Establishing Generalized Rheological Models of Lignin-based Solutions via Molecular Parameters Using Machine Learning

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Abstract

The rheological properties of natural polymer solutions are difficult to be modeled universally because of the strongly nonlinear relations between viscosities and the external factors and the discreteness of the rheological data owning to different molecular parameters including the molecular weights and size of clusters from different types of natural polymers and solvents. In this study, a typical natural polymer-lignin was selected and dissolved in polyethylene glycol (PEG). The rheological properties of different PEG-lignin solutions (PEG-Ls) and the molecular parameters of the pretreated lignin were tested. Subsequently, machine learning was applied to establish the generalized models considering the molecular parameters. The models were successfully developed in Newtonian and non-Newtonian regimes for PEG-Ls with correlation coefficients of 0.982 and 0.980, respectively. The models and relevant methodology can provide scenarios for further application of natural polymer solutions.

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