

Abstract

Holzforschung, 70, 855-865 (2016)

Almkvist G., Norbakhsh S., Bjurhager I., Varmuza K.:

Prediction of tensile strength in iron-contaminated archaeological wood by FT-IR spectroscopy - a study of degradation in recent oak and *Vasa* oak.

Oak from the Swedish warship *Vasa* and recent oak that was aged after impregnation with iron(II) chloride has been analyzed by FT-IR spectroscopy and submitted to tensile strength testing. The aim was to investigate correlations between FT-IR bands in the fingerprint region, chemical degradation, and tensile strength in iron contaminated oak.

The concentration of carboxylic functions increased and the acetyl groups in the hemicellulose fraction were decreasing as a function of degradation time. These changes are accompanied by reduced tensile strength and elevated content of oxalic acid (OA) in both *Vasa* wood and the impregnated recent oak samples.

To evaluate the possibility to predict tensile strength from spectral data, chemometric modeling by partial least-squares (PLS) regression was applied. The strategy of repeated double cross validation (rdCV) allowed a realistic prediction of tensile strength.

Overall, chemical changes and mechanical performances of iron contaminated wood are strongly correlated and thus FT-IR spectroscopy is suited to predict the strength properties of the degraded wood.