# Scalable production of bioresorbable, monodisperse, injectable microparticles using IN-AIR MICROFLUIDICS

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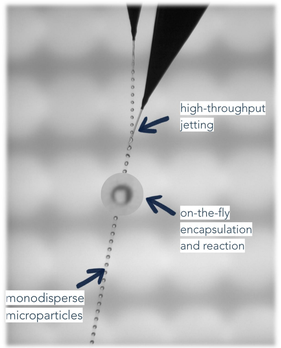
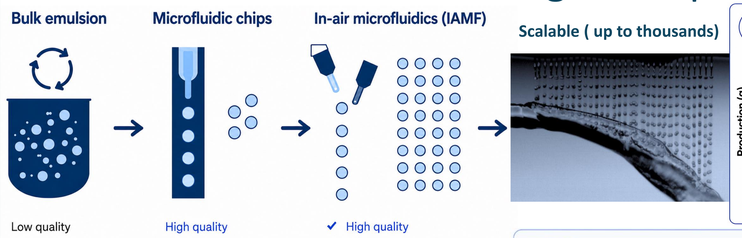
## Why IAMF?

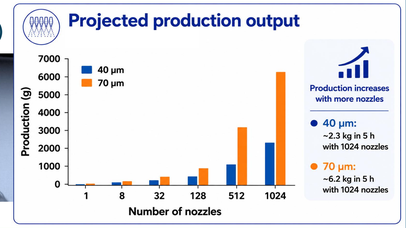
Injectable microparticles are widely used in long-acting drug delivery and regenerative aesthetic applications. However, conventional manufacturing methods often produce polydisperse particles with limited control over size, morphology, and injectability.
These limitations can lead to inconsistent product performance, nozzle clogging during administration, and challenges in process scale-up.
**IN-AIR MICROFLUIDICS (IAMF)** enables the production of highly uniform, bioresorbable microparticles with tunable size, morphology, and drug-release characteristics. By combining microfluidic precision with scalable nozzle parallelization, IAMF provides a pathway from laboratory development to industrial manufacturing of controlled-release microparticles.




- **CV < 10%** Monodisperse
- **30 µm to 3 mm** Tunable size
- **kHz** High throughput per nozzle
- **Upscalable platform** Multi nozzle
- **27G to 34G** Injectable

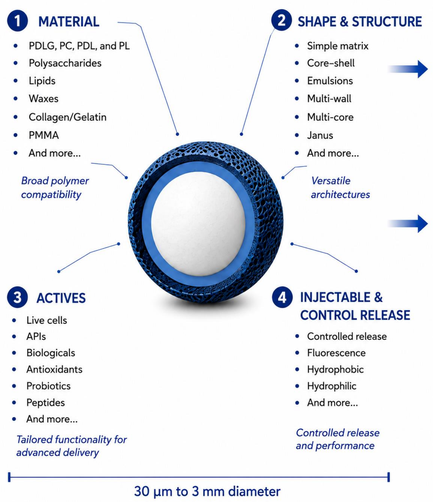
## IAMF Platform: From lab to kg–scale production



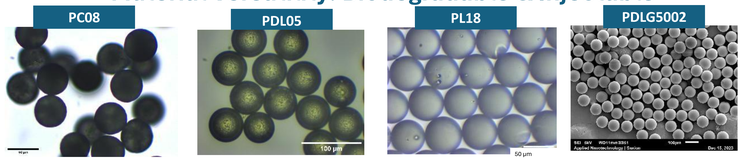

From small-scale to large-scale with consistent quality
Consistent quality
Scalable production
Reproducible process

## Microparticle design space




Various bioresorbable polymers and their combinations are compatible with the IAMF process, including PDLG, PC, PDL and PL (Purasorb®, Corbion). The particles with 38 µm can be ejected through a 27 G needle (I.D. = 0.21 *mm*).

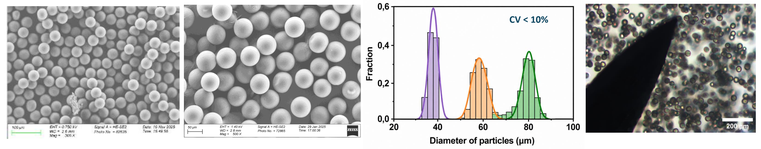
### Material Versatility: Biodegradable & Injectable




### Delicate shape and morphology control over the particles


PDLG (a) "Beads-on-a-string"; (b) fiber; c) elongated particles; (d) triangle particles; (e) capsules

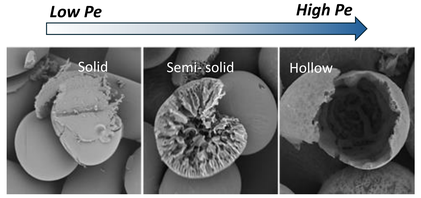
### Tunable Particle size for injectables



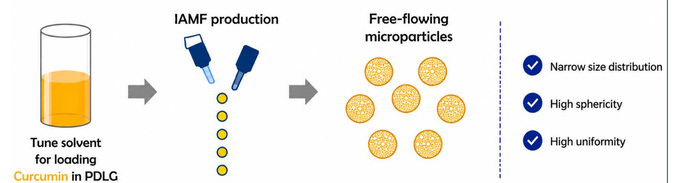

SEM image of PDL05 particles with diameter centered at 40 µm (a) and 70 µm (b), (c) The size distribution of IAMF generated particle batches is well-defined. and (d) Microscope image of PDL05 microparticles ≈ 38 µm in 15 *mg/mL* HA gel ejected through a 27 G needle

## Tunable particle morphology for controlled release

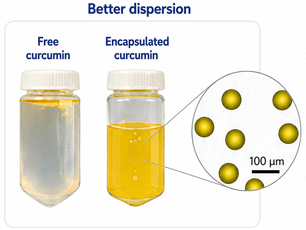
### Effect of particle Peclet number on the morphology of dry particles



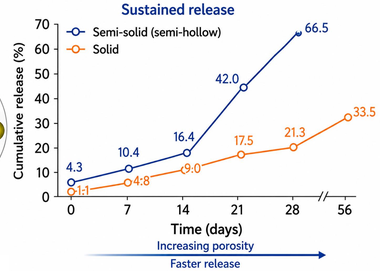

### Achieve particles with different porosity using IAMF technology




### Better dispersion




### Sustained release





The PDLG encapsulated curcumin were significantly easier to disperse in aqueous solution compared to 'free' curcumin, which indicated the potential to enhance solubilization of hydrophobic APIs into aqueous system through microencapsulation. The drug release study showed a sustained delivery of curcumin to the supernatant over at least 4 weeks for semi-solid particles, and more than three month for solid particles. More than 80% of the encapsulated curcumin was still active after 4 weeks of incubation.

### Acknowledgement

The bioresorbable polymers used in this work were kindly provided by Corbion.

Corbion

### References

[1] Visser, C. et al. (bio)materials. Sci. Adv., 4(1), 2018
[2] Wei, Y. et al. Int. J. Heat Mass Tran., 97 (2016)

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