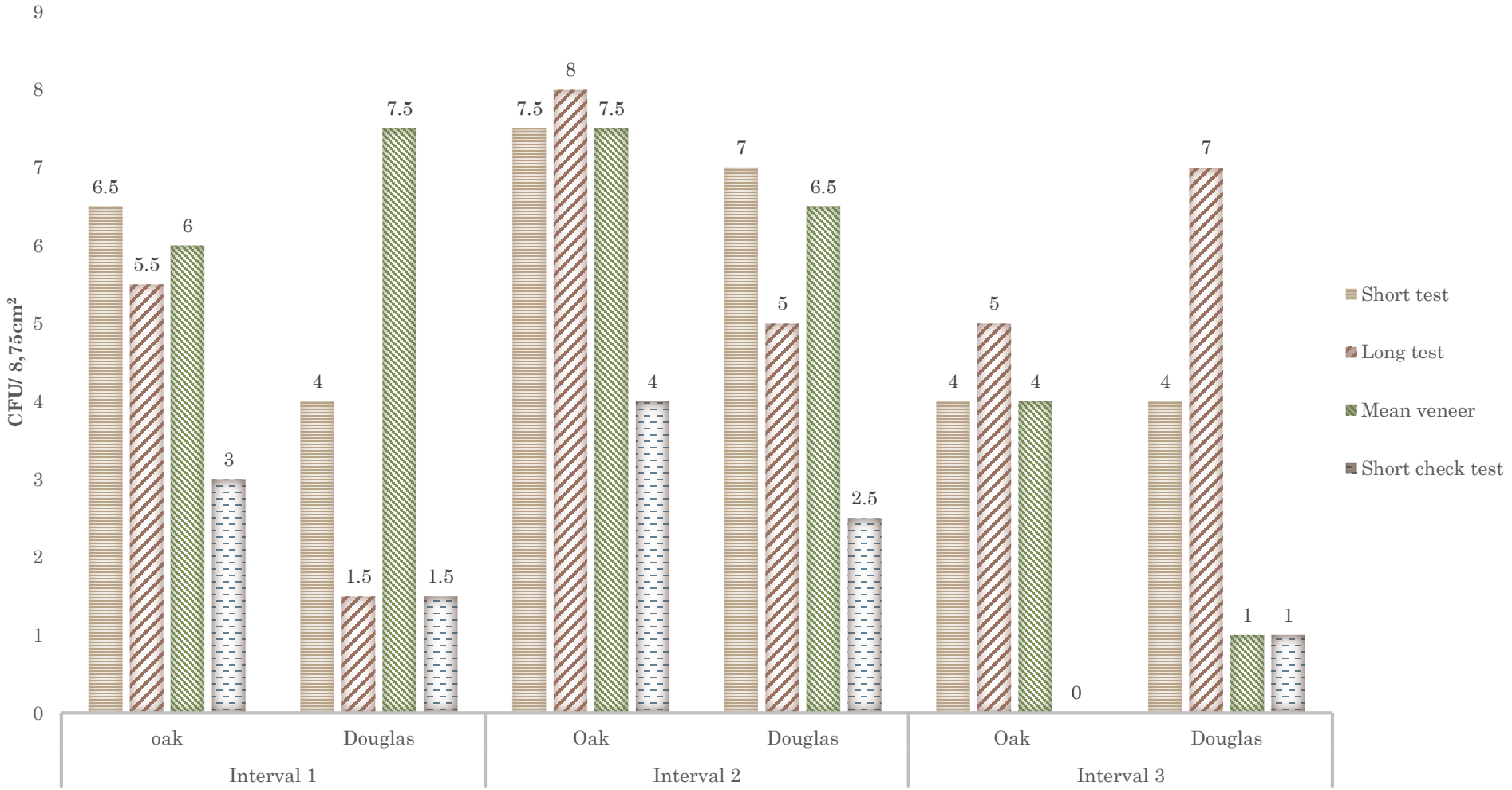
https://www.google.de/maps/@47.2406087,-1.5083861,3a,47.8y,222.05h,91.55t/data=!3m7!1e1!3m5!1sKQ8wazny2vOGscnWH8S5uQ!2e0!6s%2F%2Fgeo0.ggpht.com%2Fcbk%3Fpanoid%3DKQ8wazny2vOGscnWH8S5uQ%26output%3Dthumbnail%26cb_client%3Dmaps_sv.tactile.gps%26thumb%3D2%26w%3D203%26h%3D100%26yaw%3D74.66385%26pitch%3D0%26thumbfov%3D100!7i13312!8i6656

Context

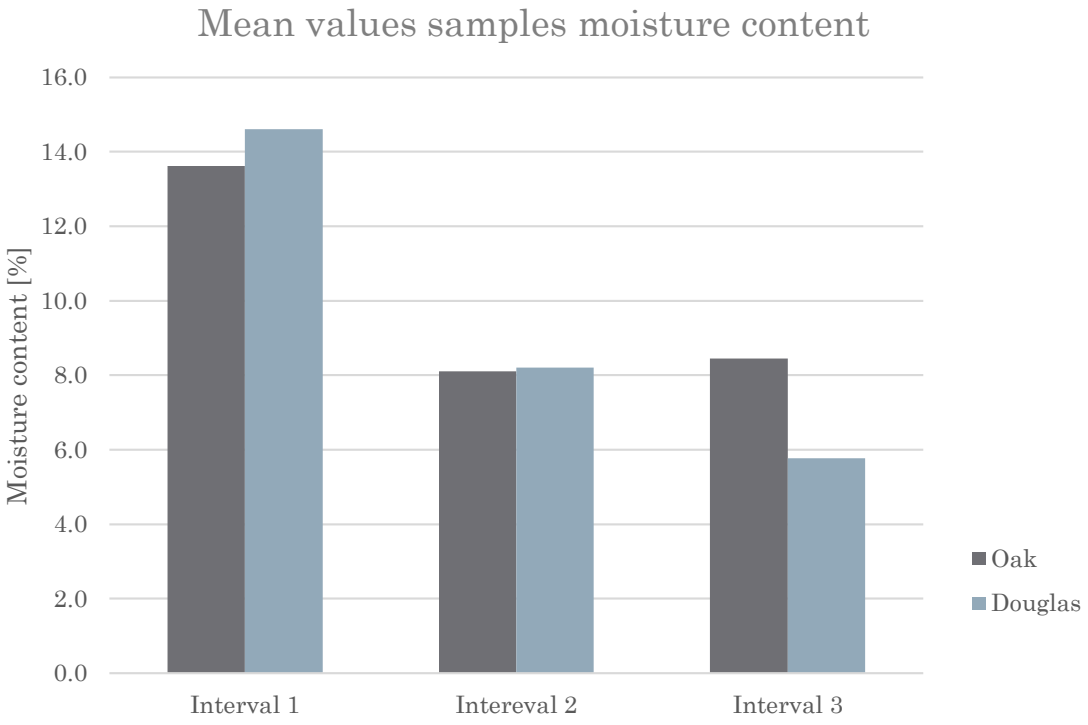
Experiment- Overview

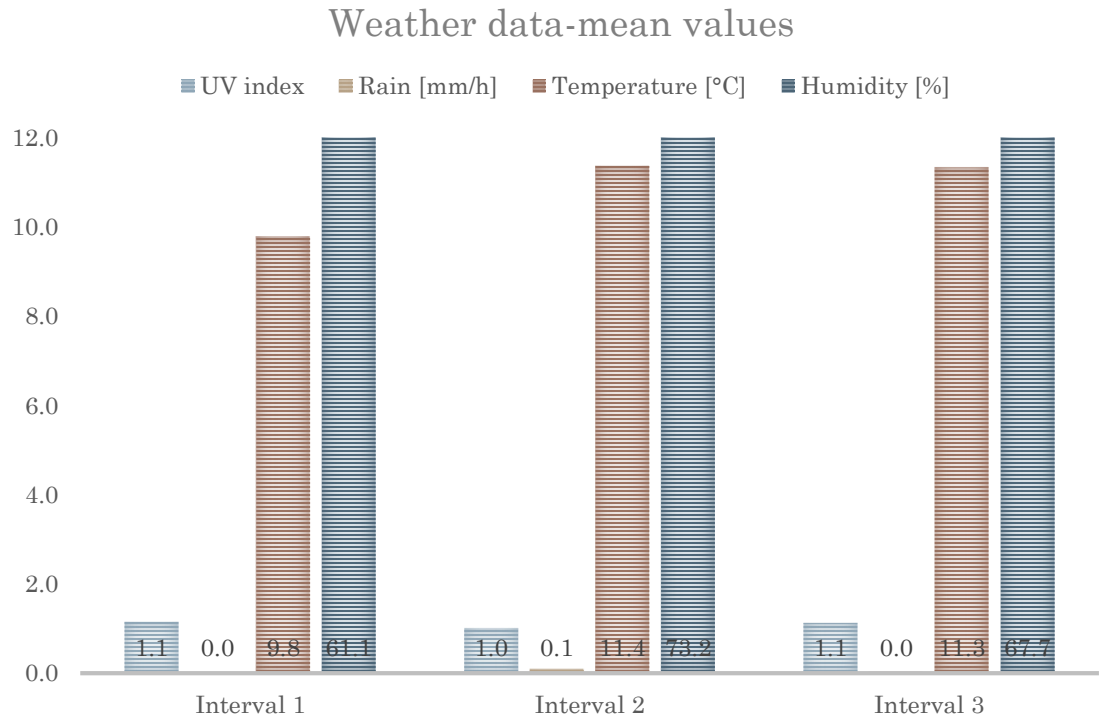
- Samples: *Quercus robur, Pseudotsuga menziesii* and glass
- Sample size: Blocks (10mm) and veneers (2mm)
- Exposure time: 1, 2 and 4 weeks
- Samples in contact with the malt- agar:
  - Short contact (5 s) of blocks, veneers and glass
  - Long contact (24 h) of blocks
  - Short contact (5 s) of blocks after long contact
- Incubation
- Reading the colony forming units (CFU)
- Microcosm-scale experiment

Results- CFU Mean Values

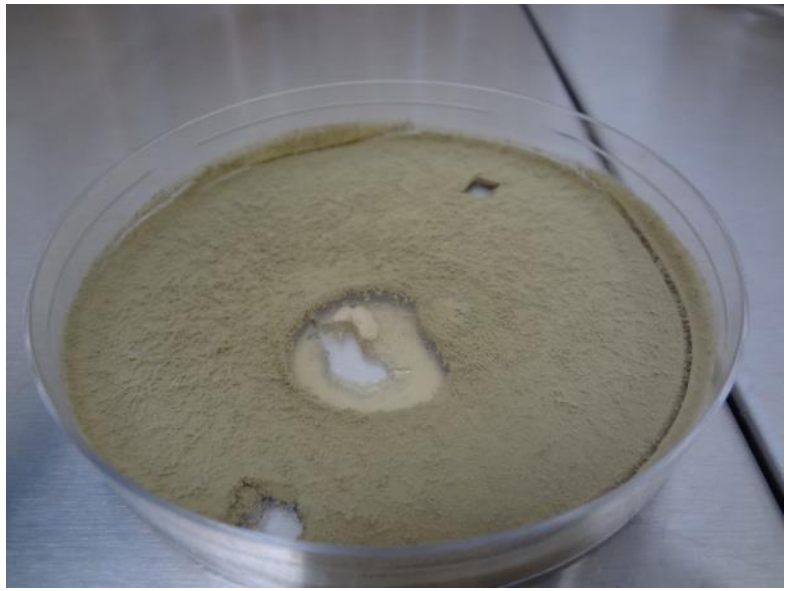


Results- Moisture content and weather data

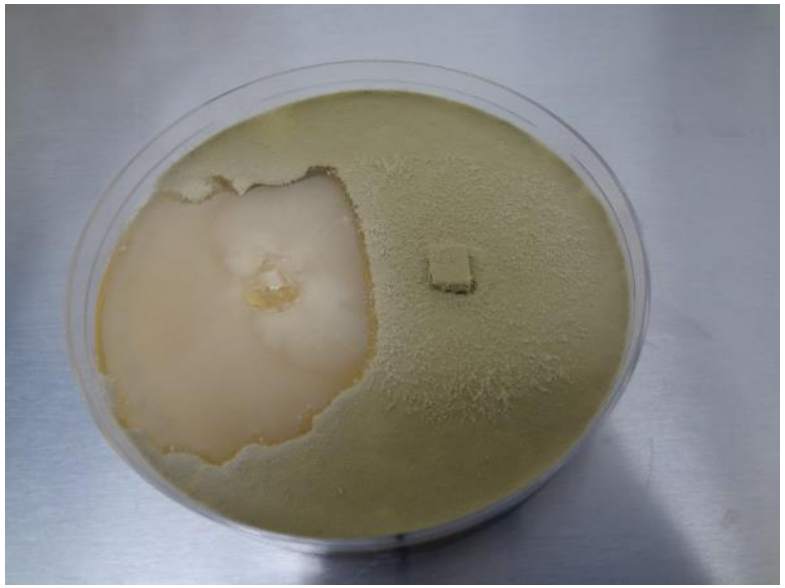




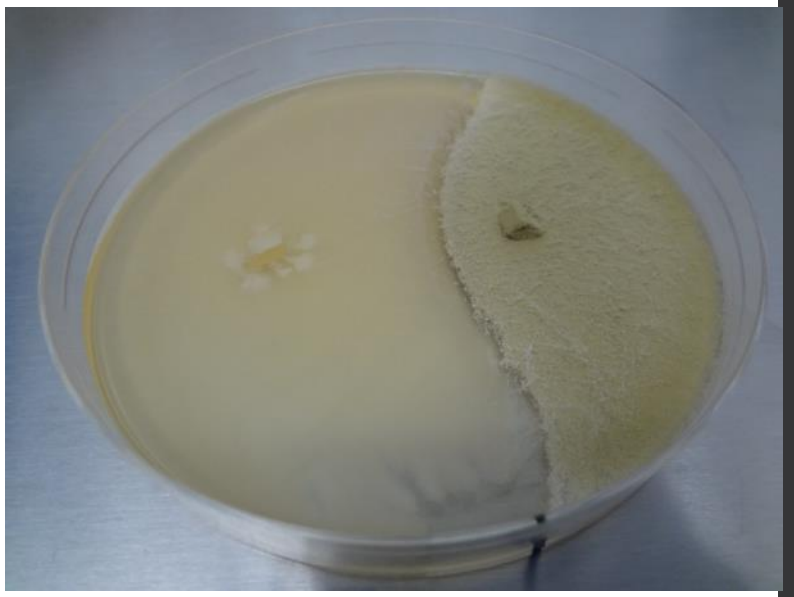
Results- Microcosm scale experiment



Original (Oak block weathered for 1 week pressed on agar plate

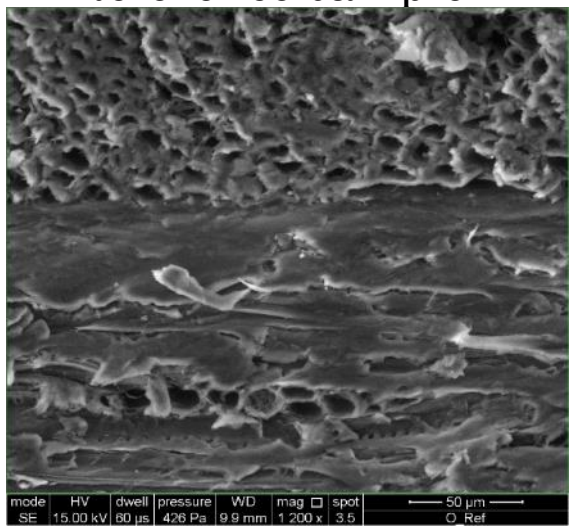
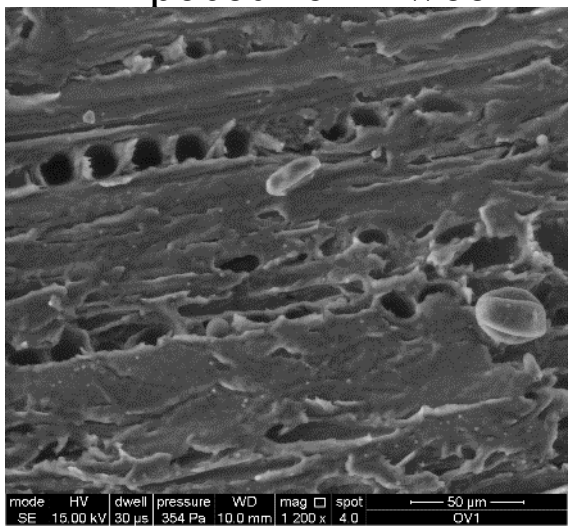
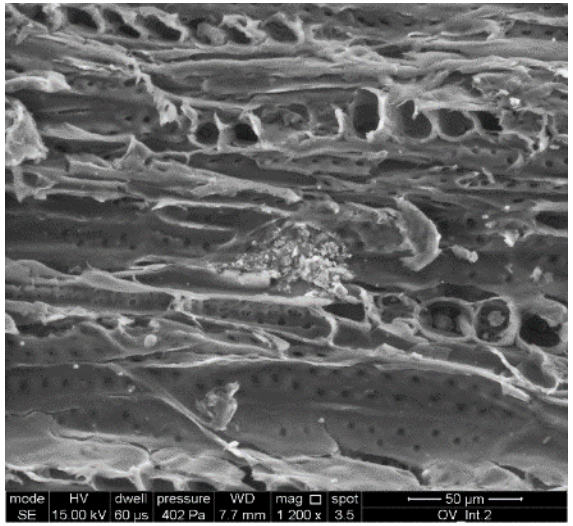
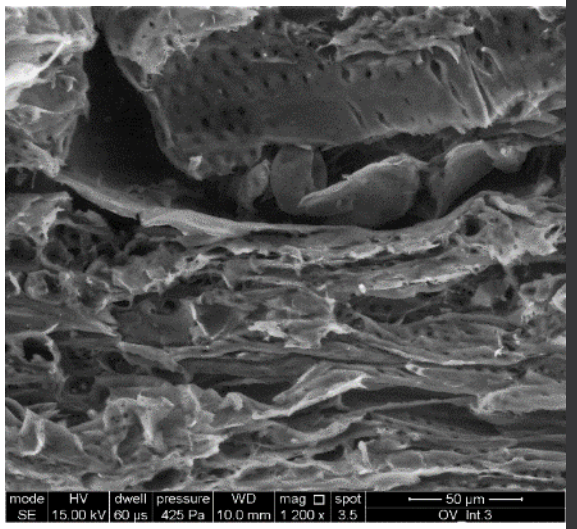
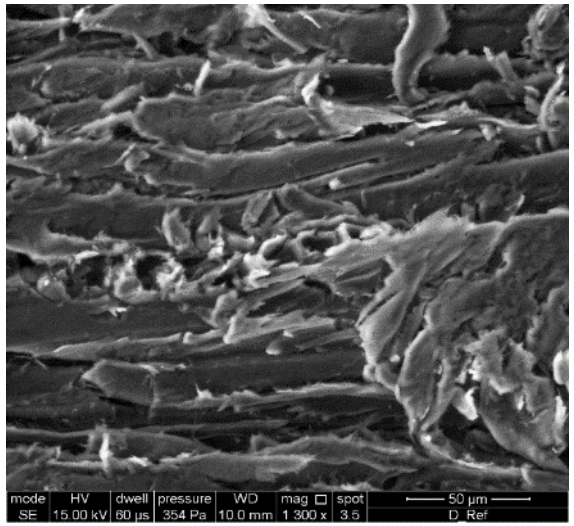
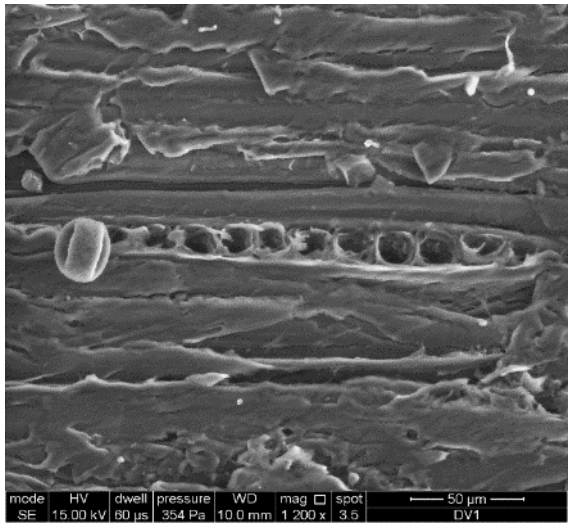
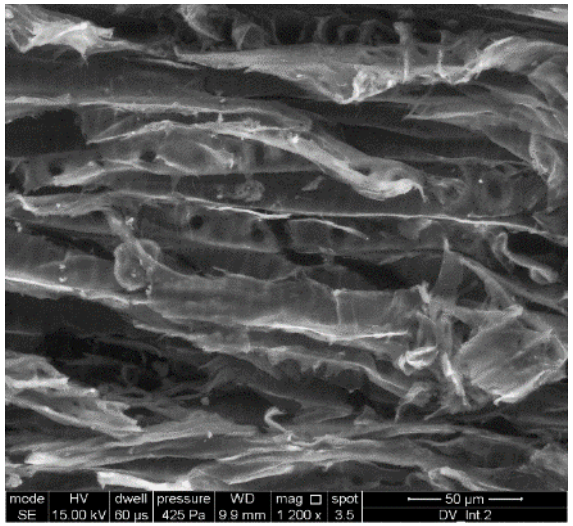
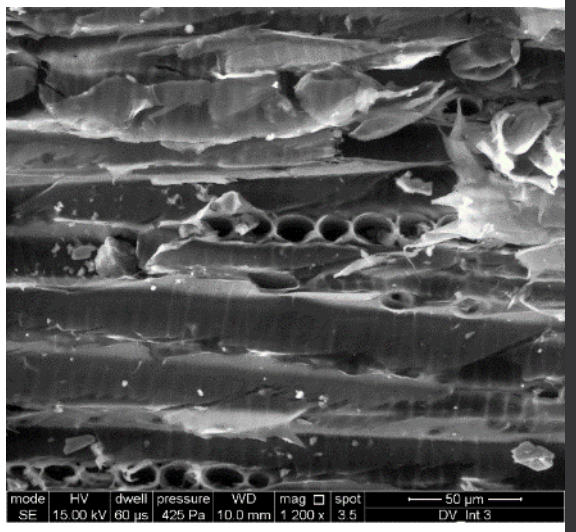


2 purification steps before microcosm scale experiment



3 purification steps before microcosm scale experiment

Results- ESEM

	Reference sample	Exposed for 1 week	2 weeks	4 weeks
Oak				
Douglas				

Conclusion

- Fungi and bacteria are present during the weathering outdoors
- Thicker samples showed slightly higher amount of CFU compared to veneers
- Moisture content of the samples have to be monitored during testing
- Weather conditions have presumably the most important impact on wood degradation
- Delignification and cracks were already visible after 2 weeks of exposure
- Methods such as Fluorescence microscopy and DNA sequencing for identification
- Some bacteria decrease the growth of wood degrading fungi

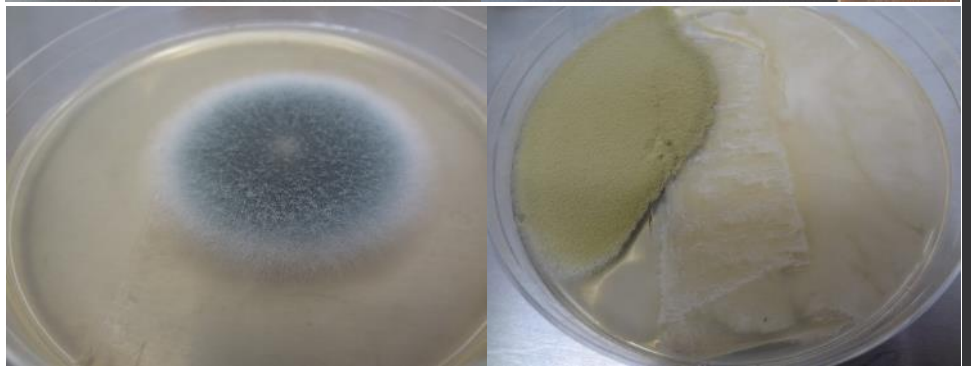
→ Bacteria do play an important role in wood weathering

Experiment- QUV

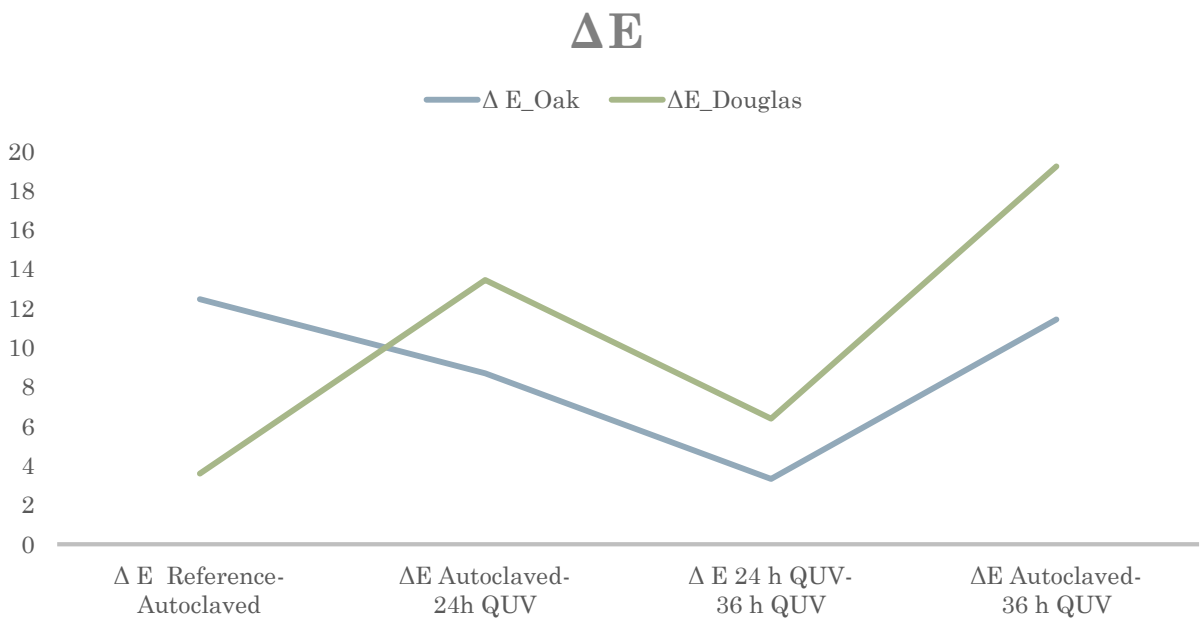
- Samples: *Quercus robur, Pseudotsuga menziesii*
- Sample size: 25 x 75 x 5 mm
- Times of measuring:
  - After cutting
  - Autoclaved
  - 24 h exposed in QUV
  - 36 h exposed in QUV

- Moisture measurements
- Surface contact test
- Colour measurements

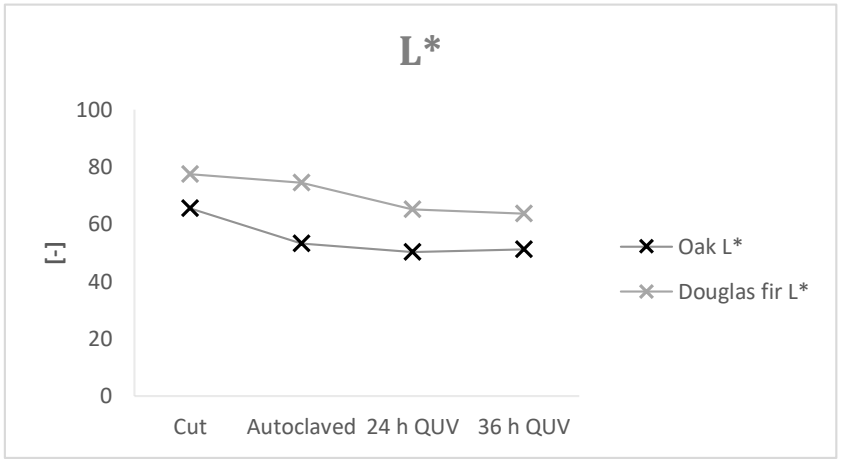
ASTM-G0154-16 Cycle # 7	Function	Temperature [°C]	Irradiation [W/m²/nm]	Time [h]
1	UVA-340	60	1,55	8
2	Water spray	Not controlled	/	0,25
3	Condensation	50	/	3,75

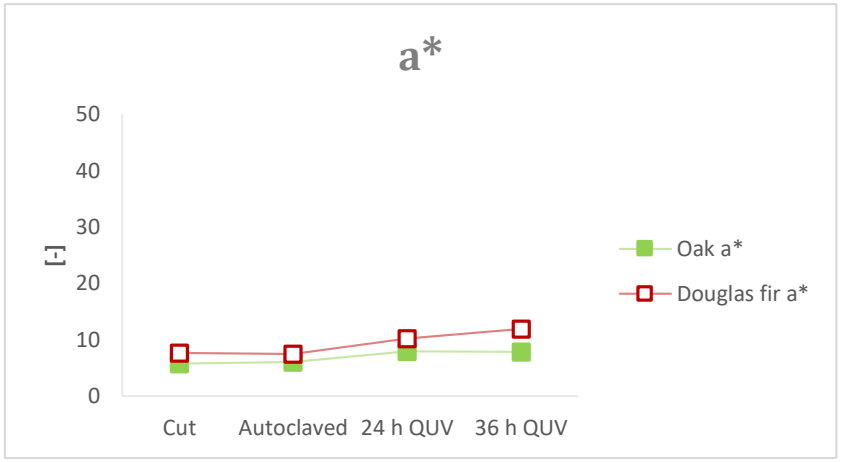


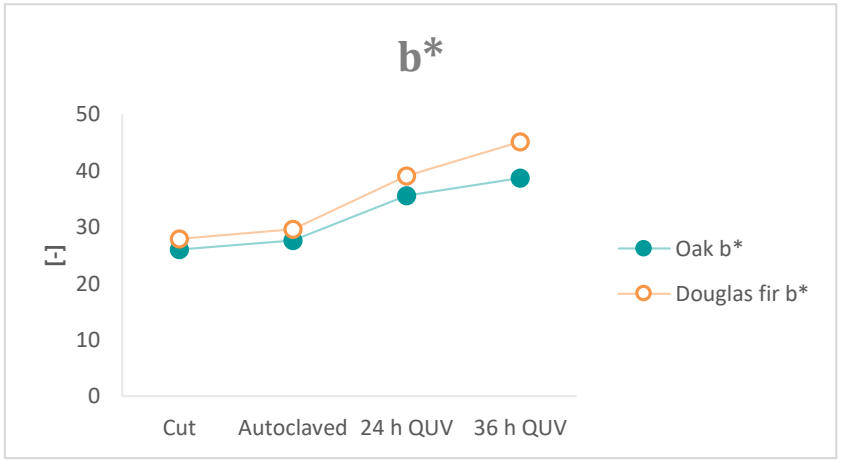
Preliminary Results- Colour measurements



$$\Delta E^* = \sqrt{(L_2^* - L_1^*)^2 + (a_2^* - a_1^*)^2 + (b_2^* - b_1^*)^2}$$







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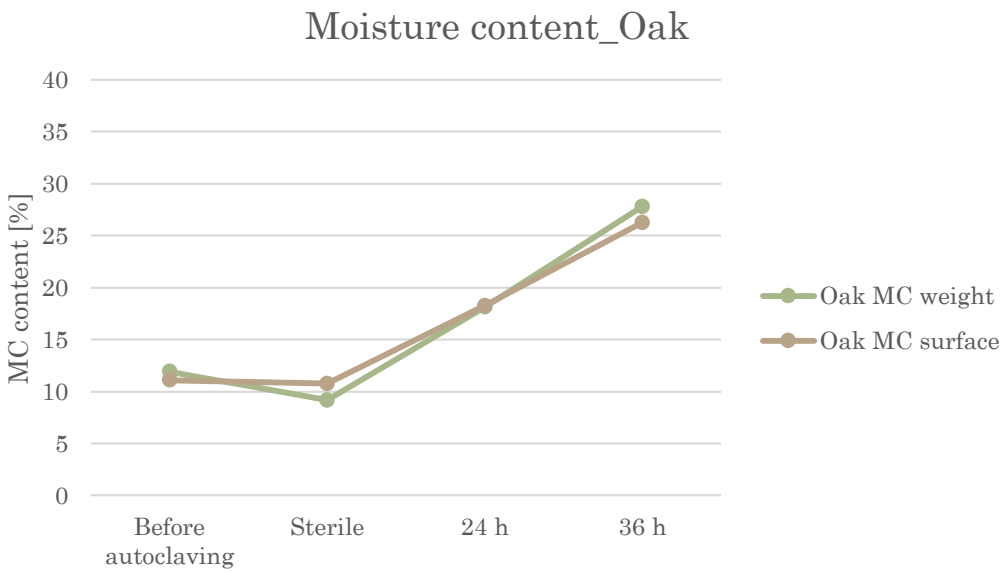
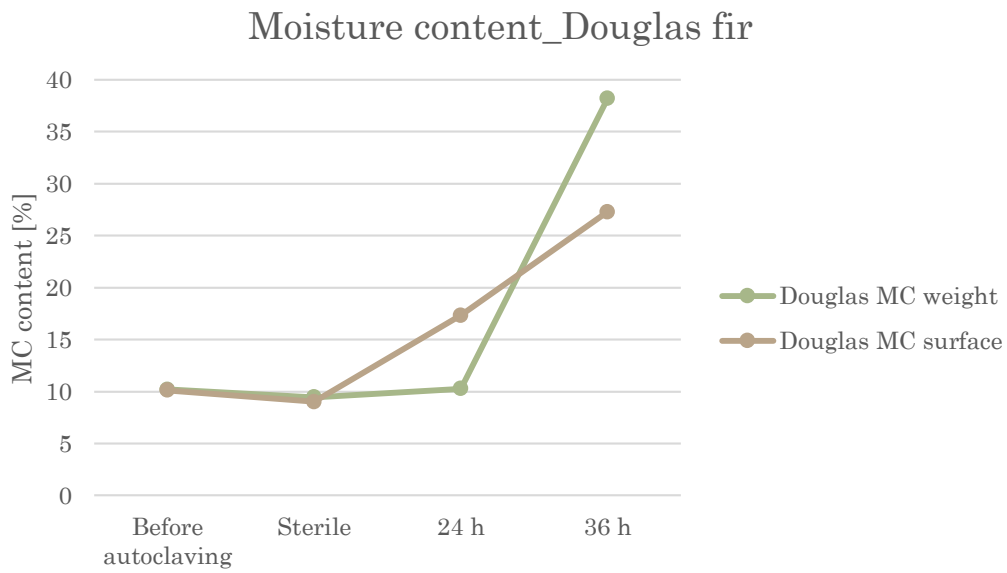
Preliminary Results- Moisture content

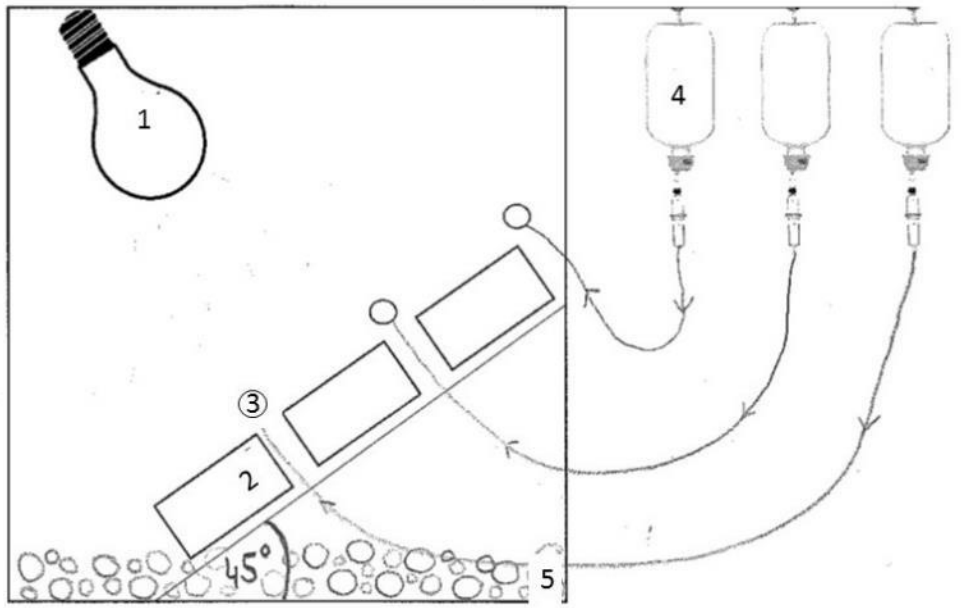




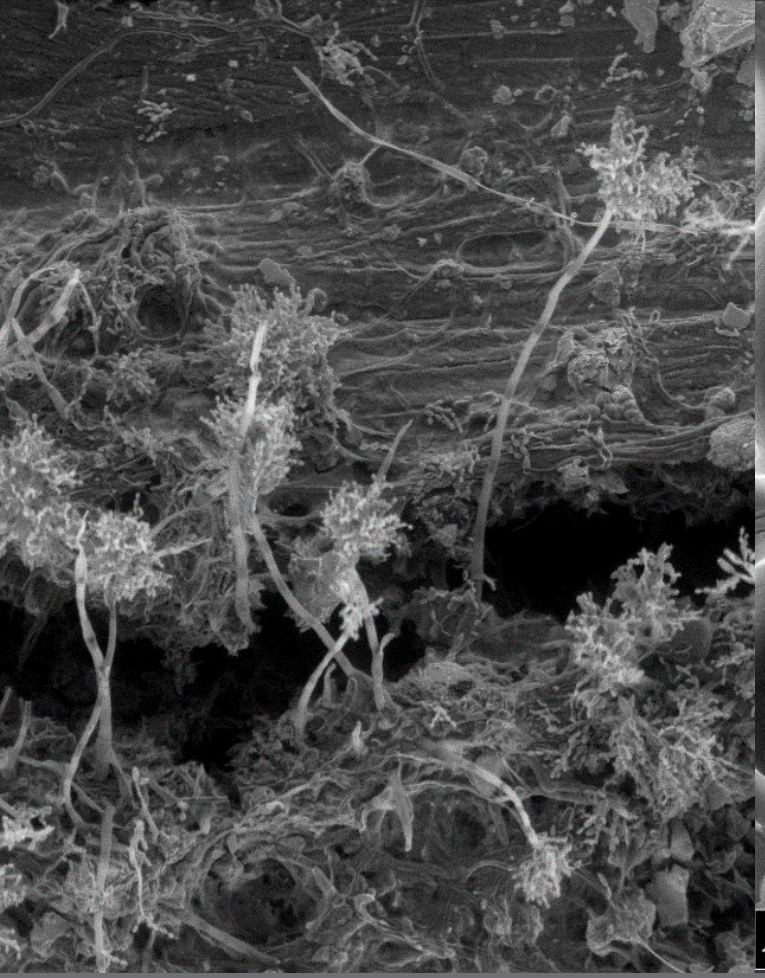
$$MC_{weight} = \frac{W_{wet} - W_{dry}}{W_{dry}} \times 100\ [\%]$$

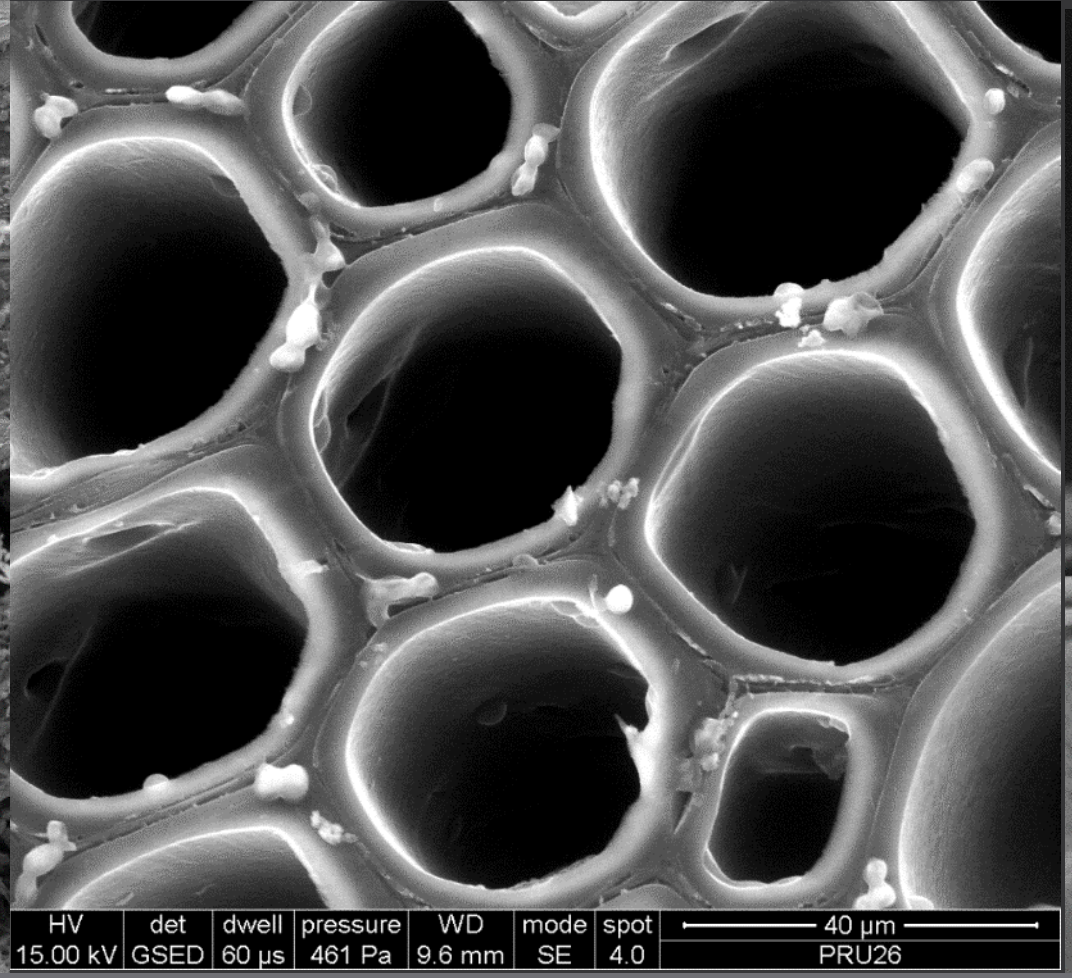
Outlook

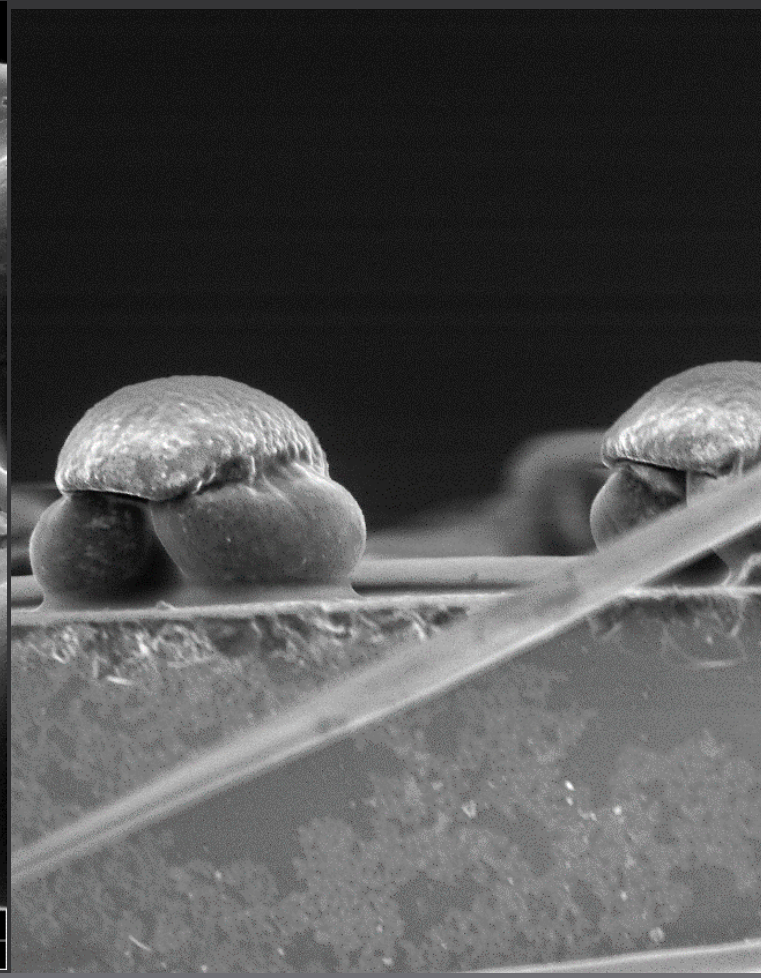
- QUV: Non-sterile weathering test
- Adapted test chamber
  - to test in sterile and non-sterile conditions
  - to test factors separately and in combination



1) Light source
2) Samples
3) Tubes to spread water uniformly on the samples
4) Small storage of sterile /non-sterile water
5) Saturated salt solution







Thank you for your attention

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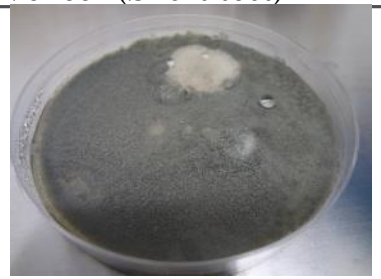
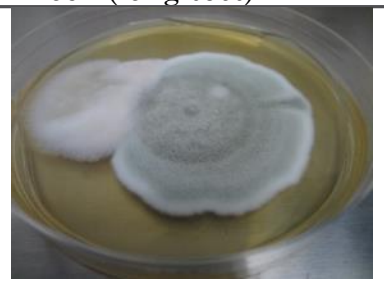
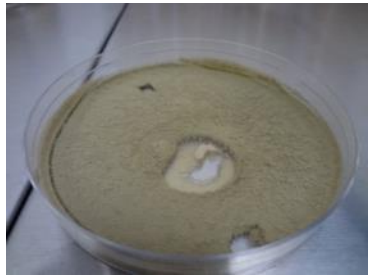
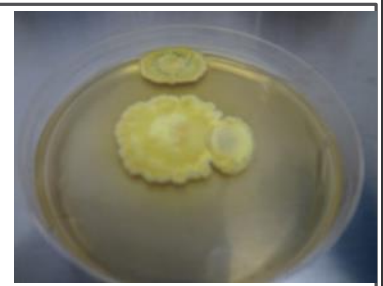
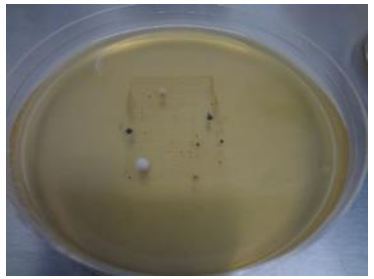
Experiment- Surface contact test

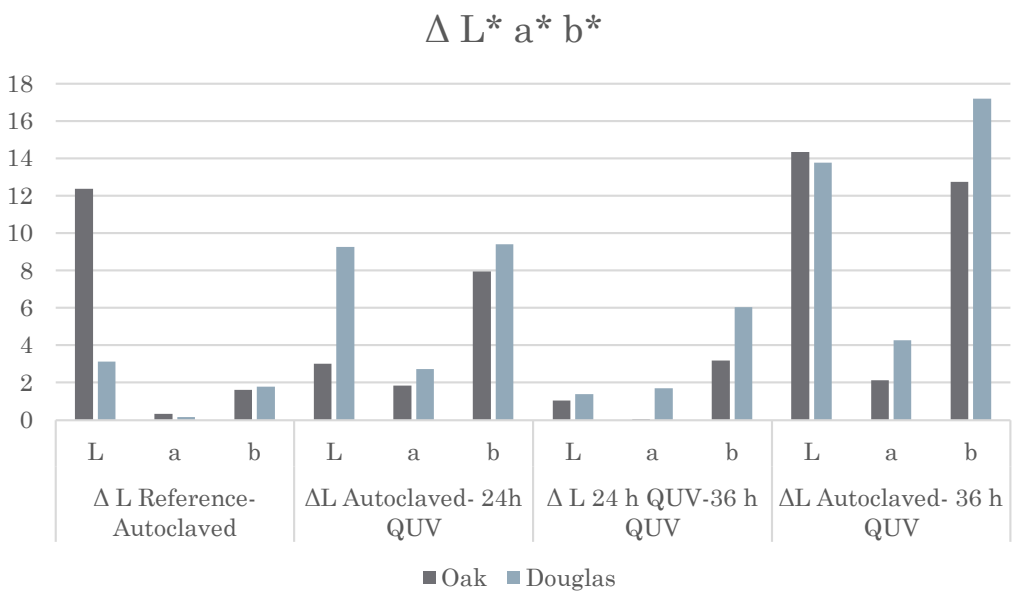
	Block (Short test)	Veneer (Short test)	Block (long test)	Blocks (Short check test)
Oak				
				
Douglas				
				

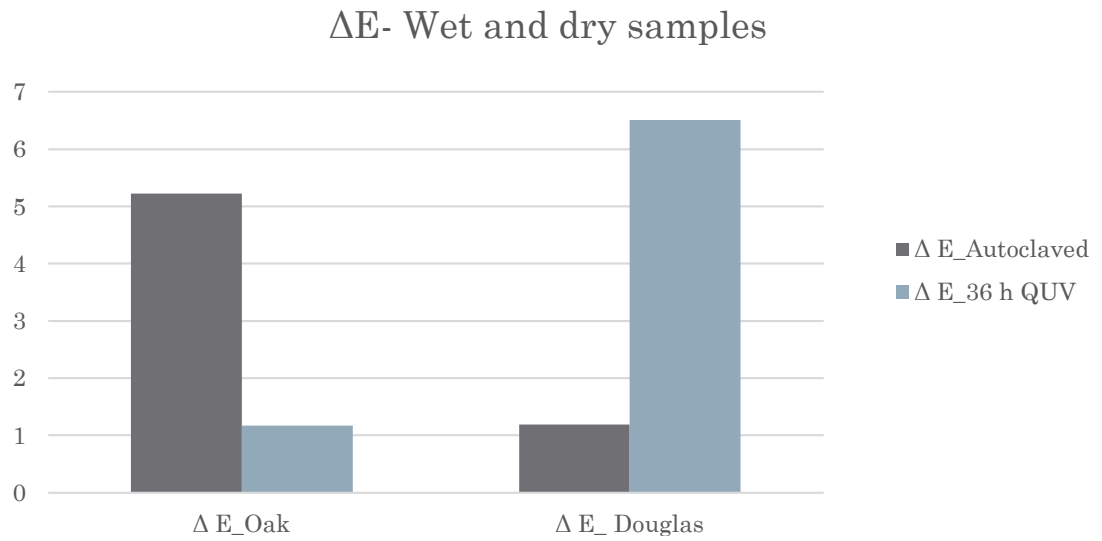
CFU after 1 week

Preliminary Results- Colour measurements

Samples_ Reference (Non-degraded)											
SE L				SE a				SE b			
n=5	n=4	n=3	n=2	n=5	n=4	n=3	n=2	n=5	n=4	n=3	n=2
0,65	**0,74**	**0,73**	**0,62**	**0,17**	**0,19**	**0,20**	**0,17**	**0,50**	**0,52**	**0,64**	**0,62**

Samples_ Weathered for 36 h in QUV											
SE L				SE a				SE b			
n=5	n=4	n=3	n=2	n=5	n=4	n=3	n=2	n=5	n=4	n=3	n=2
0,60	**0,65**	**0,68**	**0,58**	**0,21**	**0,24**	**0,22**	**0,19**	**0,48**	**0,53**	**0,59**	**0,51**





Conclusion QUV experiment

- Blue stain on Douglas fir

→ Non-sterile conditions in QUV

- Moisture gradient higher in Douglas fir than in oak
- Colour change more pronounced in Douglas fir than in oak