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Membraneless water filtration using CO_2 SANGWOO SHIN, OREST SHARDT, Princeton University, PATRICK WARREN, Unilever RD Port Sunlight, HOWARD STONE, Princeton University — Water purification technologies such as ultrafiltration and reverse osmosis utilize porous membranes to remove suspended particles and solutes. These membranes, however, cause many drawbacks such as a high pumping cost and a need for periodic replacement due to fouling. Here we show an alternative membraneless method for separating suspended particles by exposing the colloidal suspension to CO_2. Dissolution of CO_2 into the suspension creates solute gradients that drive phoretic motion of particles, or so-called diffusiophoresis. Due to the large diffusion potential built up by the dissociation of carbonic acid, colloidal particles move either away from or towards the gas-liquid interface depending on their surface charge. Our findings suggest a means to separate particles without membranes or filters, thus reducing operating and maintenance costs. Using the directed motion of particles induced by exposure to CO_2, we demonstrate a scalable, continuous flow, membraneless particle filtration process that exhibits very low pressure drop and is essentially free from fouling.

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