

Rumetrace Magnesium Capsules - Product Design

Rumetrace® Magnesium Capsules were developed at the Commonwealth Scientific and Industrial Research Organisation (CSIRO) by Dr Ralph Laby. They were the subject of international patents in the 1980's due to the technology incorporated into the product design.

Background

Magnesium

Magnesium is an important element in the diet of cattle. It is especially important to deliver a constant daily amount of magnesium over the metabolic "at-risk" period for a lactating cow. This is because body stores of magnesium cannot be mobilised in response to low blood levels as is the case with other macro-minerals such as calcium.

Controlled Release Technology

There are several characteristics to consider with any controlled release technology. These include the timing of the dose (e.g. constant, pulsating or continuous but changing predictably over time); control of the required dose level; site of dose delivery (site of release) and drug payload.

The Rumetrace Magnesium Capsules release magnesium in the rumen continuously at a rate of approx. 1.5% of capsule weight over a 9 – 12 week period.

In addition, controlled release technology design features take into account the site of absorption, the release process (e.g. physical, biological, chemical, mechanical), the biological action of the active ingredient in the device and retention by the target animal.

The Rumetrace Magnesium Capsules open in the rumen from cylindrical to flat to prevent regurgitation. Magnesium is released by an electrolytic process. The magnesium released is absorbed in the rumen of the cow to supplement the amount of magnesium provided in the diet.

Release Rate

The release of magnesium from the Rumetrace Magnesium Capsule is a function of interaction between the magnesium alloy and the rubber "hinge".

Magnesium alloy

A specific grade of magnesium alloy (with a precise, known and measured profile of other metals) is used in the

manufacture of Rumetrace Magnesium Capsules. The magnesium is cast in semi-cylindrical molds.

Rubber

The rubber layer of the Rumetrace Magnesium Capsule has two functions. It serves as a hinge joining two of the magnesium portions, so when the hinge is closed, the result is a cylindrical capsule that can be administered into the rumen of cows.

The second function of the rubber is a conductor, facilitating the erosion of the Mg of the magnesium from the outer surface. The rubber hinge of the Rumetrace Magnesium Capsules is electrically conductive, due to a specific matrix of conductive particles.

Interaction

In the cow's rumen the conductive particles of the rubber act as a cathode, and the magnesium alloy semi-cylindrical components act as anodes. The electrolytic effect drives the dissolution of the magnesium alloy.

Due to the catalytic effect the magnesium is released from the capsule in the rumen as Mg^{++} . This is the form of magnesium that is available to the cow for absorption. Conversely, magnesium in feed and other supplements must be first made available as Mg^{++} (magnesium is often bound in complexes, etc) for absorption by the cow.

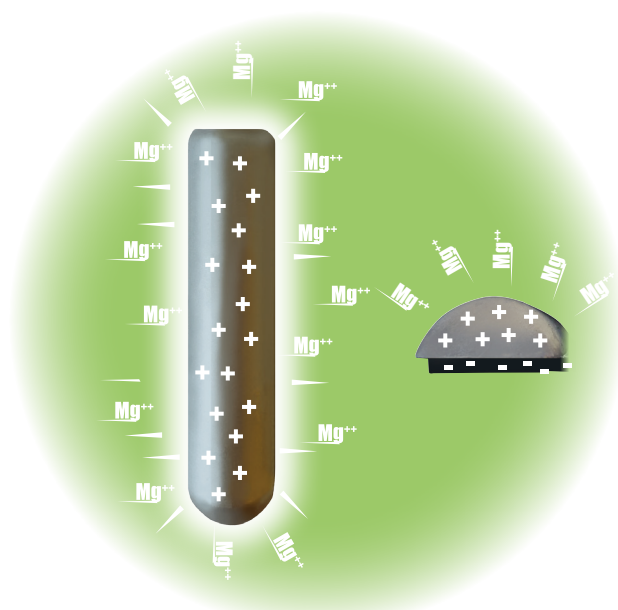


Fig 1. Electrolytic effect driving magnesium release

Product Shape

Rumetrace Magnesium Capsules form a cylinder when the rubber hinge is closed. Once the product enters the rumen the hinge opens and the product remains in the rumen as a flat section of rubber with two semi-cylindrical anodes adhered. The Rumetrace Magnesium Capsule design facilitates swallowing but limits regurgitation once the capsule opens.

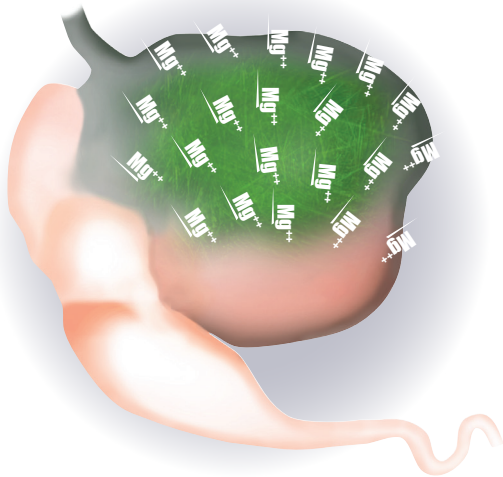


Fig 2. Available magnesium released at site of absorption, the rumen

Summary

In summary the design of the Rumetrace Magnesium Capsule is based on solid research and sophisticated technology. The result is a product that fulfils the requirements of a controlled release device and can be described as follows;

- Continuous release of magnesium in the rumen over the life of the capsule (9 – 12 weeks)
- Predictable release rate (1.5% of capsule weight)
- Fully available magnesium (as Mg^{++}) is released in target site of absorption, the rumen.
- Magnesium release driven by an electrolytic process
- Design that facilitates swallowing but limits regurgitation

References

- Ellis, KJ and Costigan P. Advances in controlled release technology for herbivores. 1989
- Laby, RH. Capsule for administration to ruminants. US Patent 4,623,345. 1986
- Laby, RH. Capsule for administration to ruminants. Australian Patent 026716. 1984

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