Structural analysis of Wood-Leather Panels

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ABSTRACT

Nature gives astonishing examples of efficient material use. Due to optimization processes over millions of years, the hierarchy of natural materials is highly adapted to the relevant demands of its environment.
This paper deals with a novel combination of two known materials, wood and leather in the form of wood-leather panels.
The aim of this paper is to assess selected mechanical properties and to determine the structural properties of the material.
An important finding is the difference in mechanical properties for panels prepared with wood particles and –fibers. Whereas all mechanical properties (Internal Bond (IB), Modulus of Elasticity (MOE) and Modulus of Rupture (MOR)) decreased with rising leather content for panels made from leather and particles, the IB showed a non-linear increase for higher leather contents for the combination of leather and wood fibers. In contrast to this, MOE and MOR decreased rather linearly.
The analysis of the panel surface by means of Raman spectroscopy showed the possibility to determine the particle distribution on the surface by means of chemometric methods. It was shown that the spectra of the constituents are not necessarily represented in the panels set of spectra, indicating some chemical changes during the hot pressing. But the set of spectra could be distinguished by statistical methods such as Principal Components analysis and Cluster analysis.
The bulk of the material was analyzed by µm-X-Ray Computed Tomography (µm-CT) with respect to materials distribution and the pore size distribution. It was shown that the three constituents could be segmented by means of statistical methods (Multi Otsu thresholding) and that the distribution of 3D-pore sizes differs for different leather contents.
It can be concluded, that leather shavings are a possible raw material for wood-based panels. With an increasing number of constituents also the complexity rises. Therefore good knowledge on the structure is necessary to predict panels properties sufficiently.