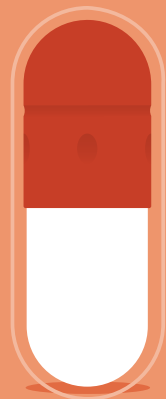


# Traditional Enteric-Coated Capsules vs a Next-Generation Polymer Capsule




Traditional  
enteric-coated  
capsules

**vs**




A next-  
generation  
polymer capsule



heat

# bilayered polymer capsule

solvents



## What are “enteric coated” capsules and why are they used?

Enteric coating refers to a dosage form (e.g. capsule) of an oral medication that is coated with a polymer. Gastro-resistant coating began in 1884 with keratin-coated pills, which failed to withstand gastric digestion. Since then, enteric coating has been widely used in the manufacturing of various drug formulations, including capsules.

The purposes of enteric coating are to promote optimal drug bioavailability by protecting an acid-sensitive active pharmaceutical ingredient (API) from early degradation in the acidic milieu of the stomach and reduce the incidence of gastric side-effects from exposure of gastric mucosa to harmful drugs. Additional benefits of enteric-coated capsules include helping improve product stability, taste, and ease of swallowing, while enabling modified release properties.

## How are enteric capsules produced?

There are currently three approaches to the formulation of enteric capsules:

- ① Coating as an add-on, final step in the manufacturing process
- ② Solvent-based coating applied to capsules prior to filling
- ③ Capsules made from gastro-resistant polymers that do not require additional coating

Polymers commonly used include cellulose acetate phthalate, methacrylic acid copolymers and hydroxypropyl methylcellulose phthalate.

## How do enteric absorption sites differ?

The pH of the small intestine ranges from 6 in the duodenum to around 7.4 in the terminal ileum. Different regions in the intestine have different drug absorptive properties, often specific to a narrow pH range at a specific site. A bi-layered polymer capsule is a suitable option for mid-gut or distal intestinal delivery of acid-labile APIs.

## How a bi-layered polymer can protect acid-sensitive API and accelerate drug development

Traditional enteric-coated capsules typically require a post-filling coating, which could expose APIs to heat and/or solvents. Below, we explore the relative benefits of deploying a bi-layered polymer capsule that enables enteric delivery without the need for post-filling coating or sealing. Alongside the potential safeguarding of an active ingredient, removing the need for an additional coating step and associated processes can also expedite manufacturing.

## What are enteric “bi-layered polymer” capsules and their advantages?

In bi-layered polymer technology, two polymer layers are seamlessly bonded, providing high levels of gastric protection, targeted API release and delayed dissolution. These polymers are hydroxypropyl methylcellulose (HPMC)—“hypromellose”—and hydroxypropyl methylcellulose acetate succinate, or “HPMC-AS.” The more recent polymer blends have several advantages: pharmaceutical compliant dissolution, compatibility with moisture-sensitive drug formulations (HPMC), and pharmaceutical compliant enteric disintegration (HPMC-AS). The HPMC layer is manufactured using a thermogelling process, followed by a second dipping step applying an outer layer of enteric HPMC-AS.

## More about HPMC/HPMC-AS as enteric capsule polymers

### *HPMC as inner layer*

HPMC was introduced as a non-animal alternative to gelatin in the early 2000s. Today’s HPMC capsules are regarded as “second-generation”; first-generation HPMC capsules do not dissolve quickly or consistently, potentially rendering the payload ineffective and delaying its release. Such effects are especially problematic when formulating immediate-release drug products. Newer HPMC capsules are engineered to mitigate these issues around dissolution, including thermogelling. Consistent and predictable dissolution performance of the capsule excipient allows formulators to avoid costly and repetitive stability tests, saving time in the drug development process.

### *HPMC-AS as outer layer*

HPMC-AS has various grades that dissolve from pH 5.5 to 7. Therefore, HPMC/HPMC-AS capsules protect an acid-sensitive drug payload, depending on the polymer grade selected; the varying pH of media around HPMC-AS influences its water solubility, thereby allowing a site-specific payload release profile.

## Unique Capsugel® Enprotect® Capsule

The Capsugel® Enprotect® capsule comprises a polymer shell with an outer layer of HPMC-AS, which dissolves in pH of ~6, and an inner layer of HPMC interfacing with the API, which dissolves easily at any pH. The capsule is robust and made to very fine tolerances, lending itself to high-speed filling with the minimum of losses.

# New Class



## Conclusion

Coating of capsules as an independent step, with its inherent limitations, was formerly the only option to achieve acid-protection. In seeking to overcome these challenges, Lonza CHI’s investment and advances in polymer technology, coupled with a unique patented manufacturing process, have created a new class of capsules for enteric drug delivery. Without the need for the post-filling enteric coating step, Capsugel® Enprotect® capsules open new possibilities for formulators, overcoming many of the challenges of enteric delivery and the limitations of enteric-coated capsules.



Learn more about the award-winning Capsugel® Enprotect® capsule platform, and how it could support your drug development process.