Tiny droplets open the doors to in-flight imaging of proteins

May 6 2019

Credit: CC0 Public Domain

For the first time, researchers have demonstrated the creation of a beam of nanodroplets capable of delivering a variety of biological samples, from cell organelles to single proteins, virtually free from any

contaminations, to the focus of an X-ray laser which can be used to image them.

The experiment was performed at the Linac Coherent Light Source (LCLS) at the Department of Energy's SLAC National Accelerator Laboratory and reported in the latest issue of *Science Advances*.

By designing a new sample delivery instrument which uses electrospray ionization technology scientists have been created droplets of around 100 nm in diameter, about 1000x smaller than with previous techniques.

Previous techniques created droplets millions of times bigger than the sample within it, which caused the accumulation of any contaminants, which inevitably exist in the solution, on top of the sample to be imaged, effectively hiding it.

Using their new instrument, the team was able to image the Tomato Bushy Stunt Virus, which, at 33 nm in diameter, is significantly smaller than any biological sample previously studied with the same technique.

Filipe Maia of Uppsala University, a corresponding author of the study, said the ability to deliver single proteins, unobscured by contaminants to the beam of an X-ray laser is a milestone in the quest to image individual proteins in-flight. Combined with the upcoming high-repetition rate X-ray free-electron lasers at the European XFEL in Hamburg and the LCLS II in California, which produce up to a million pulses a second, this result brings us closer to the vision of solving the dynamic and heterogeneous structures of biomolecules.

More information: Johan Bielecki et al. Electrospray sample injection for single-particle imaging with x-ray lasers, *Science Advances* (2019). DOI: 10.1126/sciadv.aav8801

Provided by Uppsala University