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Mark Wolverton

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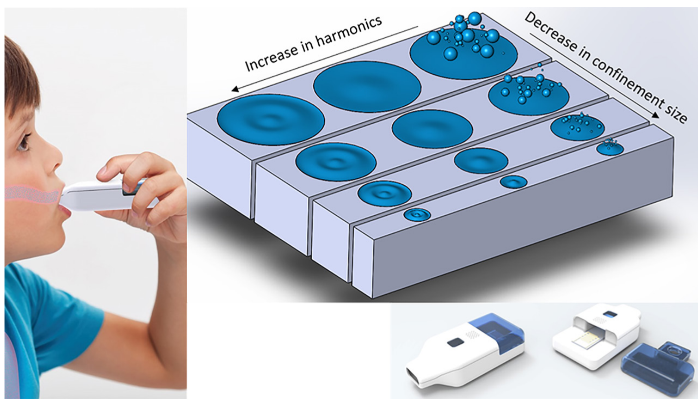
Better control of aerosolized droplets demonstrated with a new method using capillary confinement.



Some applications of aerosols, especially in medicine, require precise control of droplet size and dispersity, yet such control is difficult to realize. University of Glasgow researchers report in *Physics of Fluids* on a new technique of aerosolization using acoustic actuation of liquids via surface acoustic waves (SAWs). The surface waves on the parent liquid are mechanically confined with capillary wave filters, thereby customizing droplet size and dispersion.

Aerosols are commonly generated through the mechanical generation of waves on the surface of a liquid, which then disperses (nebulizes) into airborne droplets. Previous work demonstrated that droplets generated from SAWs vary greatly in size due to the propagation length of the liquid wave. This work shows a strong correlation between the wavelength of surface capillary waves and the length scale of the liquid in the SAW propagation path.

An interdigitated transducer, whose periodic piezoelectric structure creates SAWs, induced the acoustic waves on the surface of a lithium niobate chip. A thin silicon chip that contained deionized water in cylindrical cavities was coupled on the niobate chip. The cylindrical cavities, or microfilters, were etched with diameters of 100, 200, 400, 600, 800, and 1500 μm which filled with the water.

Upon actuation, the wavelengths of the liquid's surface capillary waves of these small, water-filled cavities are restricted by the cavity's dimensions. The researchers found that by mechanically controlling wavelengths in this way, they could control the size of the aerosolized droplets, essentially using microgrids as a "low-pass filter."

Aside from other applications, this has particularly important implications for pharmaceutical aerosols, in which smaller droplet size has been shown to result in better penetration and dispersion in the pulmonary cavities.

Source: "Confinement of surface waves at the air-water interface to control aerosol size and dispersity," by Elijah Nazarzadeh, Rab Wilson, Xi King, Julien Reboud, Manlio Tassieri, and Jonathan M. Cooper, *Physics of Fluids* (2017). The article can be accessed at https://doi.org/10.1063/1.4993793.

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