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Rheology and fluid mechanics of a hyper-concentrated biomass suspension LORENZO BOTTO, School of Engineering and Materials Science, Queen Mary, University of London, XIAO XU, Department of Chemical Engineering, Imperial College, London — The production of bioethanol from biomass material originating from energy crops requires mixing of highly concentrated suspensions, which are composed of millimetre-sized lignocellulosic fibers. In these applications, the solid concentration is typically extremely high. Owing to the large particle porosity, for a solid mass concentration slightly larger than 10%, the dispersed solid phase can fill the available space almost completely. To extract input parameters for simulations, we have carried out rheological measurements of a lignocellulosic suspension of Miscanthus, a fast-growing plant, for particle concentrations close to maximum random packing. We find that in this regime the rheometric curves exhibit features similar to those observed in model "gravitational suspensions," including viscoplastic behaviour, strong shear-banding, non-continuum effects, and a marked influence of the particle weight. In the talk, these aspects will be examined in some detail, and differences between Miscanthus and corn stover, currently the most industrially relevant biomass substrate, briefly discussed. We will also comment on values of the Reynolds and Oldroyd numbers found in biofuel applications, and the flow patterns expected for these parameter values.

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