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Optimizing cross-flow-filtration efficacy using variable wall permeabilities JAMES HERTERICH, IAN GRIFFITHS, ROBERT FIELD, DOMINIC VELLA, University of Oxford — Water filtration systems typically involve flow along a channel with permeable walls and suction applied across the wall. In this "cross-flow" arrangement, clean water leaves the channel while impurities remain within it. A limiting factor for the operation of cross-flow devices is the build-up of a high concentration of particles near the wall due to the induced flow. Termed concentration polarization (CP), this effect ultimately leads to the blocking of pores within the permeable wall and the deposition of a "cake" on the wall surface. Here we show that, through strategic choices in the spatial variations of the channel-wall permeability, we may reduce the effects of CP by allowing diffusion to smear out any build up of particles that may occur. We demonstrate that, for certain classes of variable permeability, there exist optimal choices that maximize the flux of clean water out of a device.

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