

MWP – Young Researcher Abstract 2023

<p>Project title: AI-guided biorefinery optimization for the targeted production of lignin carbohydrate complexes with tunable properties</p>	
<p>Author: Daryna Diment¹, Joakim Löfgren², Matthias Stosiek², Mijung Cho², Michael Hummel¹, Davide Rigo¹, Patrick Rinke² and Mikhail Balakshin^{1,†}</p>	
<p>Affiliation: ¹Department of Bioproducts and Biosystems, Aalto University, Vuorimiehentie 1, 02150 Espoo, Finland ²Department of Applied Physics, Aalto University, Otakaari 1, 02150 Espoo, Finland</p>	<p>E-mail: daryna.diment@aalto.fi</p>
<p>Abstract (approx. 200 words): A synergism between lignin and carbohydrates allows to obtain valuable products with an enhanced performance due to the unique amphiphilic properties possessed by lignin carbohydrate complexes (LCCs). Within the frame of this work, we present an innovative, green, and environmentally friendly approach for lignin valorization by leveraging the power of artificial intelligence, specifically Bayesian optimization (BO), for the targeted production of LCCs through a novel biorefinery concept, namely AqSO Omni (AqSO). Through AI-guided data collection, we have successfully increased the yield of acetone extracted lignin (AEL) while maximizing the amount of carbohydrates within the AEL macromolecule to the outstanding amount of 60 per 100 Ar. Moreover, our research has revealed a strong correlation between the process parameters and the resulting lignin structure, unveiling the influential role of these parameters on the antioxidant properties of lignin. The significance of the demonstrated lignin valorization approach lies in its potential to revolutionize the forest-based industry, enabling the incorporation of this flexible and efficient process into existing biorefinery scenarios. This, in turn, generates an additional value-added stream for the production of lignin-based materials with exciting prospects for versatile biomedical and thermoplastic applications bringing the humanity one step further towards sustainable future.</p>	
<p>Key words: lignin-carbohydrate complexes (LCCs), biorefinery, valorization, machine learning</p>	