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Abstract	:	This study explores the extraction of lignin from oil palm biomass using deep eutectic solvents (DESs), specifically choline chloride (ChCl) and glycerol, to develop a sustainable precursor for carbon fiber applications. Oil palm fronds (OPF) and empty fruit bunches (EFB) were treated with ChCl:Glycerol at various molar ratios (1:3–1:5), reaction times (3–6 h), and temperatures (130–170°C) to extract lignin (DES-L). The DES-L was characterized to determine its phenolic hydroxyl group (PhOH) content, functional group distribution, purity, glass transition temperature (Tg), and average molecular weight (Mw). The findings revealed that OPF-derived lignin exhibited higher phenolic hydroxyl group content (0.738–1.426 mmol/g), indicating superior structural disintegration compared to EFB-derived lignin (0.625–0.639 mmol/g). FTIR analysis revealed the presence of lignin-specific functional groups in DES-L, with peak intensities varying with ChCl:Glycerol molar ratio. The lignin purity ranged from 74.64% to 97.31% and increased with the temperature and reaction time. The Tg (99.96 − 144.15°C) and average Mw (2851 − 3835 g/mol) of DES-L demonstrated good thermal stability, which is suitable for carbon fiber precursors. This study demonstrates the potential of lignin extracted from oil palm biomass using DES as a viable and sustainable precursor for carbon fiber production. Additionally, it contributes to the enhanced utilization and value creation of agricultural waste. Optimizing the extraction parameters has uncovered a pathway for developing high-performance, eco-friendly carbon fibers.