



## Future-Ready Nutrition Starts with Precise Release

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*“Encapsulation is a technology. Precise release is the outcome.”*

India's dairy farms are moving fast—better genetics, stronger herd health programs, and higher milk yields are becoming the new normal. But as performance rises, the cost of nutrition rises too. In ruminants, it's not enough to add the right nutrient: you have to deliver it to the right place, time, and amount.

That's where encapsulation and **precise release** come in. A simple way to think about it: a nutrient has value only if it arrives intact—and arrives at the right “address” in the digestive tract. Encapsulation creates a protective delivery system around sensitive actives so they can pass the rumen and release later (typically in the small intestine), where absorption is most effective.

### Understanding Precise Release: Why It Matters More Than Just Adding Nutrients

The rumen acts as the cow's main digestive chamber, breaking down feed, supporting the growth of beneficial microbes, and turning tough plant fibers into milk. However, because the rumen is so good at its job, it can sometimes break down certain nutrients before the cow's body has a chance to absorb them where they're really needed.

**Precise release** means two things happening together: (1) the nutrient stays protected where protection is needed (often the rumen), and (2) it is released in a predictable way once it reaches the intended absorption site. That predictability is the real value—because if release is inconsistent, performance becomes inconsistent.

- **If release happens too early:** the active is exposed in the rumen and may be degraded before absorption.
- **If release happens too late:** the nutrient may move past the main absorption window, reducing utilization.
- **If release is inconsistent:** results can vary from farm to farm (and even batch to batch), making it hard to formulate with confidence.

#### Too Early

Active ingredients degrade in the rumen before reaching the absorption site.

#### Too Late

Nutrients bypass the optimal absorption window and pass through underutilized.

#### Inconsistent

Batch-to-batch variability undermines formulation confidence and on-farm results.

**Here's the hidden cost:** when release is off-target, you don't just “lose some nutrients”—you lose return on every rupee spent on that additive. The nutrient may be partially degraded, diverted to the wrong place, or simply missed by the absorption window. That invisible loss shows up later as inconsistent milk response, extra safety margins in formulation.



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## Encapsulation must be designed as a delivery system

Encapsulation is not simply “covering” a nutrient. The barrier must be engineered to stay intact when protection is needed and open up when absorption is most effective. Release can be guided by factors like pH shifts along the digestive tract and enzymatic action—so the nutrient is delivered in a protected, timed way. In short, it means cows get the right nutrients, at the right time, in the right place—making feeding more effective and less wasteful.

One more “quiet” driver of precise release is physics: **particle size** and **functional specific gravity**. Even with the right coating of chemistry, a particle that stays in the rumen too long is exposed to more mechanical abrasion and microbial challenge—raising the chance of premature breakdown.

Depending on the nutrient and the production objective, different technologies can be used—such as spray freezing, pan coating, coacervation, and fluid bed encapsulation—to create particles that protect the core and control when and where it becomes available.

Two common particle architectures help achieve different release profiles:

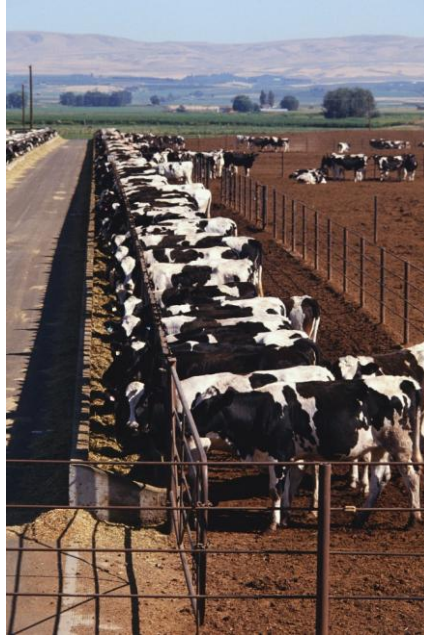
- **Matrix particles:** The nutrient is embedded inside a protective matrix (often lipid-based). This design can support a more sustained and controlled release pattern.
- **Core-shell particles:** The nutrient core sits inside one or more protective layers. By adjusting layer composition and thickness, the particle can be tuned for stronger rumen protection and more targeted, timed release.

What matters most is repeatability: the same product should behave consistently across batches and perform reliably across common ration types. Precision release is achieved not only through particle design, but also through careful evaluation of protection, release behavior, and stability under practical handling conditions.

## Why do different nutrients need different release strategies?

Not every nutrient behaves the same way in the rumen—and that’s exactly why “one coating fits all” does not work. Amino acids and choline sources differ in solubility, reactivity, and sensitivity to microbial breakdown.

Kemin offers specialized solutions for different actives. **MetiPEARL®**, **LysiGEM®**, and **CholiGEM®** use PEARL and GEM coating technologies for rumen protection and controlled release. This is also where the concept of precision becomes especially powerful. Predictable release allows nutritionists to focus on true dose-response, ensuring cows get only what they need—efficiently and with less waste.





### Built for today, ready for tomorrow

As India's dairy sector pushes toward higher productivity and tighter margins, the question is no longer whether precision nutrition matters—it is how reliably we can execute it. Precise release through encapsulation helps ensure that sensitive nutrients reach their intended site intact, in a predictable way, so farmers can capture more value from every kilogram of feed. Encapsulation platforms that can be tuned for specific release profiles—by nutrient, by diet, and by production stage—will be central to that future, because they help ensure the nutrition strategy you design is the nutrition the cow receives.

If you're evaluating strategies for rumen protection, intestinal availability, or improved nitrogen efficiency, talk to your Kemin representative about a precise release approach.

#### TAKEAWAY

- In ruminant nutrition, value is not in what you add—but in what the cow actually absorbs.
- Encapsulation is the technology; precise release is what turns it into performance.
- When nutrient release is consistent, farm performance and feed ROI become consistent too.
- The future of dairy nutrition will be defined by how precisely we deliver every gram of value.

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