Enzyme Development Corporation
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White Paper: Thistle Rennet for Enzyme Modified Cheese Production

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HISTORY OF THISTLE RENNET

Thistle Rennet has a documented use as far back as the time of the Roman Empire. It is mentioned in the works of Lucius Junius Columella in his treatise De Re Rustica: "though (milk) can also be coagulated with the flower of the wild thistle…" One of the primary reasons that Vegetarian rennets, such as the Thistle rennet, are used is that, unlike Animal Rennet, the botanical rennets are not limited by potential religious restrictions. Thistle Rennet is suitable for use in both Kosher and Halal Cheese. While other options may exist now, 2000 years ago, the choice for cheese making was limited.

Traditionally, thistle rennet was prepared on individual farms. Farmers would collect the thistle flowers and dry them so that they could be used throughout the year. As needed, the dried flowers would be pulverized with a mortar and pestle and then steeped in hot/warm water to make a "tea." Determining the correct amount of "tea" to add to the milk in the cheese recipes would require a great amount of trial and error. The enzyme activity in the "tea" would vary from year to year due to the quality and quantity of the flowers, the quality of that day's milk, and the person preparing the "tea." This "home" process could lead to a rennet having a very high activity or a low activity. The variation in homemade thistle rennet activity may be one of the primary reasons that it is often reported as causing bitter flavors. Bitter flavors are often the result of overdosing the protease. This bitter flavor effect is reported in other industries working in protein hydrolysis.

Until now, the expansion of the thistle cheeses has also been held back by regulatory issues. Rennets must be approved by the various regulatory bodies, making it difficult to produce cheese for sale beyond the local farm. As of 2015, this is no longer an issue for Thistle Rennet in the USA and Canada. Both countries approved the use of thistle rennet in cheese, as long as the rennet is produced in a facility that meets food-grade processing requirements. Thistle rennet is also included with the recent EU dossier submissions on the use of enzymes in food processing.

EMCS USING THISTLE RENNET

There's evidence to show that thistle rennet can be used to "accelerate" the aging of young cheeses, making a one-month-old cheddar taste as if it were aged significantly longer. For EMC production, it can be used to create a strong flavor from fresh or young cheese, or cultured milk. When thistle rennet is used with milk and cultures that are used for particular types of cheese production, it can create a strong EMC flavor for those types of cheese without actually producing the cheese first. The result is the production of a flavor that mimics a long-aged cheese and only a matter of days.

Thistle rennet has more active cutting sites than traditional rennets, which only cuts kappa casein. Thistle rennet cuts not only the kappa casein but also alpha, beta, and gamma casein. For clotting to occur with this product, there needs to be a high levels of calcium to form the form enough calcium phosphate bonds for curd formation. When additional calcium chloride is NOT added, this protease works extremely well at liquefaction of the cheese in EMC production. The increased number of active cutting points provides an end product that is smooth and creamy, without the grittiness that can be found in some EMCs.

Using thistle rennet for EMC production results in the production of strong flavors, as well as unique and different flavor profiles. Flavor developers can use thistle rennet to create an old-age cheese flavor without the months or years for the cheese to develop that flavor through aging. EMCs produced with thistle rennet are easily pumpable, without clots or gelling, and limited settling. The EMC is a smooth texture that does not experience separation, making it easy to work with in food processing.

KEY FINDINGS

Intensifies Flavor

Using thistle rennet as a protease helps intensify the natural flavor in the cheese without modifying it too much or causing the production of other flavor notes. When used at higher dosages, it can add a slight herbal note that can complement the cheese flavor. The main concern that most thistle rennet users have is the generation of bitter flavor notes, which is a result of over hydrolysis or overdosing of the enzyme. Commercially produced, this all rennet is standardized based on activity allowing users to have better control over their hydrolysis and reduce the possibility of generating bitter flavor notes.

Unique Cutting Pattern

Traditional rennet cuts the kappa casein, which allows for the formation of calcium phosphate bonds for clotting. Thistle rennet cuts the alpha, beta, gamma, and kappa casein; it requires additional calcium in order to get a firm curd formation. When additional calcium is not added into the process, thistle rennet can be used as a protease for enzyme modified cheese production. The multiple cutting allows for liquefaction of the cheese during the processing and creates a smooth texture for the final product without any grittiness.

Non-GMO

Thistle rennet is non-GMO and is produced without the use of chemical solvents. It is a plant-based ingredient that is perfect for use in a clean label application.

Vegetarian

Thistle rennet is a true vegetarian rennet that can help produce unique flavors and textures. This plant-based product is produced by brewing the thistle flowers like a tea.

Gluten-Free

Thistle rennet is a botanical enzyme that is extracted from the thistle flower, making it suitable for use in products making a gluten-free claim. It also meets the FDA's new requirements for use in a product that makes a Gluten-Free claim.

Kosher and Halal

Unlike animal-derived proteases, Thistle rennet is suitable for use in Kosher and Halal products. Its unique properties can create similar flavor profiles to cheeses that are traditionally made with animal-derived enzymes.

EMC PRODUCTION TEST RESULTS

Enzyme	MCU of Rennet per 100g of Cream Cheese	Incubation Time	Flavor
No Enzyme		48 hours	Cooked cream cheese, slightly salty
No Enzyme		72 hours	Cheeze Whiz, cooked, lactic
Thistle Rennet	6250	24 hours	Slight saltiness, with cottage cheese flavor
Thistle Rennet	6250	48 hours	Salty, flavor similar to cottage cheese
Thistle Rennet	12500	24 hours	Milly, almost like condensed milk. Lactic sweetness
Thistle Rennet	12500	48 hours	Cauliflower, mushroom, herbal, and a slightly meaty flavor
Thistle Rennet	12500	72 hours	Mushrooms, Cauliflower. Potatoes
Thistle Rennet	25000	48 hours	herbal, meaty, slightly bitter but not unpleasant
Thistle Rennet	25000	72 hours	Herbal, meaty, slight salt finish with a herbal bite

CONCLUSION

1. Thistle Rennet is a highly effective protease for use in EMC Production. It is capable of producing strong, intensified flavors without off notes and bitterness, as well as new and different flavor profiles.

2. This protease provides a tool for liquefication without clumping, grittiness, or gelling. Resulting in an EMC with a smooth and creamy texture.

3. Thistle Rennet is a good option for Clean Label products:
    a. It offers a Gluten-Free option for milk and cheese hydrolysis
    b. It is non-GMO
    c. Plant-Based

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