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Enhanced evaporation from surfaces of width comparable to that of the mass boundary layer thickness KARINE IP, SHREYAS MANDRE, Brown University — We investigate the optimal distribution of spacing and size of stomata on a leaf, which enhances net evaporation rate. Although evaporation flux is known to be maximal at contact lines, is diffusion of the vapor also enhanced by the accompanying increase in the total perimeter when the contact lines are adjacent? The evaporation rate from the stomata is analyzed using a 1-D model for stomata distributions on a leaf and a 2-D convection-diffusion equation in the surrounding space. A universal behavior is observed as a function of the Peclet number Pe and stomata size. For stomata much wider than the mass boundary layer thickness, evaporation rate increases as the stomata are made smaller; but below a critical size, the evaporation rate saturates to a constant value. This transition occurs when stomata size is comparable to the mass boundary layer thickness. We experimentally tested this behavior with liquid evaporating from micro-channels of varying channel widths in a wind tunnel providing a range of Pe.

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