Lonza
Pharma & Biotech

extended and dual release technologies

Extended release (ER) is often needed or desired to deliver crystalline and solubilized forms of compounds in once- or twice-daily dosing regimens to maximize therapeutic effect. Osmotic tablet technology is a key ER approach and can ensure consistent drug release over time, or zero order release, independent of GI tract pH or fed/fasted conditions. At Lonza, we utilize two osmotic tablet technologies: proprietary asymmetric membrane technology (AMT) and swelleable core technology (SCT). Dual release and fixed dose combinations (FDC) are also increasingly utilized for therapeutic effect, lower dose burden and product differentiation. In addition to a full range of multiparticulate technologies, we employ bi- and tri-layered matrix tablets and capsule-in-capsule approaches for combination products and to achieve dual drug release profiles.

Advanced osmotic technologies

Asymmetric-membrane technology (AMT)

- A single-layer tablet with an insoluble, asymmetric microporous membrane produced by controlled-release separation
- Applicable drug substance and dose: water soluble, low-to-high dose

Swellable-core technology (SCT)

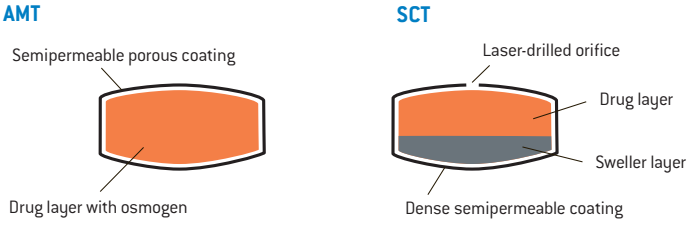
- A bi-layer tablet with an insoluble, semipermeable coating and a laser-drilled delivery orifice
- Applicable drug substance and dose: water soluble, poorly water-soluble, or bioavailability-enhanced forms (e.g., spray-dried dispersions [SDDs]); low-to-moderate doses

Myriad benefits

AMT and SCT are osmotic/hydrostatic pressure-driven dosage forms that provide steady-state zero-order drug release. This has a number of benefits.

- Release is typically independent of gastrointestinal pH andagitation; these characteristics minimize patient-to-patient variability and maximize *in vitro*/*in vivo* correlations compared with oral controlled release dosage forms
- A wide range of steady-state release rates is possible in addition to zero order
- Modifications to the platform technologies such as immediate, delayed and custom release profiles — as well as fixed-dose combination therapies — can be designed into the finished dosage form

Structure of AMT and SCT tablets



Extended and dual release technologies

Due to the physical and chemical stability of the polymer membranes, osmotic tablets can be packaged in conventional bottles and blisters, which ensures that the dissolution performance does not change with time.

Combination drug and dual release technologies

Fixed-dose combination drugs are increasingly being developed to improve therapeutic effect and patient compliance. Dual release profiles are also being sought for pulsatile- or combination-release functionality to target more than one area of the GI tract.

Multiple approaches

Lonza offers several approaches to achieve combination-drug or dual-release functionality in a single dosage unit.

- Multiparticulate or mini-tablet coating
- Bi- or tri-layer matrix tablets
- Liquid-filled capsule-in-capsule technology

Proven capsule-in-capsule capabilities

Lonza liquid-filled capsule-in-capsule technology — an advancement of our premier liquid fill hard capsule technology — provides proven capability for novel pharmaceutical and nutraceutical line extensions.

Using custom-designed filling equipment and specialized liquid-filling techniques, capsule-in-capsule technology allows a prefilled, smaller capsule to be inserted into a larger, liquid-filled capsule. The smaller inner capsule may contain either a liquid, solid or semi-solid formulation and — based on the formulation or product requirements — either or both capsules may be made of gelatin or hydroxypropyl methylcellulose (HPMC). They can also be coated, if desired, for additional functionality or targeting of sites such as the colon.

Broad formulation and design options

Capsule-in-capsule options include:

- An inner capsule that contains a liquid, semi-solid, powder, or pellets
- An outer capsule that contains a liquid or semi-solid formulation
- Coating of capsule shells to achieve enteric protection or colonic drug delivery

Wide-ranging applications

- Immediate-, extended-, delayed- or pulsatile-release profiles
- Bioavailability enhancement and/or stability improvement through the use of self-emulsifying systems (SEDDS)

Capsule-in-capsule formulations are manufactured using custom liquid-fill equipment and sealed with either banding or proprietary "Fusion" or LEMS® Sealing Technology. The technology is incorporated into our integrated product development model — with equipment scaled for pilot through clinical trials — and commercial-scale production.

Learn more about how Lonza's extended and dual release technologies can be utilized to optimize your compound's pharmacokinetic profile.

Contact us

pharma.lonza.com/contact

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