

Electro hydrodynamic atomization: An emerging technique

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Abstract

Electrohydrodynamic atomisation (EHDA) is an emerging technique for the production of micron and nano-scaled particles. The process often involves Taylor cone enablement, which results in a fine spray yielding formulated droplets, known as electro spraying, which then undergo drying during deposition.

Multi tip devices have been designed and engineered to be utilised in potential up-scaled EHDA, in comparison to the traditional single needle system.

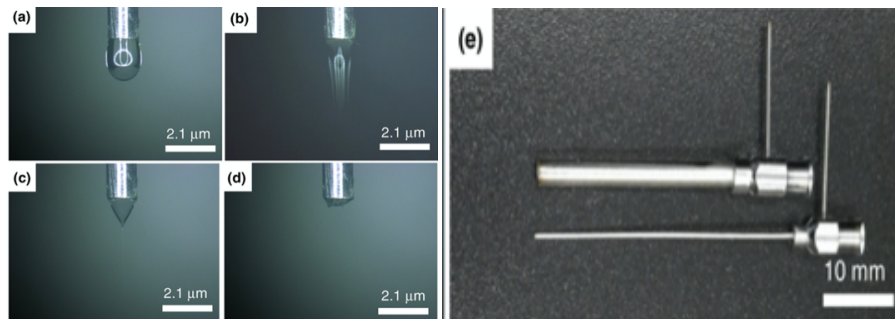


Figure 1: EHDA jetting examples from a single nozzle system showing: (a) Formulation flow with no applied voltage – dripping; (b) Unstable jetting; (c) Stable jetting – Taylor cone; (d) Multiple-jets from a single nozzle. (e) The coaxial nozzle system used for jetting with two co-flows (Inner and outer nozzles).

The physical properties of solutions used in this technique have an undeniable impact on the particles formed. The physical characteristics of the solutions are, but not limited to, viscosity (Dependent on polymer concentration); surface tension and electrical conductivity. The properties can be manipulated to result in the sister technique of electrospinning, the formation of fibers, as oppose to particles with electro spraying.

Multiple characterization techniques can be applied to this engineering technique in order to ensure desired particles are formed, these are but not limited to: differential scanning calorimetry (DSC), thermal gravimetric analysis (TGA), X-ray diffraction (XRD) and scanning electron microscopy (SEM).

The applications of EHDA are vast and have demonstrated high potential in both the pharmaceutical and biomedical field. Most recently, research into the use of EHDA and polymer solutions to create drug delivery systems has been extremely popular worldwide. Furthermore, research into its utilization in food science is fast emerging. As a result, the advantages of this one step engineering method have overcome limitations faced in these sectors.

Biography

Bushra Yousef is a final year PhD student, with a background on pharmaceuticals and drug delivery at De Montfort University. She is currently researching biomaterial therapies to target cell death as a result of cardiovascular diseases. She has collaborated in one published paper focusing on multi-tip electro spraying to achieve nanoparticle production. She has also presented at the Royal Society twice. She is hoping to publish many more papers on both the EHDA technique as well as cardiomyocyte behavior in relation to different geometries and environments.



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