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Rotating drum tests of particle suspensions within a fines dispersion

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Natural flows like mudflows, debris flow, and hyperconcentrated flows are commonly composed by a matrix of particles suspended in a viscous fluid. The nature of the interactions between particles immersed in a fluid is related to its size. While coarse particles (sand, gravel, and boulders) interact with each other or with the surrounding fluid, a dispersion of fine particles interacts with each other through colloidal forces or Brownian motion effects (Coussot and Piau, 1995, and Ancey and Jorrot, 2001). The predominance of one of the previous interactions defines the rheology of the flow. On this sense, experimental insight is required to validate the limits where the rheology of a dispersion of fines is valid.

For this purpose, an experimental program in a rotating drum is performed over samples of sand, loess, and kaolin. The solid concentration and angular velocity of the rotating drum are varied. Height and normal loads are measured during flow. High-speed videos are performed to obtain the flow patterns of the mixtures. The experiments provide new laboratory evidence of granular mixture behaviour within an increased viscous fluid phase and its characterization. The results show an apparent threshold in terms of solid concentration, in which the mixtures started to behave as a shear-dependent material.