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Pressure Driven Flow of Inhomogeneous Suspensions: Experiments and Theory ASHWIN VAIDYA, Montclair State University, MEHRDAD MASSOUDI, National Energy Technology Lab, DOE, SIOBHAN SOLTAU, GIN SANCHEZ, JILLIAN VARNER, JOSEPH FIORDILINO, Montclair State University — This study is devoted to the experimental and theoretical investigation of the pipeline flow of low volume fraction suspensions. We derive our motivation from questions concerning the feasibility of pipeline transport of biomass. Our experimental observations, based on a table-top scale study indicate an unusual relationship between flow rate and pressure gradient which has not been observed in homogeneous systems. For our system, which consists of (2%-6% volume fraction) mixtures of mulch/coffee powder/crushed leaves in water, we find that for a certain range of pressure gradients, the flow rate in fact decays for increasing pressures. Based on a generalization of the Newtonian fluid model, we mathematically model our mixture by taking the system's bulk viscosity and being dependent upon the pressure gradient. The resulting expression for flow rate is fitted to experimental data showing a very good correlation. The results of this study provide the only example of a system where a pressure dependent viscosity is valid at low pressures. We also consider a single phase non-Newtonian model for this system where the effects of shear rate and normal stresses are incorporated.

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