

Mepron® - The best Methionine source for ruminants shows excellent handling properties

Key information

- Mepron® is a dust free mini pellet (1.8 * 3mm) with a very high degree of durability and low humidity with min. 85 % content of DL-methionine in a rumen protected form. Its specific gravity (1.2 kg/L), bulk density (650 kg/m³) and angle of repose (21°) assure excellent flow and conveying properties.
- Using conventional mixing techniques, the product can be mixed with many types of feed ingredients quickly (2.5 min) and homogeneously (coefficient of variation < 5 %) and remains stable.
- Processed with abrasive or aggressive components (mineral feed, molasses, silage) Mepron®'s protective functions are fully retained. Also mechanical stress incurred in handling the product on conventional conveyors does not impair Mepron®'s functions.
- The excellent nutritional effects in feeding ruminants especially dairy cows are well known and published in brochures and on our web site.

Objectives

It is generally acknowledged that high yielding dairy cows require more methionine in their metabolism than average cows. In response several so called protected methionine products of varying quality have become available in the past. Mepron® has become the product with is taken serious by apliers in the market due to its well proven performance in animal feeding.

After 20 years of practical experience and a lot of investigations concerning our protected methionine source for ruminants this is an overview about properties and the excellent application and processing qualities of Mepron®.

Mechanical properties of Mepron®

An overview about the mechanical properties of Mepron® is given in Table 1:

Table 1: Mechanical properties of Mepron®

Properties	Values	Remarks
Particle size	1.8 * 3 mm	Can be mixed homogeneously
Specific gravity	1.2 g/cm ³	Hardly any segregation
Bulk density	650 kg/m ³	Good dosing properties
Angle of repose	21°	Free flowing
Percentage of dust	0.1 % < 1.4 mm	Virtually dust free
Loss on drying	max. 2 %	High stability during storage

Mepron® is a pellet (1.8 x3 mm) containing min. 85 % DL-Methionine wrapped in a protective coating which mainly consists of Ethylcellulose. Due to its **particle size** it can be mixed homogeneously with components with a mean particle size distribution of $d_{50} = 1.4-3$ mm, which is a typical size in common types of feeds.

Mepron® is virtually dust-free, has a very high durability (> 99.9 %) and low loss on drying (max. 2 %). Its **specific gravity** (1.2 g/cm³) is in the same range as that of most (organic) mixed feed components namely 1.2 – 1.4 g/cm³.

Bulk density (650 kg/m³) is a prerequisite for determining the capacity of containers and bulk flow on conveyors. In this respect Mepron® also matches the ranges of many other mixed feed components. The **angle of repose** (21°) which is a measure required to assess flow and conveyor performance confirms excellent performance during conveying and perfect flowability. Components with an angle of repose < 29° are usually said to have favorable mechanical conveying characteristics.

At a maximum of 2 % **loss on drying** (moisture content) Mepron® has a very low water content compared with other feed mix components.

Mepron® can be mixed **homogeneously** (CV < 5 %) with most feed ingredients within short mixing times (2.5 min). Those mixtures will not segregate under normal conditions (CV < 3 %). The rate of rumen protection will not decrease when mixed with abrasive or aggressive components (mineral mixes, molasses, silage) or when subjected to heat (85° C) and/or moisture.

The **mechanical stress** during transport with usual conveyers (screw, elevator, pneumatic transport) is of no effect on the rumen protection of Mepron®. Detailed results can be seen later on. To test its qualities under extreme conditions, Mepron® was exposed in a stress test conducted in a climate chamber at 40° C and 92 % relative atmospheric humidity under pressure corresponding to 1.6 t/m². Following the 24 h test the product's abrasion and protective parameters were found to equal the characteristics of unexposed material.

Due to its good mechanical stability the packaging could be switched from cardboard boxes used to 25 kg bags (750 kg/pallet) and 750 kg big bags. 2 pallets can be stacked upon each other also during transportation without damaging the protective coating.

Handling properties of Mepron®

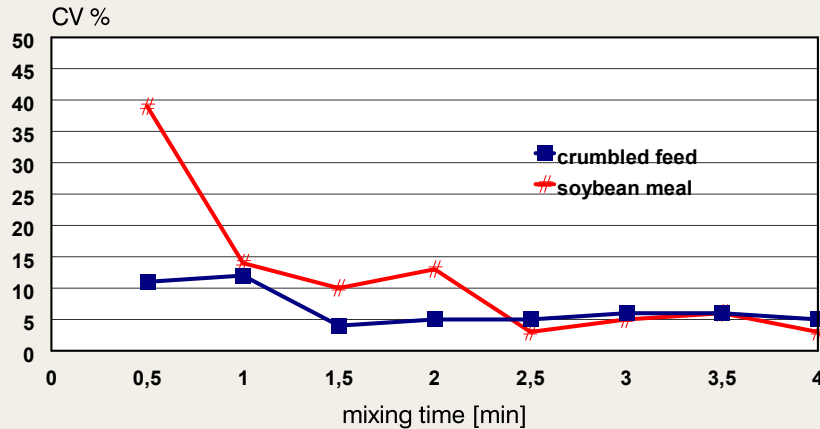
Mixing

In order to determine the mixing properties of Mepron in ordinary feed a mixing time profile was measured:

Thus 2 % Mepron® were mixed with soybean meal using a single shaft horizontal ribbon mixer with 20 rpm and 90 % loading at 20° C and 74 % of rel. atm. humidity. 8 samples of 250 g each were taken from the mixer after 0.5 up to 4 minutes mixing time.

After 2.5 minutes resp. 1.5 minutes a coefficient of variation (CV) of less than 5 % is reached.

Figure 1: Mixing time profile at ambient temperature and humidity



For the mixer used in this experiment, mixing time profiles obtained with DL-Methionine or sodium chloride as test substance result in mixing times of 2.5 min as well to get a CV < 5 %. That means, the necessary mixing time for Mepron® corresponds to that of other microingredients. Crumbles are particularly suitable.

Segregation

A sample of a mixture (2 % Mepron® in soybean meal) was released from a bin (diam. 150 mm, height 115 mm, diam. outlet 28 mm, drop 200 mm) to form a cone approx. 60 mm high spread horizontally. The cone was divided into 3 horizontal layers of the same height (approx. 20 mm). Each layer was analysed for its methionine content to calculate the CV %. The result was a very low CV of only 3 %.

	Angle of repose [°]	CV [%] of Mepron® in layers of the cone
Mepron® in soybean meal	31	3

Stability during mixing process

Many components - especially additives - are not stable in mixes with other components. Mixes using mineral feed, molasses and silage with protected methionine were therefore of special interest.

In a typical experiment 10 % Mepron® was mixed with 6 different mineral mixes (M1 - M6) and soybean meal (S). A horizontal mixer with plow shaped mixing tools was applied (60 % loading, 19° C, rel. atm. humidity 68 %). Samples were taken after varying mixing intervals in order to test the influence of the mixing process on the methionine protection in comparison with an untreated sample. By this the relative protection [%] was determined (Table 2).

Table 2: Relative rumen protection [%] of Mepron® in different mineral mixes RRP [%]

Mixing time (min)	M1	M2	M3	M4	M5	M6	S
2	> 99	> 99	> 99	> 99	> 99	> 99	> 99
4	> 99	> 99	> 99	> 99	> 99	> 99	> 99
6	> 99	> 99					> 99
8	> 99		> 99	> 99			
20*)							> 99

*) at 85° C

RRP [%] = Protection rate after mixing/ Protection rate before mixing *100

Even after 8 minutes of mixing and the use of very coarse and very abrasive minerals at times, Mepron® did not lose its protection, which can be seen from the practically unchanged relative protection rate of > 99 %.

A lot of protected methionine compounds, especially with excipients of low melting point, are destroyed by heat treatment. Mepron® however, mixed with soybean meal at 85°C proved to be stable.

Stability in silage

6 different types of silage were mixed with Mepron® (2 %) and stored at room temperature for 48 h. Mepron® proved to be practically 100 % stable.

Table 3: Relative rumen protection [%] of 2 % Mepron® in silage (stored) for 48 h

Type	DM [%]	pH	RRP [%]
Corn	38	3.9	> 99
Corn	42	4.0	> 99
Grass	45	5.1	> 99
Grass	48	4.7	> 99
Grass	59	4.8	> 99
Grass	67	5.5	> 99

Stability in molasses

40 % Mepron® were mixed with molasses and stored for 8 days at room temperature. The methionine content as well as the protective capability of Mepron® remained intact after this exposure.

40 % Mepron® in molasses

	RRP [%]
24 hours	> 99
8 days	> 99

Stability in mineral mixes

After 18 months of storage of mineral premixes including 10 % of Mepron® its protected qualities still remained unchanged.

10 % Mepron® in mineral mixes

	RRP [%]
18 months	> 99

Conveying

Raw materials, intermediates and finished products require conveying to undergo numerous processing steps in feed manufacturing. To maintain quality the in-plant material handling must be accorded the same care as, say, mixing processes. In particular, conveying equipment such as screw type, elevator or pneumatic installations must not alter or segregate feed and their mixes. Mechanical stress imposed by horizontal and vertical continuous conveyors means a challenge for any protective coating. Therefore, conveying experiments with different typical feed conveying systems were undertaken and relative protection rate after conveying was determined (Table 4).

Table 4: Relative rumen protection [%] after different conveying operations

Number of conveyances	RRP [%]			
	Horizontal screw	Vertical screw	Bucket elevator	Pneumatic conveyor
1	> 99	> 99	> 99	> 99
2	> 99	> 99	> 99	> 99
3	> 99	> 99	> 99	> 99
4	> 99	> 99	> 99	n.d.
5	> 99	> 99	> 99	n.d.

For example the horizontal screw conveyor (U-shape trough, width 110 mm, depth 120 mm, length 750 mm, 90 rpm) was loaded with Mepron® and conveyed altogether 5 times. After each conveying process the protective function of each sample was tested and compared to untreated material. Analogously the other conveying systems were tested (vertical screw: diameter 127 mm, length 5 m, 800 rpm; bucket elevator: length 4.5 m, 7 buckets of 300 mL each per m, speed 1.75 m/s; pneumatic vacuum conveyor: air volume 100 m³/h at -0.2 bar, diameter of the piping 50 mm, length 20 m with two 90° and one 180° elbow).

In all cases relative rumen protection rates were > 99 %. This means that typical conveying systems like screw, bucket or pneumatic conveyors do not affect protective coating of Mepron® in any way.

Conclusion

Besides its very good nutritional effectiveness in feeding of dairy cows and other ruminants Mepron® shows excellent mechanical and handling properties like high durability, high stability during typical steps of feed processing and towards aggressive feed components, excellent flowability and mixability as well as low segregation tendency from feed mixtures.

Therefore, Evonik's Mepron® is the first choice to supply ruminants reliably with methionine.

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Evonik Operations GmbH
Nutrition & Care
Animal Nutrition Business Line

animal-nutrition@evonik.com
www.mepron.com