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Experiments versus modeling of buoyant drying of porous media DOMINIQUE SALIN, University Pierre & Marie Curie, ANDREAS YIOTIS, Institut Demokritos (Athens), ESHAN TAJER, YANNIS YORTSOS, University of Southern California — A series of isothermal drying experiments in packed glass beads saturated with hydrocarbons are conducted. The transparent cell allow observation of the formation of liquid films, as the gaseous phase invades the pore space. We demonstrate the existence of an early Constant Rate Period that lasts as long as the films saturate the surface of the packing, and of a subsequent Falling Rate Period that begins practically after the detachment of the film tips from the external surface. During the CRP, the process is controlled by diffusion within the stagnant gaseous phase in the upper part of the cells. During the FRP, the process is controlled by diffusion within the packing, with a drying rate inversely proportional to the observed position of the observed tips in the cell. Our model incorporates effects of corner film flow, internal and external mass transfer and the effect of gravity. Analytical results were derived. We are thus able to obtain results for the drying rates, the critical saturation and the extent of the film region with respect to the various dimensionless numbers that describe the process; the Bond, Capillary numbers and the dimensionless extent of the mass boundary layer. The experimental results agree very well with the theory, provided that the latter is generalized to account for the effects of corner roundness in the film region which were neglected in our analytical approach.

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