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Investigation of drop motion through circular orifices[1] ANKUR DEEP BORDOLOI, ELLEN K. LONGMIRE, Aerospace Engineering & Mechanics, University of Minnesota, XIANGZHAO KONG, MARTIN O. SAAR, Earth Sciences, University of Minnesota — The motion of drops though porous media occurs in numerous science and engineering fields including multiphase fluid flow in the subsurface during groundwater flow, geothermal energy recovery, and geologic carbon dioxide sequestration. Here, we simplify the porous medium to a thin plate with an orifice to study the interactions between the drop and the solid medium. Drops of water/glycerin with diameter, D, are released in a tank of silicone oil with matched refractive index and allowed to fall downward by gravity. After reaching terminal speed, the drops encounter a thin plate with orifice diameter, d, placed horizontally within the surrounding tank. Drop deformation, contact with the orifice, and breakage are investigated using high-speed imaging, and velocity fields are determined by particle image velocimetry (PIV). Effects of diameter ratio d/D, drop Reynolds number, and drop offset with respect to the orifice center are examined. The experimental results are compared to results from numerical simulations using an immiscible, two-color BGK lattice-Boltzmann method performed under similar test conditions.

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