

Defence announcement

Public Defence on 30 June 2023

Chemical imaging of modified wood

Title of the doctoral thesis	Hyperspectral imaging and chemometrics to investigate the chemical wood modification
Content of the doctoral thesis	<p>Wood possesses an anisotropic hierarchical structure that causes a heterogeneous distribution of chemical reagents in modified wood at different spatial scales. Due to the heterogeneity in chemical distribution, localised regions of wood may remain susceptible to moisture uptake, dimensional instability, and fungal decay. The identification of regions with insufficient chemical uptake is necessary to develop efficient treatment processes. The studies combined two chemical imaging techniques that differ in their lateral resolution to identify the process-dependent heterogeneity in modified wood. Near-infrared (NIR) hyperspectral imaging identified and quantified the distribution of chemical reagents and the corresponding moisture content at a macroscopic scale of a few millimeters. Chemometric analysis not only revealed the sample-to-sample variations in chemical uptake and the associated moisture content but also highlighted the localised variations, most notably earlywood and latewood differences. Confocal Raman imaging validated the differences between earlywood and latewood on the cellular level and visualised chemical differences between cell wall regions.</p> <p>This thesis demonstrated the ability of chemical imaging techniques to localise chemical reagents in small woodblocks and larger board sections. The findings provide a step forward in understanding the chemical changes caused by wood modification in different hierarchical structures in wood on different length scales. In the future, the methods may be used to characterise other treatments and processes that affect the wood composition.</p>
Field of the doctoral thesis	Wood Material Science
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Remote defence	https://aalto.zoom.us/j/64743122687
Place of public defence	Aalto University School of Chemical Engineering, Lecture hall Ke1, Kemistintie 1, (main door at Biologinkuja) Espoo
Opponent(s)	Professor Ingunn Burud, Norwegian University of Life Sciences, Norway
Custos	Professor Lauri Rautkari, Aalto University School of Chemical Engineering
Link to electronic thesis	https://aaltodoc.aalto.fi/handle/123456789/51
Keywords	Near-Infrared hyperspectral imaging, confocal Raman imaging, wood modification, chemometrics, moisture content