



# Thermo-induced gelation of ligneous resole resin pre-condensates in ethylene glycol: An approach towards mesoporous monolithic aerogels of high internal surface

Enkhjargal Budjav<sup>a</sup>, Ana Requejo<sup>a</sup>, Masoumeh Ghorbani<sup>b</sup>,  
Johannes Konnerth<sup>b</sup>, Falk Liebner<sup>a\*</sup>

<sup>a</sup> University of Natural Resources and Life Sciences Vienna, Division of Chemistry of Renewable Resources, Konrad-Lorenz-Strasse 24, 3430 Tulln an der Donau, Austria

<sup>b</sup> University of Natural Resources and Life Sciences Vienna, Division of Material Science and Process Engineering, Institute of Wood Technology and Renewable Materials, Konrad-Lorenz-Strasse 24, 3430 Tulln an der Donau, Austria

\* Corresponding author: [falk.liebner@boku.ac.at](mailto:falk.liebner@boku.ac.at)

## ABSTRACT

Lightweight, mechanically stable, monolithic aerogels featuring bulk densities between 25 and 690 mg·cm<sup>-3</sup> have been prepared by thermo-induced gelation of lignin-rich ( $\leq 40$  w% replacement of phenol) resole-type pre-polymers ( $\nu \approx 1000$  mPa·s) using ethylene glycol as diluent, subsequent neutralization, washing, solvent exchange to ethanol and scCO<sub>2</sub> drying. Scanning electron microscopy, nitrogen sorption at 77 K and thermoporosimetry using *o*-xylene as probe solvent revealed a largely homogenous internal mesoporous morphology featuring accessible specific surface areas of up to 448 m<sup>2</sup> g<sup>-1</sup>.

**Keywords:** lignin, aerogels, PF resins, phenol replacement

## ACKNOWLEDGMENTS

The financial support of the Austrian Research Promotion Agency (FFG) through the projects 843687 and 836650, and of the Andalucía Talent Hub Program launched by the Andalusian Knowledge Agency, co-funded by the EU 7<sup>th</sup> Framework Program, Marie Skłodowska-Curie actions (COFUND Grant Agreement 291780) and the Ministry of Economy, Innovation, Science and Employment of the Junta de Andalucía is thankfully acknowledged.