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Surface Chemistry Effects in Submerged Granular Flows of Hydrophobic Grains BRIAN UTTER, BENJAMIN FOLTZ, James Madison University — We experimentally investigate submerged granular flows of hydrophobic and hydrophilic grains in a rotating drum. While slurry and suspension flows are common in nature and industry, effects of surface chemistry on flow behavior have received relatively little attention. The experiment consists of a cylindrical drum containing various concentrations of hydrophobic and hydrophilic grains of sand submerged in water rotated at a constant angular velocity. Sequential images of the resulting avalanches are taken and analyzed. While it is known that at slow speeds, submerged avalanches appear qualitatively similar to dry flows, our results suggest that the surface properties of the grains affect underwater flow significantly. High concentrations of hydrophobic grains result in an effectively cohesive interaction between the grains forming aggregates. We present data on the size of the aggregates, slope, and avalanche statistics with changes in concentration. The formation and nature of the aggregates depends significantly on the presence of air in the system. At concentrations larger than 75% hydrophobic sand, the avalanches do not behave in a manner which is typical for sand, but as the concentration decreases, the aggregates are smaller, the angle of repose decreases, and the grains start showing rheological properties similar to those in regular sand.

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