Enhancing High Performance Mechanical Properties of Lignin/PVA-Based Fiber: How Purity, Morphology, and Spinnability Play a Role

Silvia Mar'atus Shoimah [1], Yati Mardiyati [1,*], Arif Basuki [1], Valentinus Alphano Dabur [1], Husaini Ardy [1], Sigit Puji Santosa [2], and S. Steven [1]

[1] Material Science and Engineering Research Group, Faculty Mechanical and Aerospace, Institut Teknologi Bandung, Jl. Ganesa 10, Bandung 40132, Indonesia; silviamaratusshoimah@gmail.com (S.M.S.); arifbasuki@itb.ac.id (A.B.); valentinus50@gmail.com (V.A.D.); husaini@material.itb.ac.id (H.A.); and steven@itb.ac.id (S.S.)

[2] Solid Mechanics and Lightweight Structures Research Group, Faculty Mechanical and Aerospace, Institut Teknologi Bandung, Jl. Ganesa 10, Bandung 40132, Indonesia; sigit.santosa@itb.ac.id (S.P.S)

* Correspondence: mardiyati@itb.ac.id

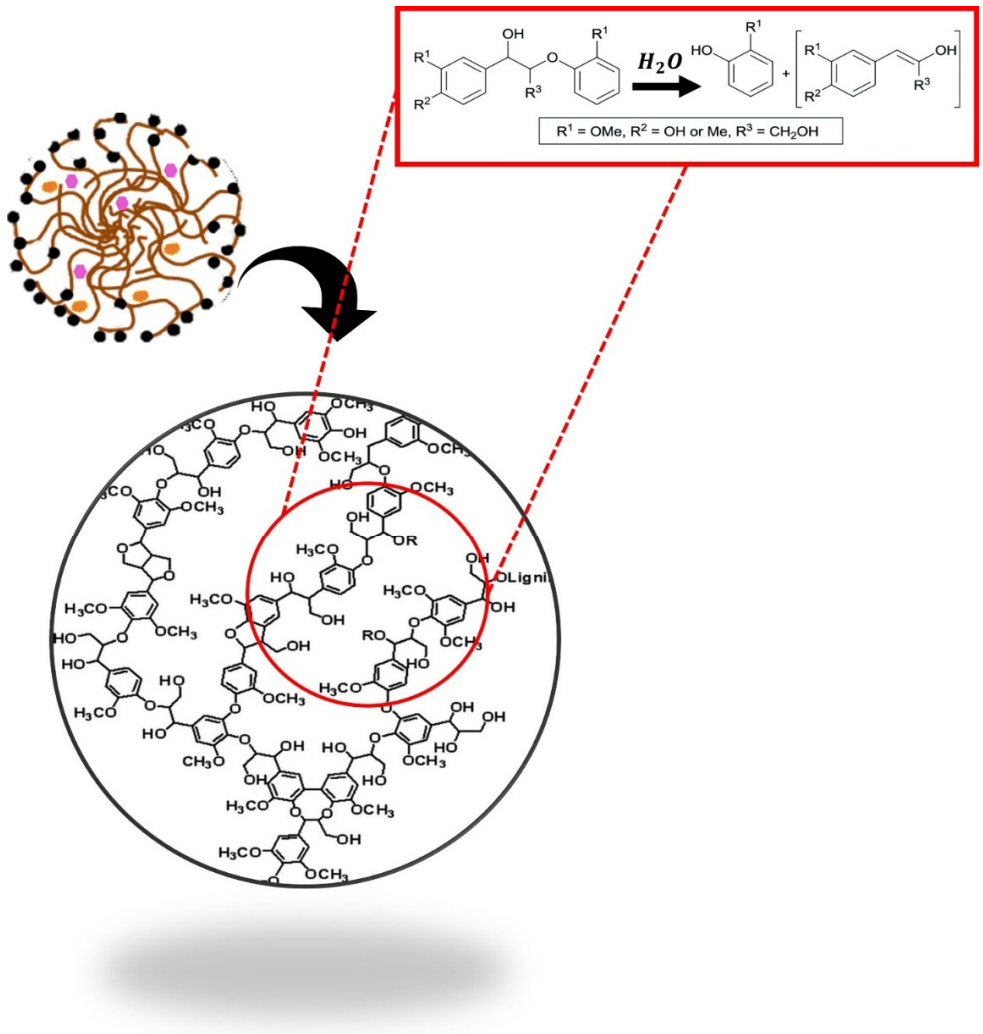


Figure S1. Schematic representation of lignin structure highlighting the β–O–4′ ether linkages. The upper inset shows the chemical cleavage of β–O–4′ linkages in lignin under hydrolytic

conditions, where R^1 = OMe, R^2 = OH or Me, and R^3 = CH_2OH. The main figure illustrates the polymeric arrangement of lignin, with the red circle emphasizing the β–O–4′ motifs within the complex three-dimensional network. This depiction provides a molecular-level understanding of the structural motifs that influence lignin's reactivity and interaction in composite fiber systems.

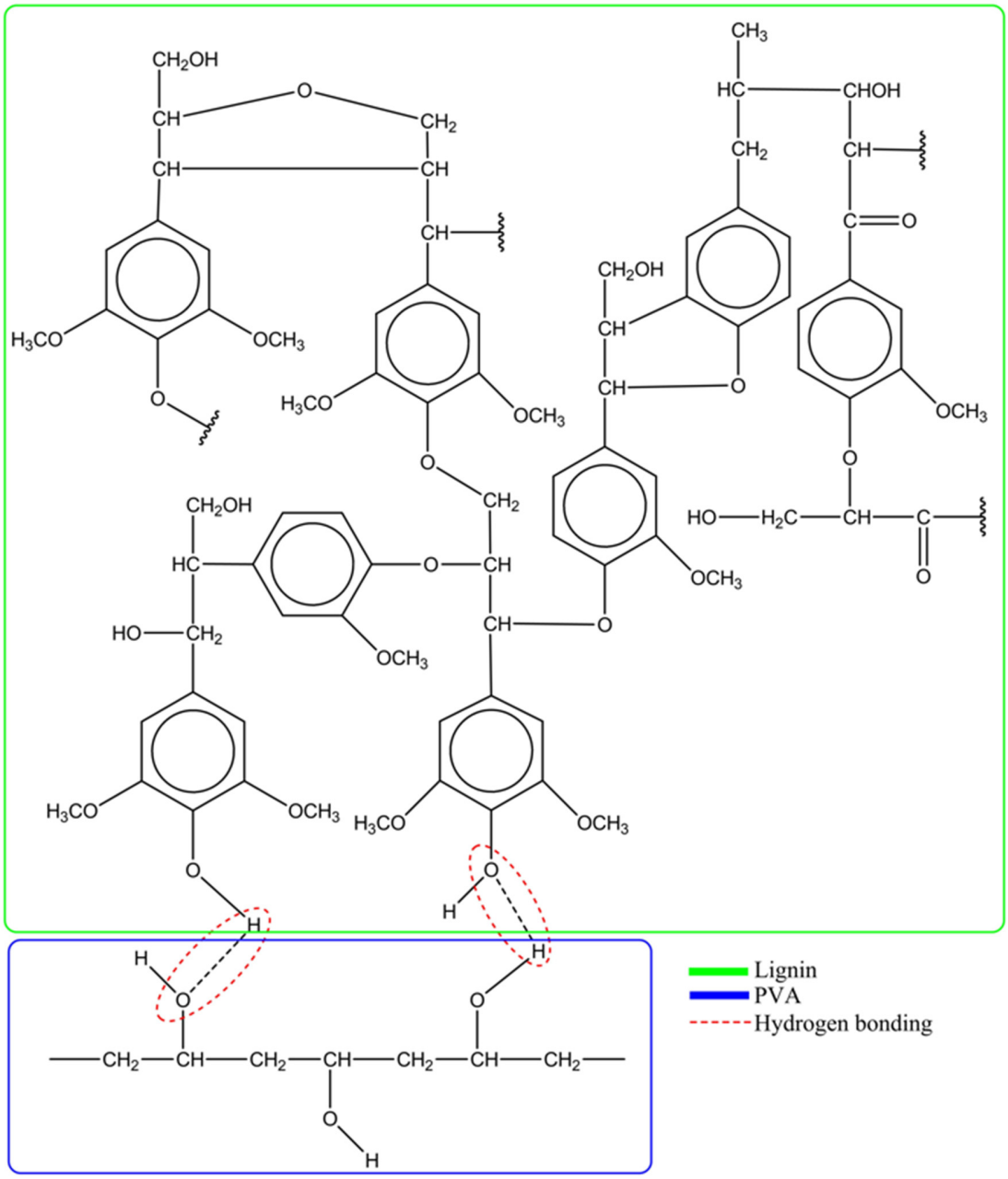


Figure S2. Schematic representation of hydrogen bonding interactions between lignin and PVA functional groups.

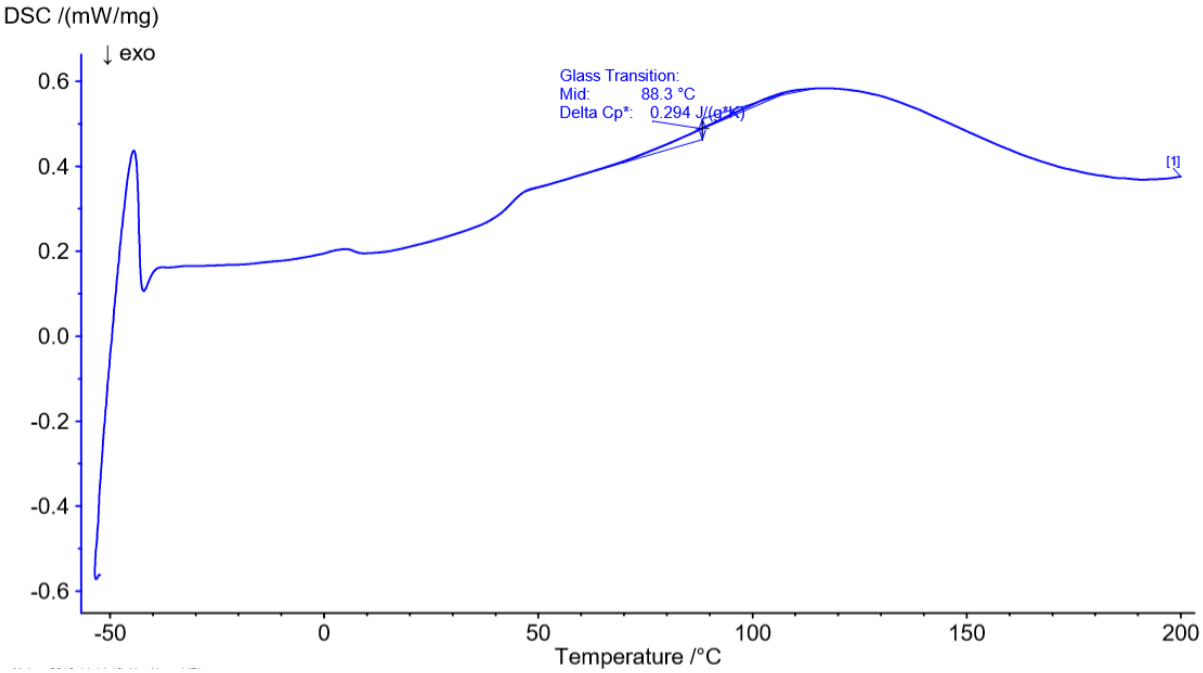


Figure S3. DSC thermogram of the L50P50 lignin/PVA fiber blend.

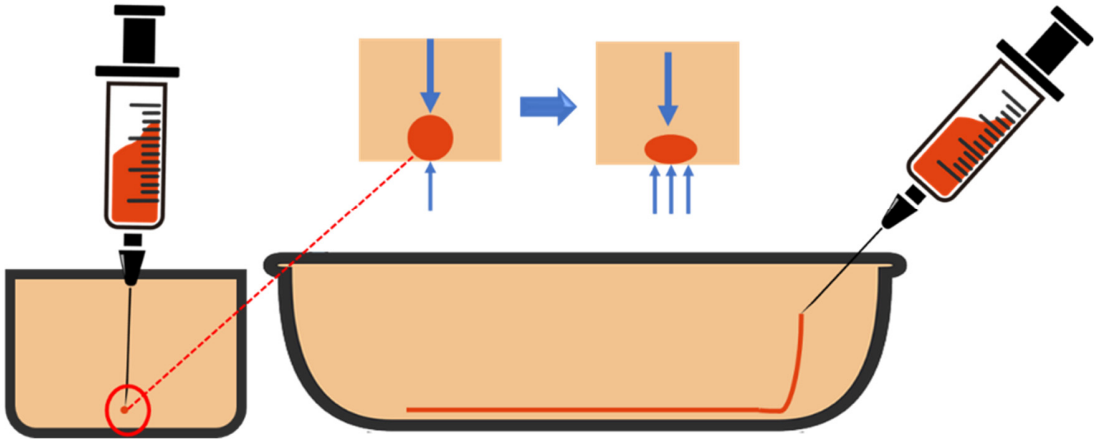


Figure S4. Illustration of the formation mechanism of a flattened fiber cross section.