

Technical Memorandum

TM 2104-1e

MARZYME® Microbial Coagulant

DANISCO



INTRODUCTION

MARZYME® is a single enzyme, milk coagulant for the dairy industry, produced by fermenting our preferred production strain on a replenishable vegetable substrate. The activity is then standardised for use in all types of cheese.

The enzyme has a highly specific cleaving activity on k-casein, resulting in optimal curd formation, high cheese yield and the correct cheese flavour and texture development.

MARZYME® complies with JECFA (FAO/WHO) and FCC recommended specifications for food grade enzymes. It is produced in compliance with the regulations of the USA and other relevant health authorities for the production of food enzymes. MARZYME® is certified Kosher and Halal.

PRODUCT RANGE

The MARZYME® product range consists of the products mentioned in table 1.

ENZYME CONTENT

MARZYME® is a mono-component enzyme solution of MucorPepsin (EC 3.4.23.23). The fermentation is carried out under contained conditions, and neither the strain nor any genetic material is present in the final product. Each batch is tested to confirm the absence of potential contamination by lipolytic activities.

APPEARANCE

MARZYME® Liquid is a clear amber liquid. MARZYME® Powder is an off-white to beige powder with improved solubility.

Small batch to batch variations in colour may be seen. This has no influence on the performance or declared clotting activity.

USE

It is advisable not to dilute more of the coagulant than required to meet immediate needs. The recommendation is to dilute one part coagulant in 10 to 20 parts water prior to use, depending on what is required to ensure uniform distribution in the cheese vat. The water should be potable, chlorine-free and have a slightly acid to neutral pH. The diluted coagulant should be used immediately by stirring into the milk for 2-3 minutes to ensure uniform distribution in the cheese vat. Excessive stirring can impair curd formation.

The first signs of clotting may be faster with MARZYME® compared to chymosin (animal or FPC, fermentation-produced chymosin) but setting times are generally similar. Ideally an additional five minutes should be added to the setting time to ensure the same firmness prior to cutting. Cutting should begin at a slow speed to prevent fat and fines losses. A 30-second heating time may be introduced after a few passes of the knives. This will help optimise yield. Cut times will, of course, depend on the efficiency of the knives and size of curd required, but 10 to 15 minutes is generally sufficient. At a pH below 6.5, MARZYME® will usually produce a firmer set than chymosin.

TYPICAL DOSAGE FOR CHEESE-MAKING

MARZYME® is normally dosed with 3000-6000 IMCU/100L of cheese milk. Individual dosages are determined by the following factors:

- Temperature of cheese milk
- Cheese milk pH at renneting
- Cheese type and desired setting time
- Characteristics of the culture
- Calcium content natural/added

Product name	IMCU/ml	Packaging sizes	Format	Supply area
MARZYME® 10	140	25 L	Liquid	Europe
MARZYME® 15	210	25/1000 L	Liquid	Europe
MARZYME® 50	710	25/200/1000 L	Liquid	Europe
MARZYME® 55	800	25/1000 L	Liquid	Global
MARZYME® 55 PF	800	25 L	Liquid	Global
MARZYME® Supreme DS	710	5 gal	Liquid	US, Canada
MARZYME® 150 mg	2200	500g	Powder	Global

Table 1. The activity in IMCU/ml, International Milk Clotting Units, is determined according to the ISO 11815/IDF 157 standard. NB: other packaging sizes may be available upon request.

Cheese type	Dosage/ml for 100L of milk	
	MARZYME® 10	MARZYME® 50
Fromage frais	2 to 6	0.5 to 1.1
Goat cheese	7 to 12	1 to 2
Camembert type	18 to 22	3 to 4
Cheddar and Italian	40	7.2

Table 2. Typical dosages for cheese-making.

Addition of calcium chloride solution is also recommended (100ml of a 500gL⁻¹ solution per 1000 litres of milk). It is important to ensure that the milk surface is not subject to temperature gradients that may cause inadequate setting near the surface and so reduce yield.

Studies of *Mucor*-derived coagulant by Fedrick and Fuller (1988) and at the University of Wisconsin have shown no significant differences in fat, protein and non-protein nitrogen levels when using MARZYME® in whey compared to traditional or fermentation-produced chymosins. Nor could a licensed cheese grader distinguish flavour differences at 1, 3, 6, 9 or 12 months (Chen *et al.*, 1994).

In Danisco's laboratories, comparisons of peptides formed in Cheddar cheese made with MARZYME® show a similar pattern of bitter and non-bitter peptides as that found in the same cheese made with animal coagulant. Overall peptide concentrations were almost identical.

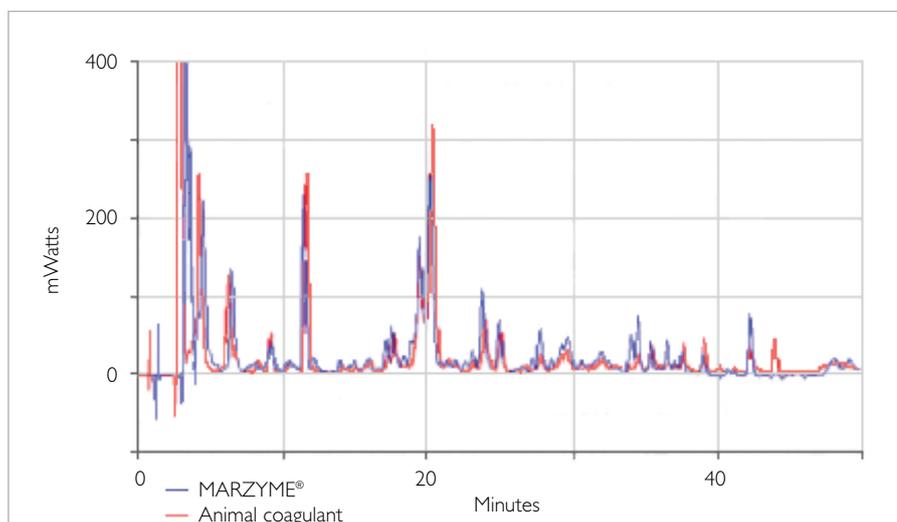


Figure 1. Peptides extracted from Cheddar cheese. Separation based on hydrophobicity and size.

SPECIFICATIONS

Specifications for microbial quality, activity and other technical data are available upon request along with Kosher and Halal certificates. A certificate of analysis, including the product reference numbers and batch delivery data, will normally accompany all MARZYME® deliveries.

ACTIVITY CONSIDERATIONS

The measurements of relative clotting time in the graphs below indicate the time necessary for a typical milk coagulation process, relative to other points on the same graph (expressed in arbitrary units). A fall in the relative clotting time reflects an increase in the enzyme activity for that material.

pH

The relative activities of coagulants are pH-dependant – the lower the pH, the higher the activity. MARZYME® closely reflects the pH activity profile of traditional rennet.

CALCIUM

Calcium chloride addition to the cheese milk increases the activity of MARZYME®, partly due to a decline in pH due to the effect on the Ca²⁺ H⁺ balance and on casein micelle aggregation.

TEMPERATURE

The relative activity of coagulants is determined by temperature. The temperature optimum for MARZYME® is around 40°C. It is more easily deactivated at a higher scald than animal or fermentation-produced chymosin.

THERMOLABILITY

Danisco was the first to patent technology for increasing the thermolability of microbial coagulants. MARZYME® is deactivated in whey using standard pasteurisation techniques: 20 seconds pasteurisation at 68°C and pH 6.0 reduces residual activity by 98%.

This improved functionality is especially evident with pizza cheese applications where MARZYME® ensures minimum proteolysis during cheese shelf life.

A MARZYME® product with reduced thermolability and thus higher process activity can be supplied on request for high scald processes.

STORAGE/TRANSPORT

MARZYME® should preferably be stored cool at 0 to 6°C in the closed original container. During transportation, the temperature should not exceed 20°C. Prolonged exposure to elevated temperatures may influence product shelf life.

HANDLING PRECAUTIONS

The product is non-flammable, miscible with water and safe to use when applied according to the instructions. Proteolytic enzymes may irritate skin and eyes, and aerosols made with enzymes may cause sensitisation when inhaled. In the event of spillage and contact with eyes and skin, rinse with water. For further information, please request our safety data sheet.

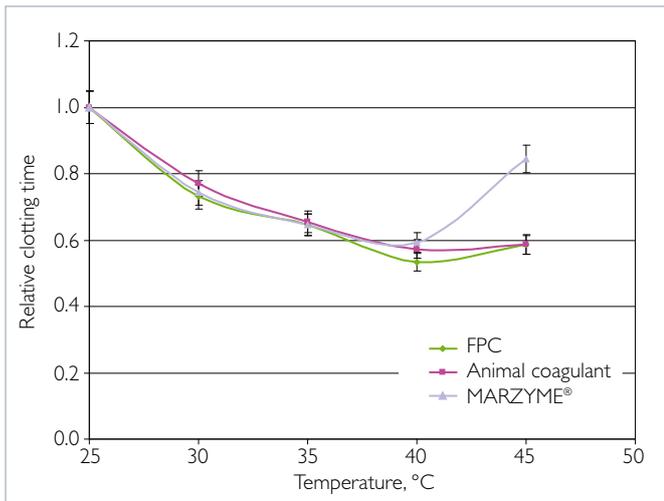


Figure 2. The relative activity of coagulants in relation to temperature.

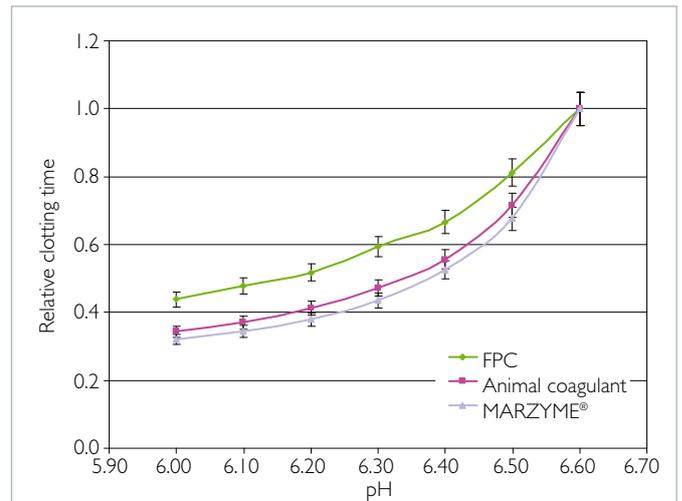


Figure 3. The relative activity of coagulants in relation to pH.

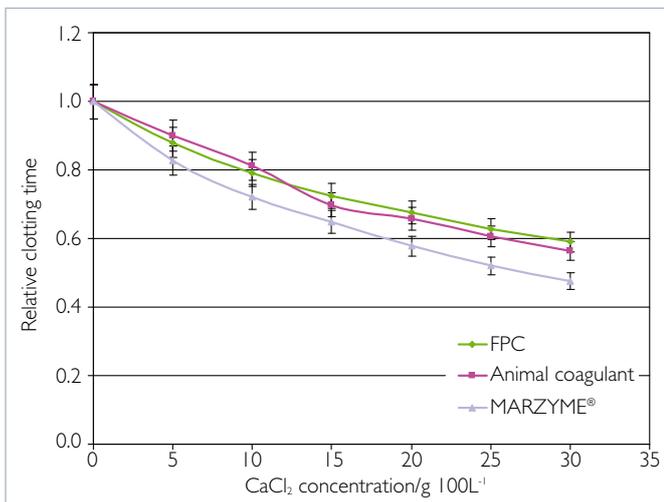


Figure 4. The relative activity of coagulants in relation to calcium chloride.

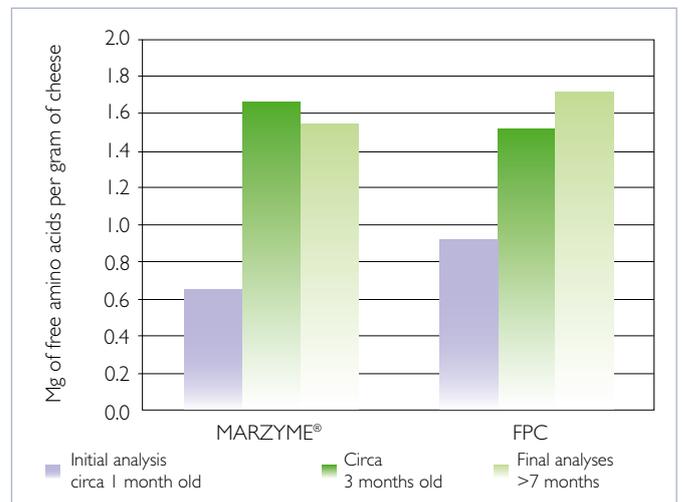


Figure 5. String cheese. Note assay variation of 10% thus no significant differences observed between samples.

STABILITY

When stored and transported under optimal conditions, MARZYME® will maintain the declared minimum activity until the expiry date, losing no more than 0.5% activity a month.

PURITY

MARZYME® is produced using a carefully monitored process to avoid lipase, amylase or other protease side activities. Each batch is monitored, and a maximal residual value for lipolytic or amolytic activities is quoted on the PDF.

TECHNICAL SERVICE

Danisco's facilities and application staff are available to provide worldwide assistance and instructions.

Danisco A/S

Edwin Rahrs Vej 38
DK-8220 Brabrand, Denmark
Telephone: +45 89 43 50 00
Telefax: +45 86 25 10 77
info@danisco.com
www.danisco.com

The information contained in this publication is based on our own research and development work and is to the best of our knowledge reliable.

Users should, however, conduct their own tests to determine the suitability of our products for their own specific purposes and the legal status for their intended use of the product.

Statements contained herein should not be considered as a warranty of any kind, expressed or implied, and no liability is accepted for the infringement of any patents.

DANISCO

First you add knowledge...