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Habilitation thesis title: Valorisation of bio-based resources for innovative materials, products and applications

Domain: Faculty of Wood Engineering

## SUMMARY

The habilitation treatise entitled "Valorisation of bio-based resources for innovative materials, products and applications" presents the author's contributions to the material science fields of theoretical, experimental and industrial research or implementation in production processes. This present thesis reflects the author's considerations and research merits after graduation the doctoral study at Technical University of Munich (Munich, Germany) in 2009. The habilitation treatise is divided into two main parts: i) scientific and ii) professional achievements with career development plans. Moreover, the different parts contain various chapters with some of the research conducted results from the author's finding during his research activity within Salzburg University of Applied Sciences and in collaboration with other institutes like University Salzburg, Åbo Akademi University in Turku (Finland), University of Ljubljana, University of Natural Resources and Life Sciences in Vienna, Technical University Munich, University of Applied Sciences Upper Austria in Wels (Austria), University of Belgrade, University of Lleida (Spain), FH Campus Wien - University of Applied Sciences in Vienna, and Holzforschung Austria in Vienna. The research activity is mainly related to circular economy and bio-economy. The transition from by-product materials to innovative raw materials and added value products is presented for various case studies. Based on the background from bio-economy some different materials were analysed and identified as possible new materials for different applications.

The first direction of research includes crop materials like different straw-based insulation materials under the author's supervision (Schnabel et al. 2016b). Research with straw of various plant species resulted in low density insulation panels and in materials for blow-in insulation. The information about both insulation products was not published before the starting point of the research project BiInsPa in the year 2012 (Schnabel et al. 2016b).

The second main direction of research includes composite materials produced under the author's supervision from wood fibres and by-products from the leather manufacturing process (e.g. after tanning) (Wieland et al. 2010b;a). The possible combination of leather shavings/particles and wood fibres for innovative fibreboards showed improved material properties, Schnabel et al. (2019c). These first discussions of the possible material combination with different companies and the Salzburg University of Applied Sciences resulted in two further granted research projects (Schnabel 2015).

Besides the compared mechanical properties with low leather amounts decrease the strengths of the panels with increasing leather ratio (Solt et al. 2015). However, enhanced fire resistance properties were only determined with a high leather portion of the fibreboards (Schnabel et al. 2019c).

The third research topic was about antimicrobial effects of wood and wood extractives as well as condensation products from different wood processing steps (e.g. drying and steaming process) for the transformation from waste materials to added value products (Schnabel 2016). Fundamental knowledge was gained in the field of wood extractives and their influence on the microbial activities of wood. Wood samples as well as extractives from different wood species and wood processing steps were analysed for the identification of possible effects (Laireiter et al. 2014).

The second part presents the progress and career development plans from the professional, scientific and academic point of view. Professional and teaching experience includes the short description of the personal development. Scientific research experience is reflected by the number and type of national and international projects which the author managed and supervised. These research and development projects are also important for the development of the department of Forest Products Technology & Timber Constructions at Salzburg University of Applied Sciences at the Campus Kuchl and they should strengthen the transnational and cross-sectoral collaborations between academia and industry within research and Erasmus projects. This includes further collaboration with the Faculty of Wood Engineering at the Transilvania University of Brasov. Proposals of further research activities are based on nature-inspired subjects related to transfer technical into biological processes for material and product development. The changes of these processes may play an important role for solving the challenges in future and to save energy and to reduce material consumption.