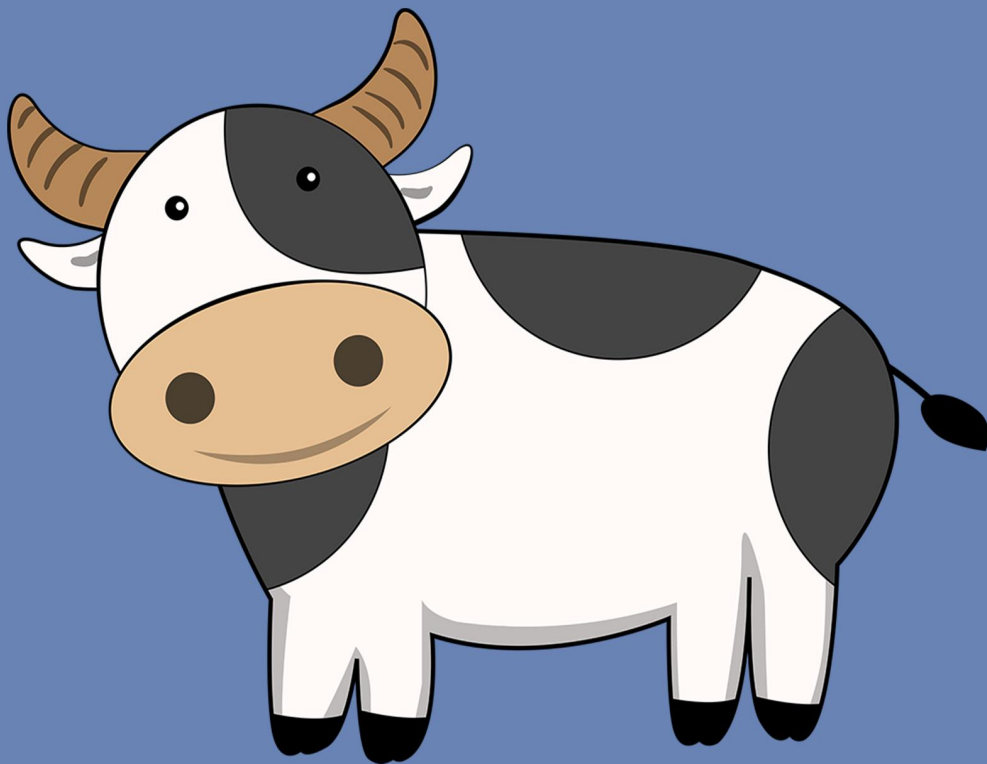


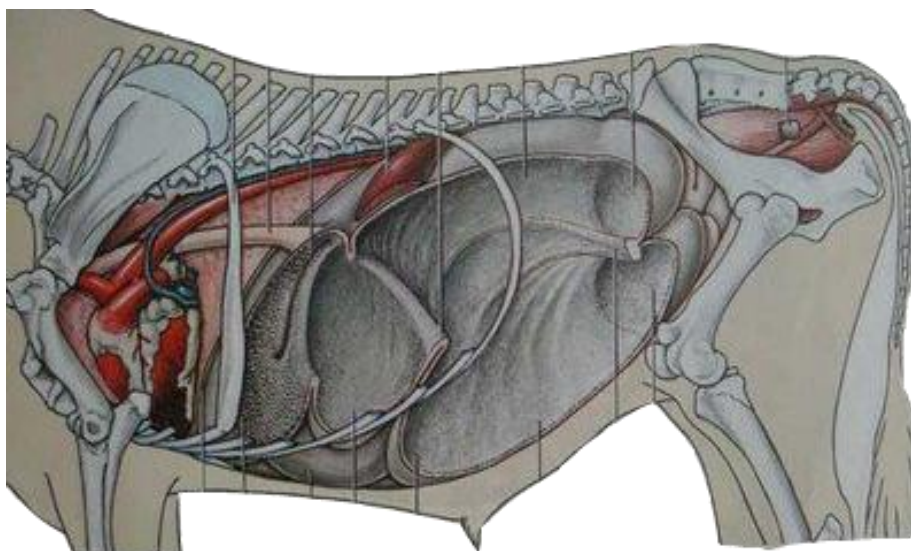
# Effect of rumen-bypass methionine on ruminants



## **Effect of rumen-bypass methionine on ruminants**

**Abstract:** Methionine is one of the important nutritional components of ruminants, which can be rapidly degraded by rumen microorganisms when it is directly added into the diet, and cannot meet the high-yield needs of animals.

Since Zuntz and Hagemann, two German scientists, discovered in 1891 that ruminants can use non-protein nitrogen, human beings have studied protein nutrition for more than 100 years. At present, researchers have confirmed that the essence and core of nutrition in protein is amino acid nutrition. It is deeply recognized that methionine, as an important restrictive amino acid of ruminants, plays an important role in giving full play to animal production potential, alleviating the shortage of feed resources in protein, reducing manure and urine nitrogen emissions and protecting the environment. However, due to the special digestive and metabolic pathway of ruminants, the direct addition of crystalline methionine will degrade rapidly under the action of rumen microorganisms (protozoa, bacteria and fungi) and lose its remarkable biological efficacy.

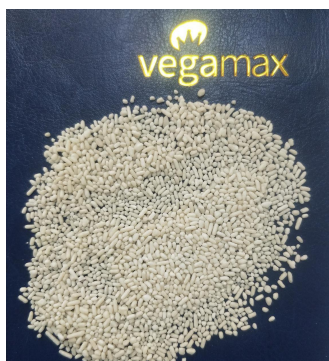


### **1 Physical and chemical properties and biological characteristics of methionine**

Methionine is one of the essential amino acids, which can play a positive role in regulating the synthesis and metabolism of protein, improving production performance and enhancing immunity.

① In metabolism, methionine is the methyl donor of the methyl reaction in lipid synthesis, and its deficiency will affect the synthesis of milk fat. Creatine can be produced by methionine

degradation, and creatine and creatine phosphate play an important role in energy storage and utilization. Methionine can produce spermine in vivo, and spermine can promote cell division and DNA transcription. Methionine is also involved in the synthesis of adrenaline and choline in animal body, and its deficiency will lead to a series of deficiencies such as dysplasia, weight loss, muscle atrophy and hair deterioration. ②In terms of improving production performance, many experiments show that methionine can increase milk yield and milk protein content, increase daily gain of beef cattle, and improve cashmere production of cashmere goats. ③In terms of immunity, methionine has a wide range of antibacterial effects. Studies have confirmed that rumen methionine can reduce lymphocyte apoptosis in peripheral blood and enhance T lymphocyte proliferation in summer.



Methionine is the most toxic among all amino acids, and excessive addition will break the balance of animals and damage animal tissues and organs. Excessive addition of methionine will destroy the balance of amino acids, make the body metabolize excessive amino acids, and cause the increase of urea nitrogen content and urine nitrogen output.

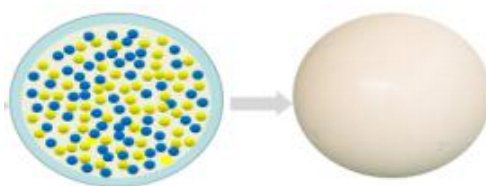
## **2 Type and mechanism of rumen-bypass methionine**

### **2.1 Chemical protection method**

The mechanism of chemical protection method is to mask amino groups in methionine through a certain chemical reaction, and then use rumen microorganisms to re-form amino groups, so as to achieve the purpose of rumen bypass, so that methionine can enter the small intestine and be effectively absorbed and utilized. At present, the main products are amino acid analogues and amino acid metal chelates.

### **2.2 Physical protection method**

Physical protection method mainly refers to amino acid coating method, namely fat coating, cellulose coating and polymer coating. The mechanism is to utilize the physiological characteristics of obvious pH difference among rumen, stomach and small intestine of ruminants. Methionine was coated with pH sensitive material, which made it stable in rumen and easy to be released and absorbed in stomach and small intestine. Commonly used coating materials include fat (animal fat, vegetable fat, palm oil fat powder), cellulose (ethyl cellulose, hydroxypropyl cellulose) and high polymer (acrylic resin type I, II, III, IV).



### 3 Effect of rumen-bypass methionine on ruminants

#### 3.1 Effect of rumen-bypass methionine on dairy cows

##### 3.1.1 Effect on rumen environment

The stability of rumen environment is an important guarantee for high yield of dairy cows. The experiment proved that the addition of rumen methionine can promote the growth of rumen microorganisms, enhance the ability of rumen microorganisms to synthesize bacterial protein by  $\text{NH}_3\text{-N}$ , and improve the utilization efficiency of  $\text{NH}_3\text{-N}$ .

##### 3.1.2 Effect on milk yield and milk composition

Milk yield and milk composition are important indexes to measure the availability of rumen methionine. Many experiments show that the effect of methionine on milk yield and milk composition is influenced by many factors such as animal species, age, physical condition and basic diet.



### 3.2 Effect of rumen-bypass methionine on beef cattle

When nutrients in ruminants' diets are insufficient, they will degrade body tissues to meet the needs of maintenance and production, which will lead to abnormal nitrogen metabolism. Methionine can increase nitrogen deposition rate and nitrogen digestion percentage, and reduce urine nitrogen emission. Experiments show that methionine can significantly improve the rumen effective degradation rate and degradation rate constant of dry matter, organic matter, neutral washing fiber and acid washing fiber of corn straw, and significantly improve the utilization rate of inferior corn straw.