Liquid jets break up more readily on a substrate

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Whether we're aware of it or not, in day-to-day life we often witness an intriguing phenomenon: the breakup of jets of liquid into chains of droplets. It happens when it rains, for example, and it is important for inkjet printers. However, little is known about what happens when a liquid jet, also known as a liquid filament, breaks up on top of a substrate. According to a new study, the presence of a nearby surface changes the way the filament breaks up into smaller droplets. In a new paper published by Andrew Dziedzic at the New Jersey Institute of Technology in Newark, New Jersey, USA, and colleagues in *EPJ E*, computer simulations are used to show that a filament is more likely to break up near a surface.

The authors examined how different values of surface tension, the viscosity of the liquid and the dimensions of the liquid filament affect the way droplets are formed. This has important implications for a range of areas—from technology that uses tiny amounts of fluids and requires precise dosing, to the study of biological and geological systems.

When a filament is broken into multiple droplets, the structure is unstable because surface tension means liquids tend to shrink to have the smallest-possible surface area. Moreover, a single droplet has a smaller surface area than multiple droplets. The researchers found there were three possible scenarios: the filament collapses into one droplet, breaks up into multiple droplets, or breaks up and then re-forms back into a single droplet.

Further, they found that the presence of a substrate makes the breaking up of the filament more likely. The team hopes their work will benefit a variety of applications, such as the production of DNA chips and in connection with lab-on-a-chip technology.

More information: A. Dziedzic et al, Breakup of finite-size liquid filaments: Transition from no-breakup to breakup including substrate effects⋆, *The European Physical Journal E* (2019). DOI: 10.1140/epje/i2019-11785-y

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