

CholiGEM™: DESIGNED WITH C³ MODEL FOR SUPERIOR BIOAVAILABILITY, GREATER FLEXIBILITY AND SUSTAINABILITY

Key conclusions

Kemin's Scientists have invested more than half a decade to design a unique C³ model, to achieve the best results from supplementing Choline in the next generation of encapsulated choline solution "CholiGEM". The main advantages of CholiGEM with its C³ model is that it provides:

Superior Bioavailability

- ✓ More than double the concentration
- ✓ More than triple the bioavailability for better transition management

Greater Flexibility

- ✓ Creates up to 30 % more space in premix/feed formulation
- ✓ Contributes in green footprinting

Introduction

Choline can be fed unprotected to cows. However, like all B vitamins complex it is very rapidly broken down in the rumen. So, the only effective method of increasing choline availability to dairy cows is to feed it in a form that is protected from ruminal degradation (Grummer, 2008).

There are several commercial protected products on the market designed to supply choline for absorption in the small intestine. However, the amount of choline delivered to small intestine for absorption (bioavailability) may vary largely between products (Sales et al., 2010, Humer et al., 2019).

There are three main reasons for variation in bioavailability of encapsulated choline chloride products:

1. Type of encapsulation technology: There are different types of encapsulation technologies which are available to coat choline chloride granules. Based on the applied technology, results vary from one encapsulated choline chloride product to another.
2. Concentration of choline chloride in the encapsulation: In ruminants, the aim of the encapsulation is to provide maximum choline chloride for rumen bypass and intestinal release. Even if, the encapsulation technology is good enough to bypass choline chloride from the rumen for intestinal release, the concentration of choline chloride in the product makes a significant difference in economic viability of supplementation. Lower concentration of choline chloride in encapsulated product has always been a challenge for nutritionist to balance cost and space in the formulation.
3. Balance of coating ingredients: It has been found that two or more commercially available products in the market with same encapsulation technology vary in results as far as bioavailability is concerned. This is primarily due to coating material and its concentration applied on choline chloride. Strong or weak coating can result differently. If the coating is strong, it is possible that the product may have superior rumen bypass of choline chloride, however, it may also bypass intestinal release and excreted through faeces.

CholiGEM with C³ Model

Kemin's Scientists have invested more than half a decade to design a unique C³ model, to achieve the best results from supplementing Choline in the next generation of encapsulated choline solution "CholiGEM". The uniqueness of this model lies in:



Kemin's Choline Core: Kemin has developed its own choline core. This is developed with an expectation to coat with technical ingredients, hence various physical characteristics were considered during the development phase of these granules. These characteristics are: smooth core surface, controlled hygroscopicity, desired specific gravity, homogeneity, standard particle size, stability, desired level of active load of choline chloride in the dry granules and resistance during physical processing.

Scientific Coating: Kemin encapsulates the Choline Core with different levels of technical ingredients, improving the strength of the coating. This coating isn't too strong or too weak, but a perfect scientific balance. Excellent results are obtained with our scientific balance of 60% Choline chloride in the encapsulation.

Effective rumen degradation, rumen bypass rate and intestinal digestibility of CholiGEM are mentioned in Table 1 (TD-19-5765, TD-19-5766) which is a result of perfect scientific coating.

Table 1: Degradation kinetics, effective degradability and intestinal digestibility of CholiGEM

Parameters	CholiGEM
Degradation kinetics	
a%	27.57
b%	9.99
c%	62.45
Kd	0.0081
Effective rumen degradability (%)	28.71
Rumen bypass (%)	71.29
Intestinal digestibility (%)	98.4
Bioavailability (%)	70
G, bioavailable choline chloride/kg	370

Choline Concentration: Today, most of the commercially available encapsulated choline chloride products contains only 25 - 28 % choline chloride. This lower level of choline chloride in the product has always been challenging for a nutritionist to balance cost and space in the diet formulation. Kemin's choline core encapsulated with scientific coating resulted in to **60% choline chloride** in CholiGEM. More than double the concentration of choline chloride in CholiGEM with superior bioavailability creates up to 30 % more space in premix formulation.



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Higher concentration of choline chloride in CholiGEM with superior bioavailability also helps in lowering carbon and water footprints from manufacturing and transportation of CholiGEM based on per kg bioavailable choline chloride produced and shipped in the market. In this way, CholiGEM contributes in green footprinting.

Key advantages of CholiGEM with C³ Model

Kemin's Scientists have invested more than half a decade to design a unique C³ model, to achieve the best results from supplementing Choline in the next generation of encapsulated choline solution "CholiGEM". The main advantages of CholiGEM with its C³ model is that it provides:

- ✓ 60% Choline chloride in encapsulated form
- ✓ 370 g bioavailable Choline chloride/kg of CholiGEM
- ✓ Creates up to 30 % more space in premix/feed formulation
- ✓ Contributes in green footprinting



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