Soft textured sheets mimic the hummingbird's tongue for efficient fluid capture

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Abstract

Passive and effective fluid capture and transport at small scale is crucial for industrial and medical applications, but also for the feeding of small nectarivores. Among them, hummingbirds have developed a highly specialised tongue made of two soft open grooves that efficiently trap nectar by elastocapillary effects. Inspired by this observation, we design a fast and efficient fluid capture device at the capillary scale. The device consisting in soft grooves stacked together on a flat sheet exhibits a sequential capillary rise when dipped in a liquid bath. Combining elasticity, capillarity and viscous flow, we rationalize the speed of the liquid fronts as well as the deformation of the structure. This device captures more liquid that its rigid flat counterpart and captures a given amount of liquid much faster than its rigid closed counterpart. Such structures may open the way for the design of optimal devices for fluid capture, aliquoting and transport in microfluidics.

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