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Using multi-tip emitter devices to achieve increased and stable formulation atomization

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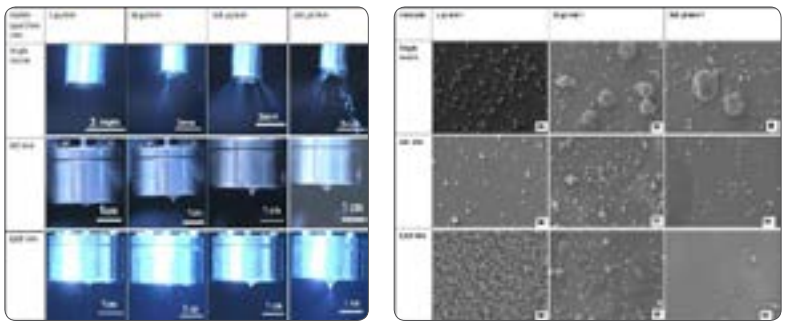
Micro and nanoparticle engineering using the electrohydrodynamic atomization (EHDA) technology has received greater focus in recent years compared to other particle engineering methods due to its many advantages which includes greater particle size control and morphology alteration. This technology is based on the droplet formation which yield desired particle characteristics due to Taylor cone enablement at the nozzle tip. This study involved the utilization of a novel multi-tip emitter (MTE) device which was designed and engineered for possible EHDA up scaling. An active ketoprofen (KETO) was used in the formulation with a polymer matrix material polyvinylpyrrolidone (PVP) polymer. Ethanol and distilled water was used as vehicle for production of PVP polymer with ketoprofen (5% w/w of PVP). Physical property evaluation was carried out on resulting solution and electrospraying of formulation using both novel MTE and conventional single nozzle system at various flow rates. Ethanol and distilled water was used to prepare PVP polymer solution with ketoprofen (5% w/w of PVP) then physical properties were obtained for resulting formulations. Electrospraying was done using both novel MTE and conventional single needle device at different flow rates (5-300 µl/min) and applied voltages (0-30 kV) applying various process parameters. X-ray diffraction (XRD), differential scanning calorimetry (DSC), scanning electron microscopy (SEM) and thermal gravimetric analysis (TGA) were used to analyze resulting particles. Digital optical camera recordings confirmed formation of stable jet at higher flow rates while electron micrograph confirmed stable jet derived more near uniform particles, particle size variation observed were due to nozzle head design. TGA, DSC, and XRD confirm encapsulated KETO molecules were dispersed in nanoparticles. In conclusion, the MTE enabled stable atomization at higher flow rates compared to the conventional single needle device. This indicates an exciting approach for scaling-up (EHDA) in contrast to current efforts focusing on multiple nozzle outlets.



Biography

Ekhoerose Valentine Onaiwu is a second year PhD student at Leicester School of Pharmacy, De Montfort University, Leicester. His current research focus is on pharmaceutical nanoparticle engineering using the electrohydrodynamic atomization (EHDA) system in the modelling and engineering of pharmaceutical particles. His current work has yielded a novel multi-tip nozzle system that has been found to have increased formulation output as well as stable and controlled particle size with potential for upscaling in pharmaceutical industry.

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