Using Enzyme Technology to Improve Plant Protein Performance in Food Applications

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Amano Enzyme USA
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Amano Enzyme

Who is Amano Enzyme?

Leading the World in Research & Development for Enzymes

AMANO HAS AN EXTENSIVE STRAIN LIBRARY

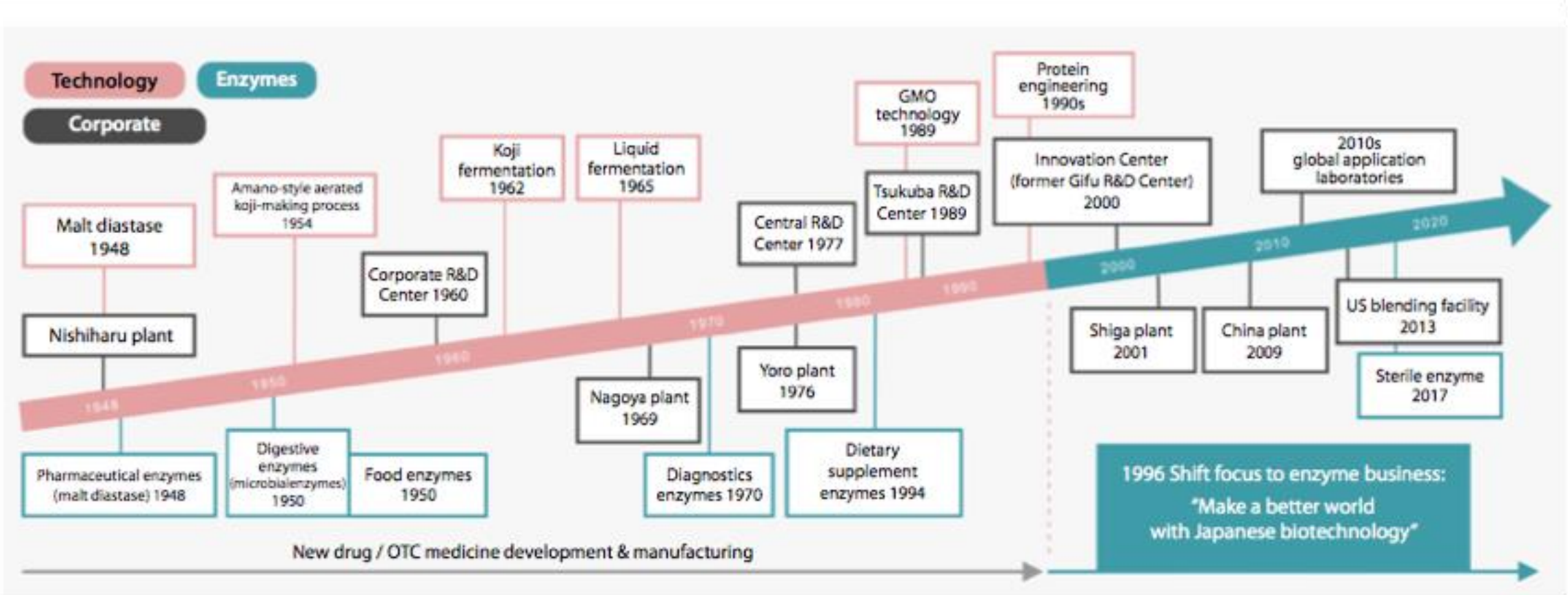
Over 16,000 micro-organisms obtained from a variety of environments, such as the deep sea.

Our Innovation Centre and Production Technology Centre continue working on the discovery of new enzymes and yield improvement, while our regional application centres offer technical support to our customers.

R & D Innovation Centre (Gifu, Japan)

70 Years in the Enzyme Business

Amano Enzyme has been researching nature's enzymes to develop and manufacture microbial enzymes for over 70 years (since 1948).

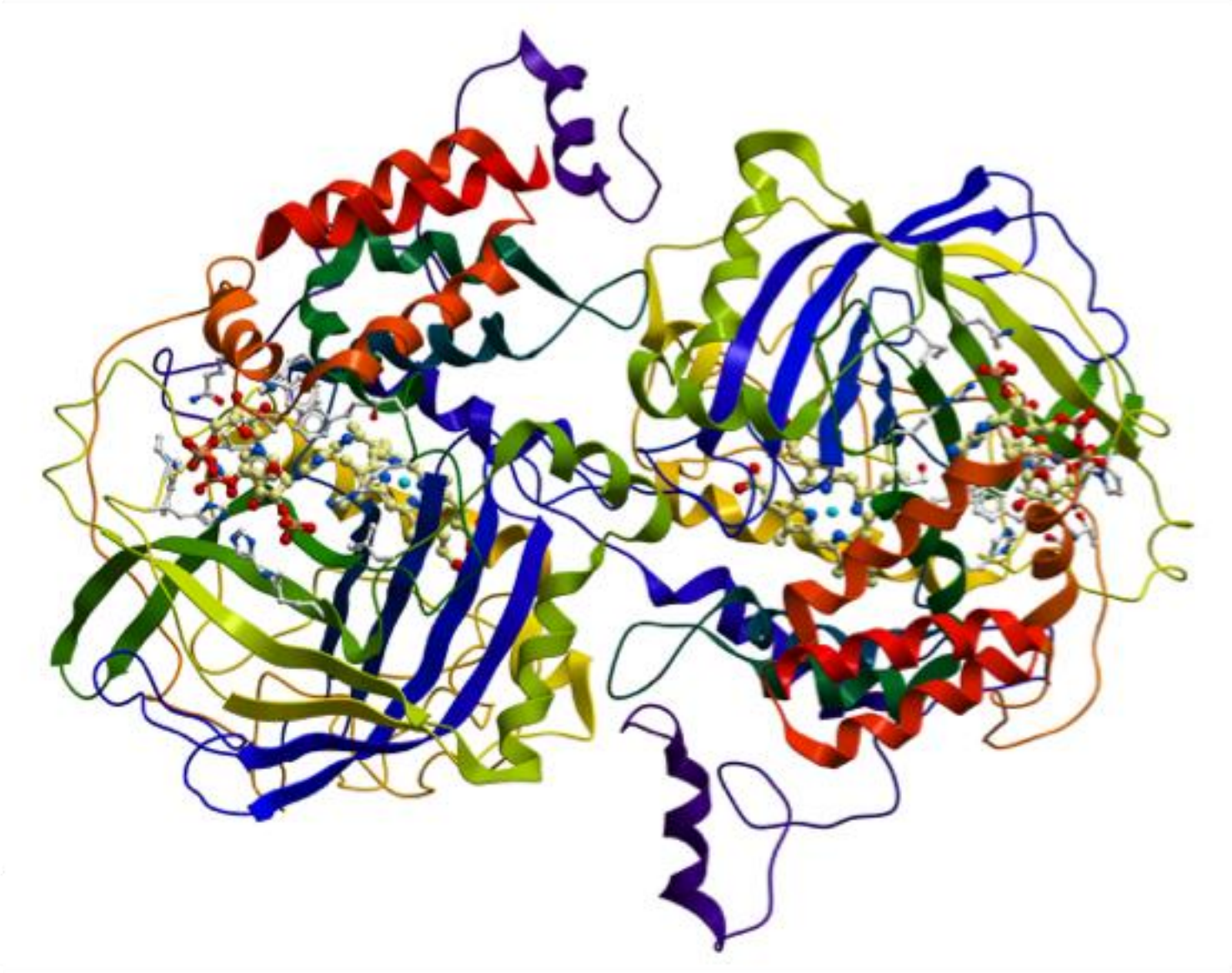


A Global Network - From Japan to the World!

Amano has a global network with our headquarters, 3 plants and Innovation Centre in Japan, as well as overseas operations across 5 regions

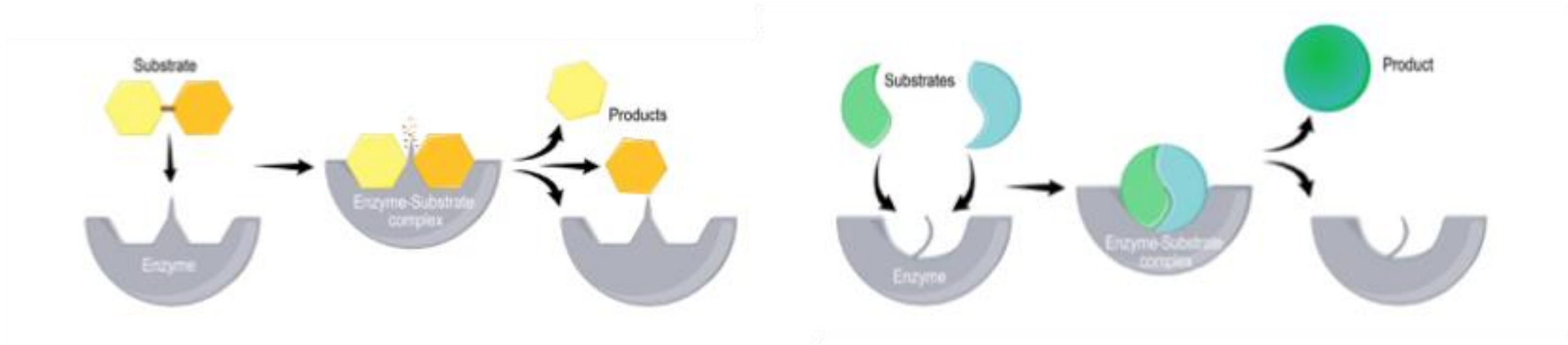
... with the best support team close to you, we are able to reach and provide you with the finest solutions and service imaginable!

Welcome to the Wonderful World of Enzymes



What are Enzymes?

- **Biological catalyst,** most often proteins, that catalyze reactions so they happen more quickly
- **Enzymes have very distinct conformations** that result in precise reactions on specific substrates and mostly predictable products
- **Enzymes react on substrates** – they usually break substrates apart or take substrates and connect them together



Enzymes are all around us

Food stain on your shirt?

The enzymes in your laundry detergent will break down the stain to make it easier to clean.

Biofuels for cars?

Enzymes break corn down to sugars, and the enzymes in yeast convert it to alcohol.

Lactose intolerant?

Enzymes break down lactose in milk so you can enjoy your dairy products.

Plant-based Dairy

Plant-based milks have both functional and nutritional challenges

- They tend to be low in protein
- They can be high in simple sugars (DP1, DP2)
- They curdle when added to hot drinks like coffee
- They separate and sediment settles without stabilizers
- Some don’t have a smooth creamy mouthfeel
- They don’t foam and froth well

PG500 for creamy, frothy, plant-based milks

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PG500 for creamy, frothy plant-based milks

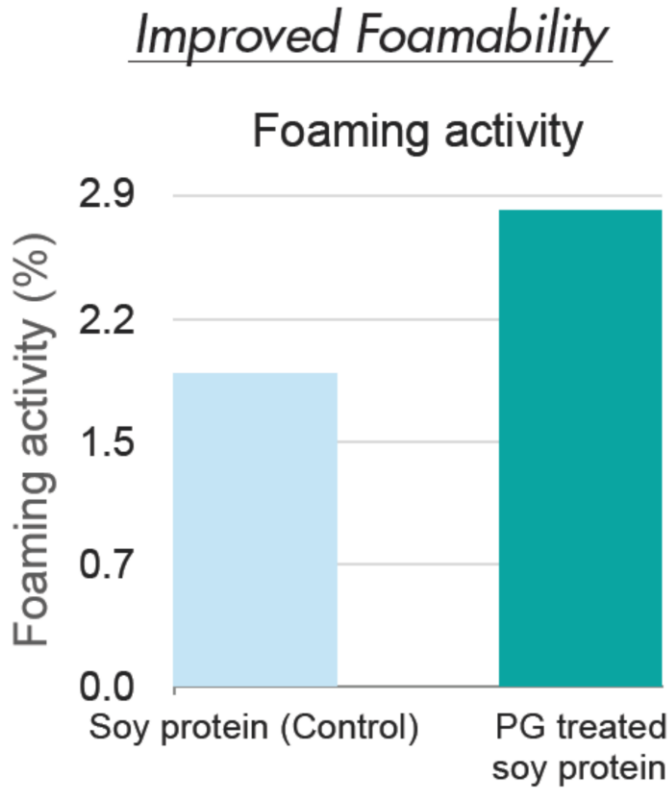
- Protein Glutaminase “Amano” 500 (PG500) improves the functional properties of proteins
- Improve protein solubility and stability at low pH
- Allows for increased protein content
- Promotes a smooth, delectable mouthfeel
- Creates better quality, more stable froth

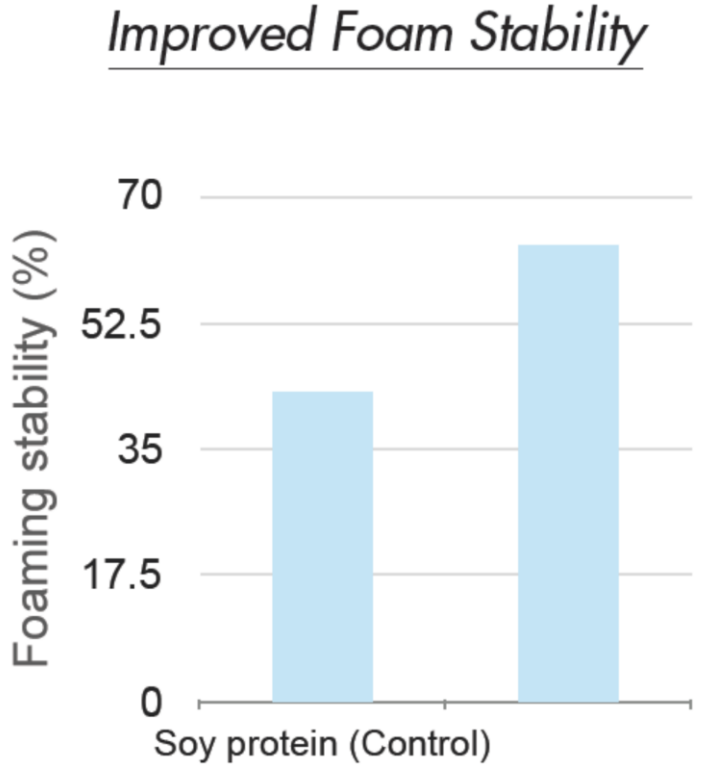
PG500 increases protein solubility, creates stable froth

control with PG500

control with PG500

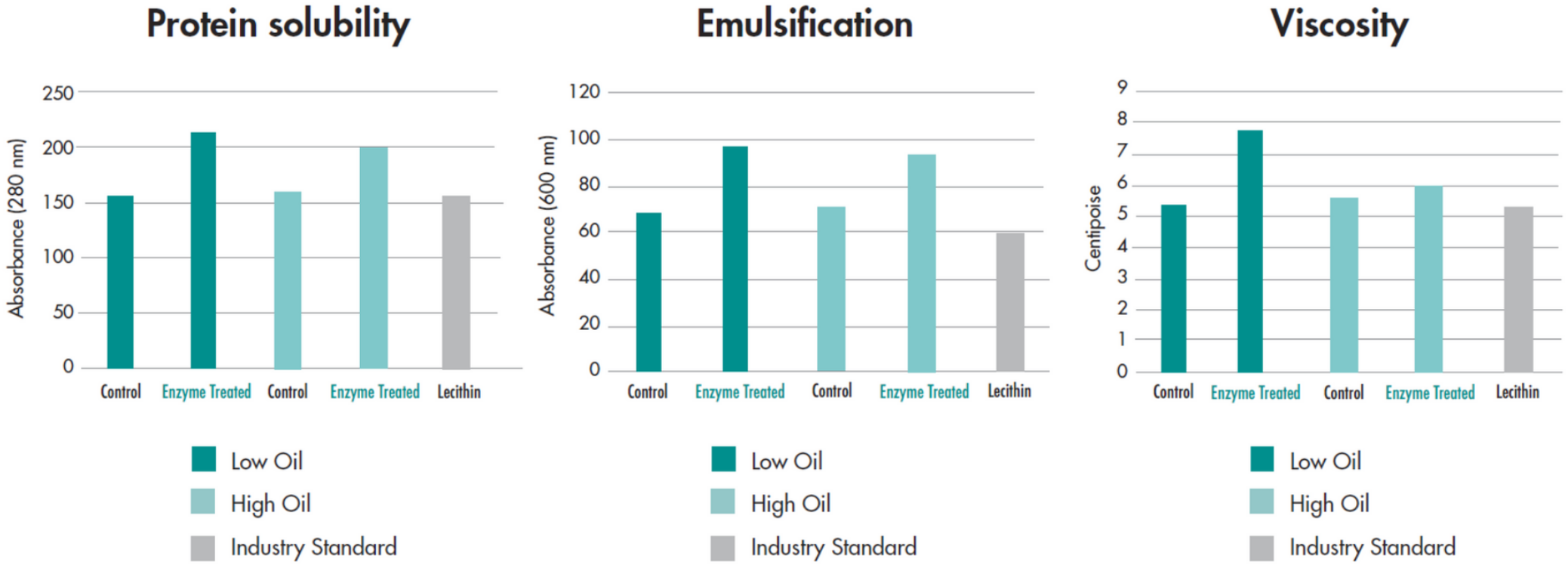
PG500 increases foaming activity and stability



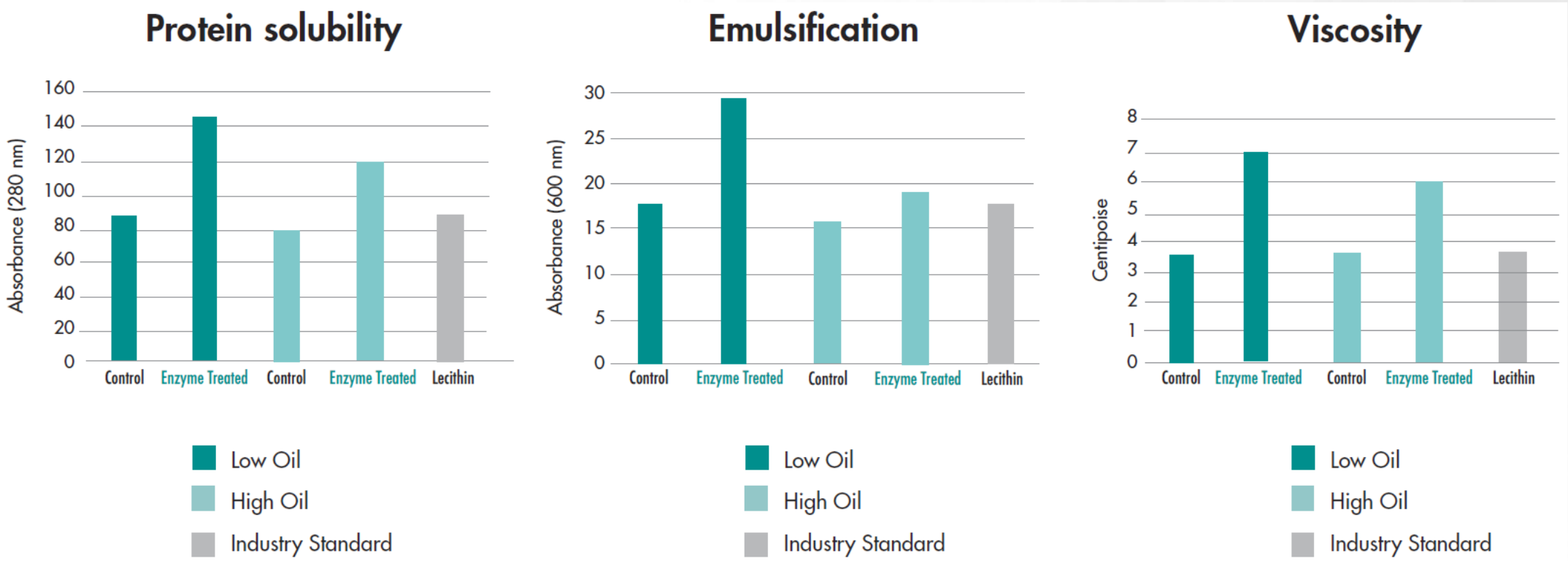


Soy protein: 0.5 mg/ml
10 mM Na-phosphate (pH 7.0)

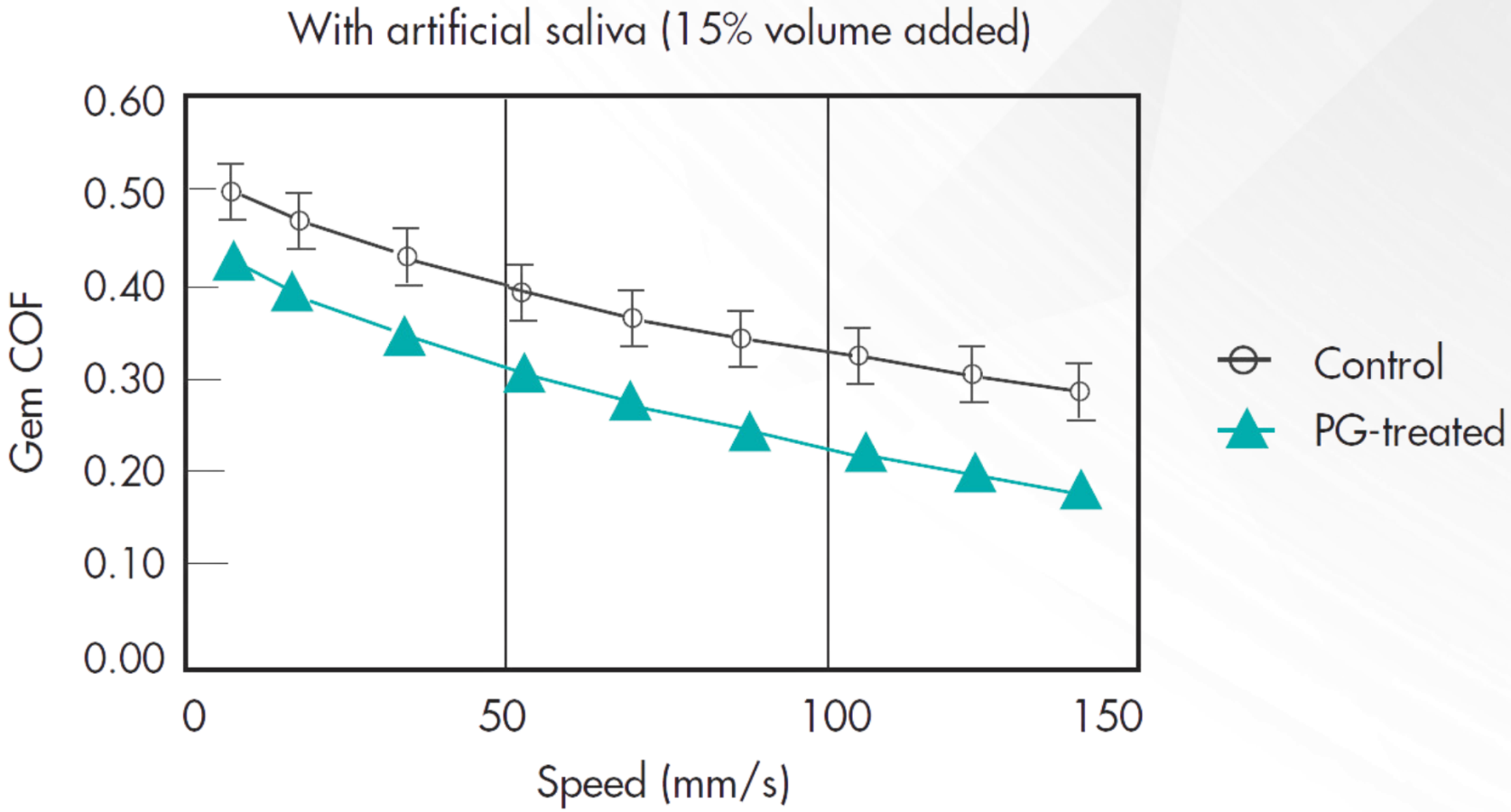
PG500 increases protein solubility, emulsification and viscosity



Increased protein solubility, emulsification and viscosity maintained for 12 months



PG500 optimizes mouthfeel of plant-based milks

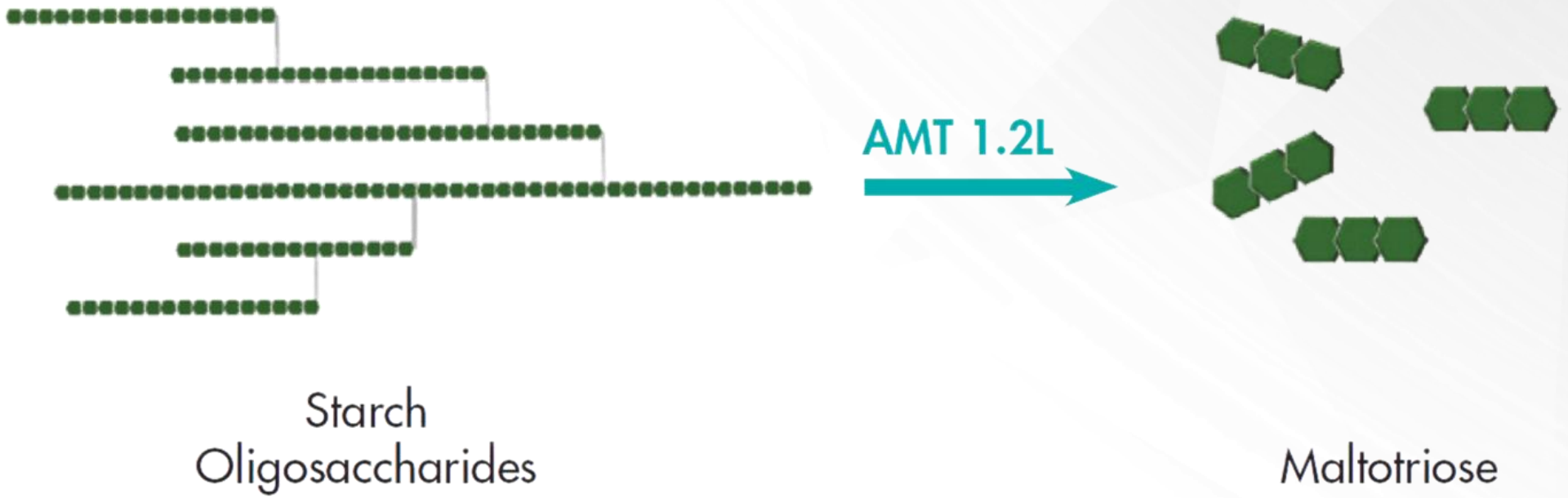


Source: NIZO (Tribology test), Amano Enzyme Limited (Sensory test) Note: Commercial soymilk (Protein: 3.3%, Fat 1.9%/Ingredient: Water, Hulled Soya Beans)

Optimize sugar content by creating complex sugars (DP3+)

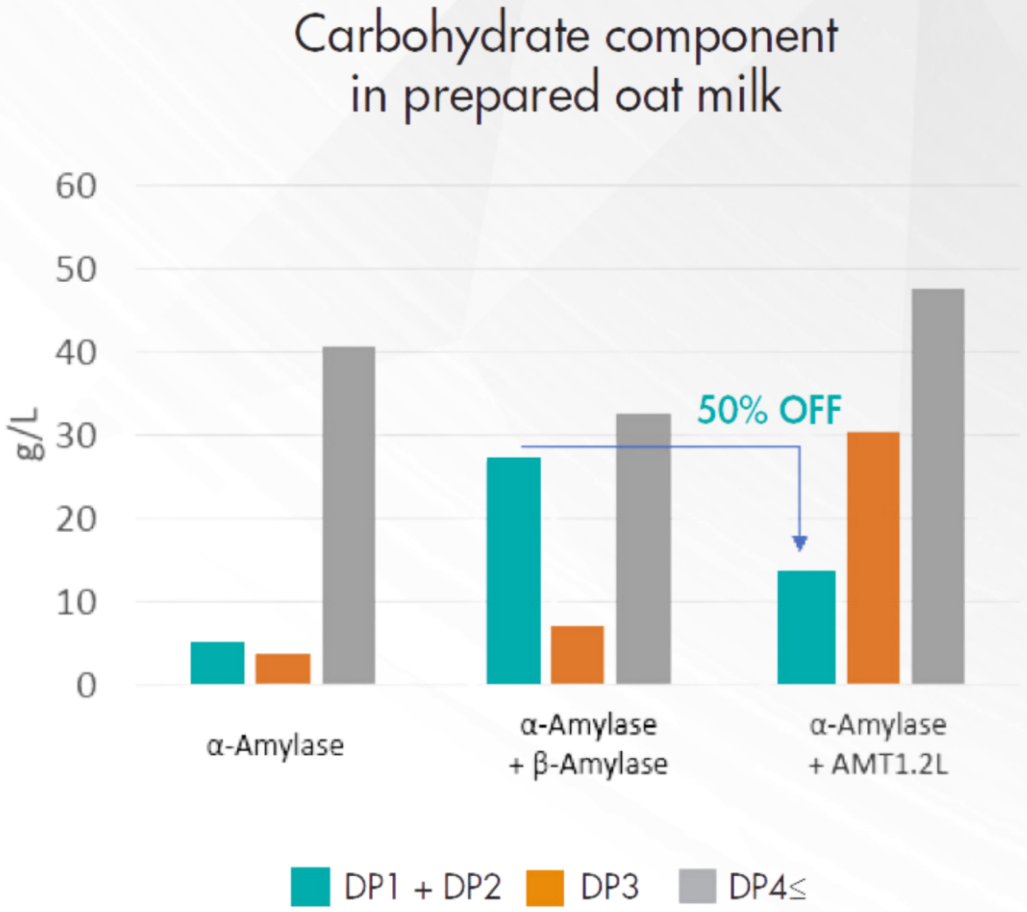
Amano Enzyme

AMT 1.2L cleaves starch into maltotriose, a DP3 oligosaccharide



AMT 1.2L helps retain sweetness without added sugars

g/L	α-Amylase	α-Amylase B-Amylase	α-Amylase +AMT1.2L
DP1 + DP2	5	27	13
DP3	4	7	30
DP4≤	40	32	48
Sweetness	±	+++	++



CheeseMax™PB for melty, stretchy, plant-based cheese

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CheeseMax PB for high protein cheese melt and stretch

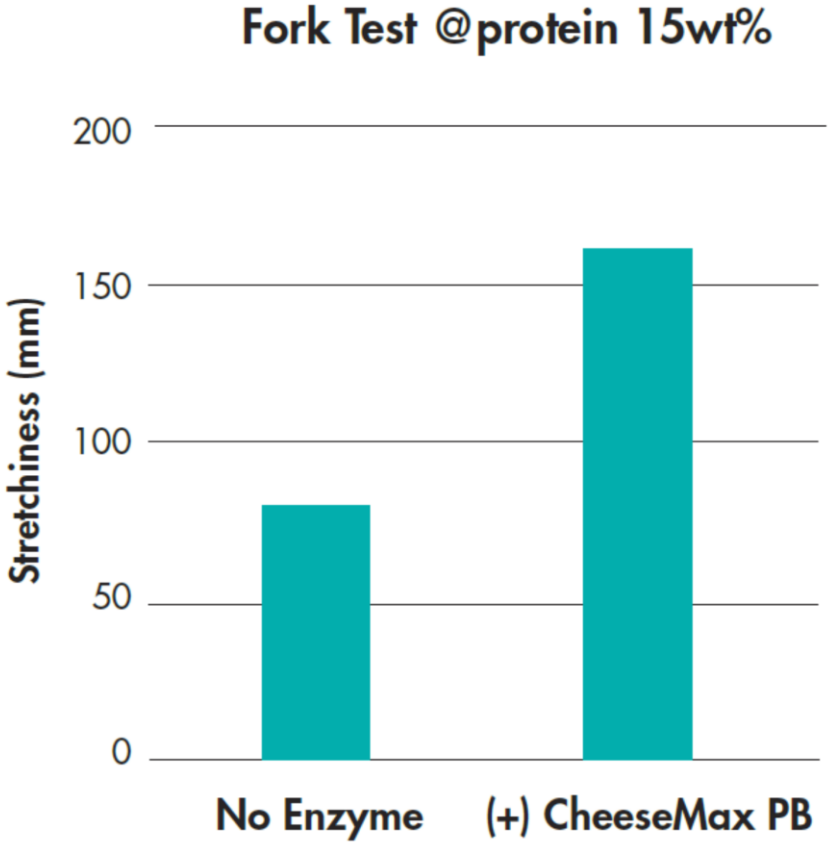
Native plant-based protein

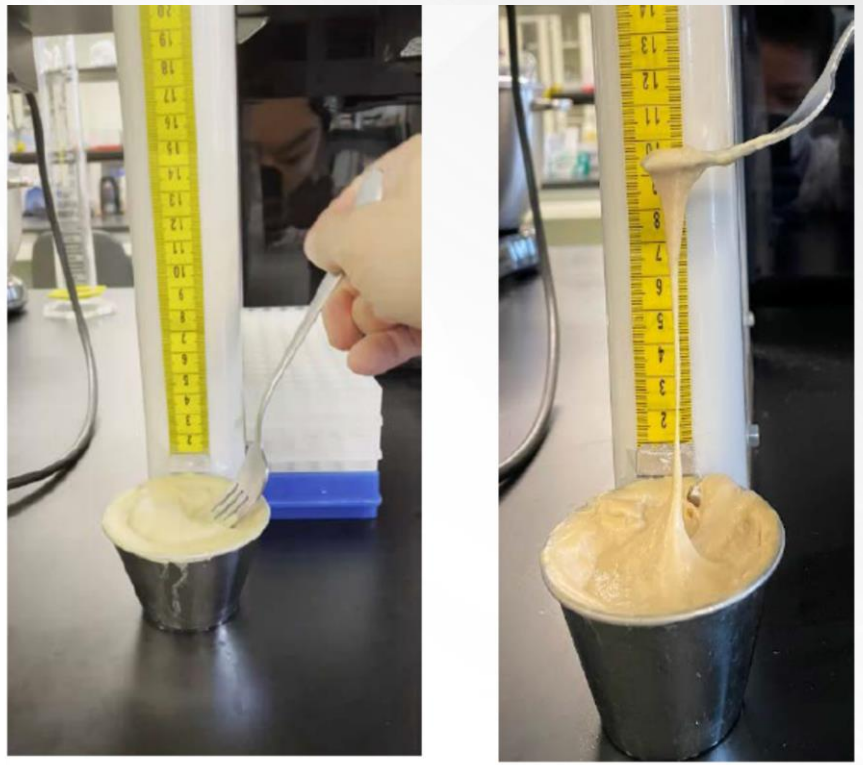
Low solubility
High WHC
Insufficient gelatinization of starch
Little to no stretch and melt

CheeseMax PB treated protein

High solubility
Low WHC
Increased free water
Sufficient gelatinization of starch
Increased savory notes

CheeseMax PB increases stretch in high protein plant-based cheese





(+) CheeseMax PB

FIX LABELS

Plant-based cheese with CheeseMax PB melts beautifully

15% protein by weight

No Enzyme

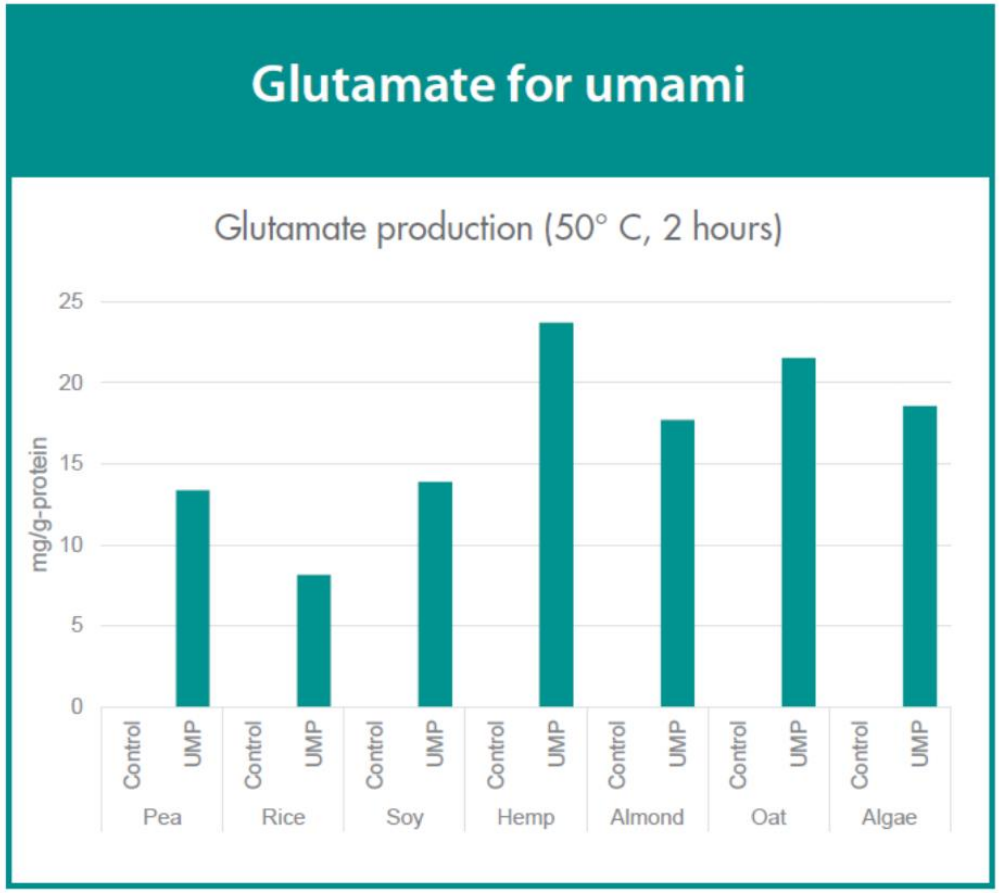
(+) CheeseMax PB

Plant-based Meat

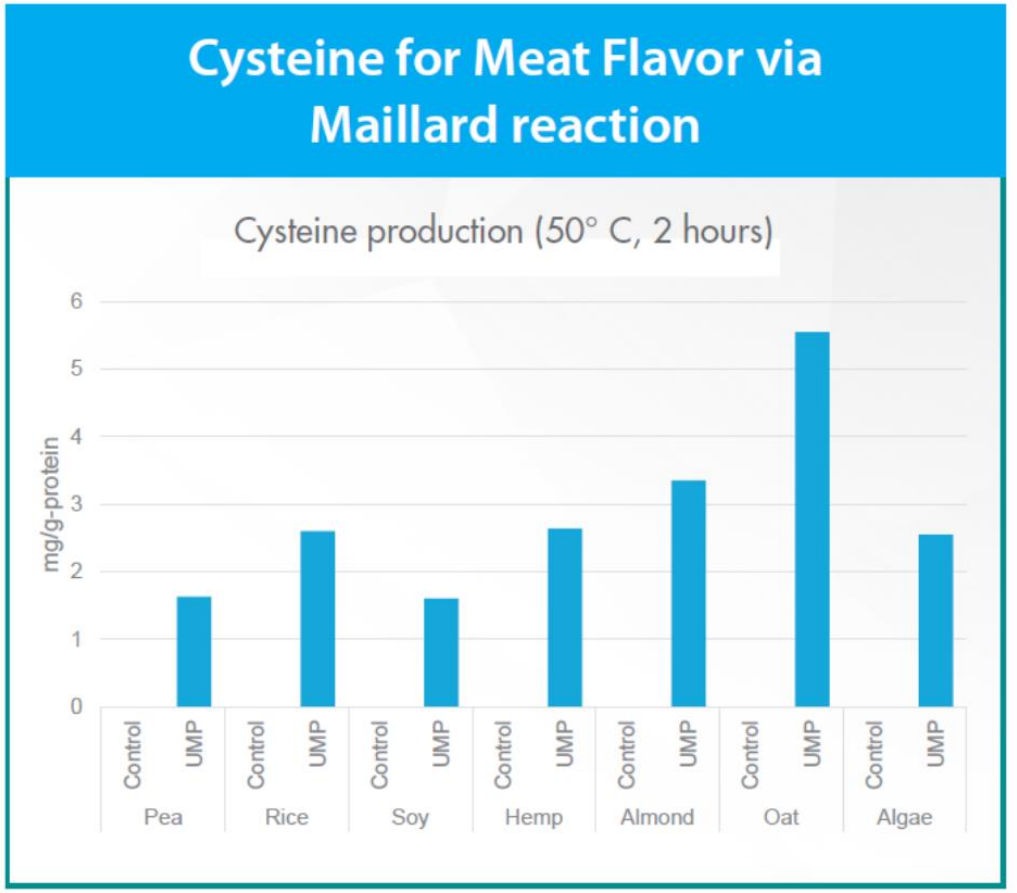
Umamizyme™ Pulse for savory, meaty flavors

- Increase umami flavor
- Increased protein in textured pea protein (TPP)
- Increased digestibility of protein in TPP
- Salt reduction
- Lighter color
- Increased oil holding capacity

Glutamate and cysteine levels after Umamizyme Pulse



Key: UMP: Umamizyme Pulse



Key: UMP: Umamizyme Pulse

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Umamizyme Pulse increases umami and meatiness

Process of using Umamizyme Pulse for TPP-based patties

TPP

↓← Hydrate with Umamizyme Pulse

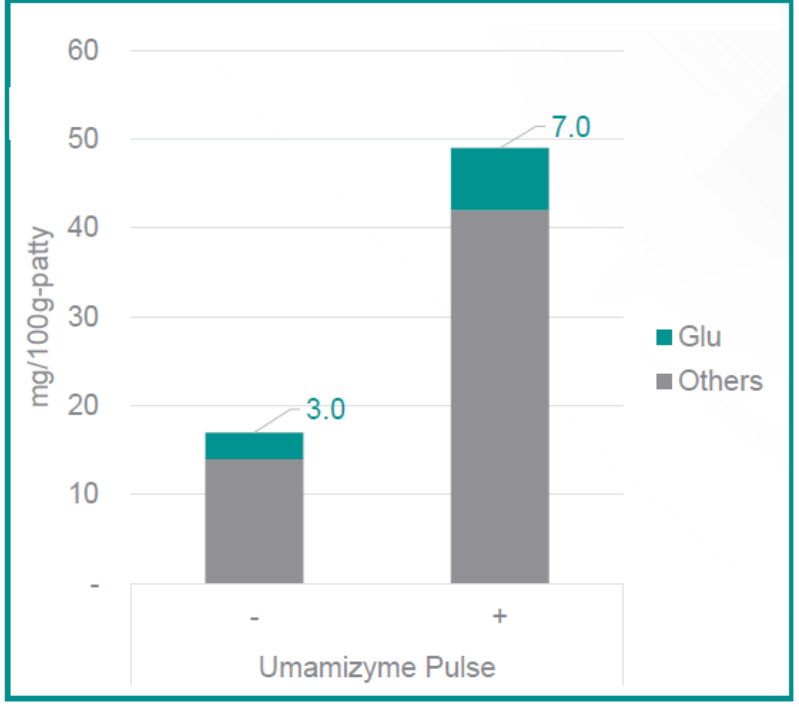
↓← Add other ingredients

↓← Mixing

↓← Mold and grill

Amino acid analysis

Amino acid production in TPP patties with Umamizyme Pulse treatment



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UMP treated TPP is visual similar to control

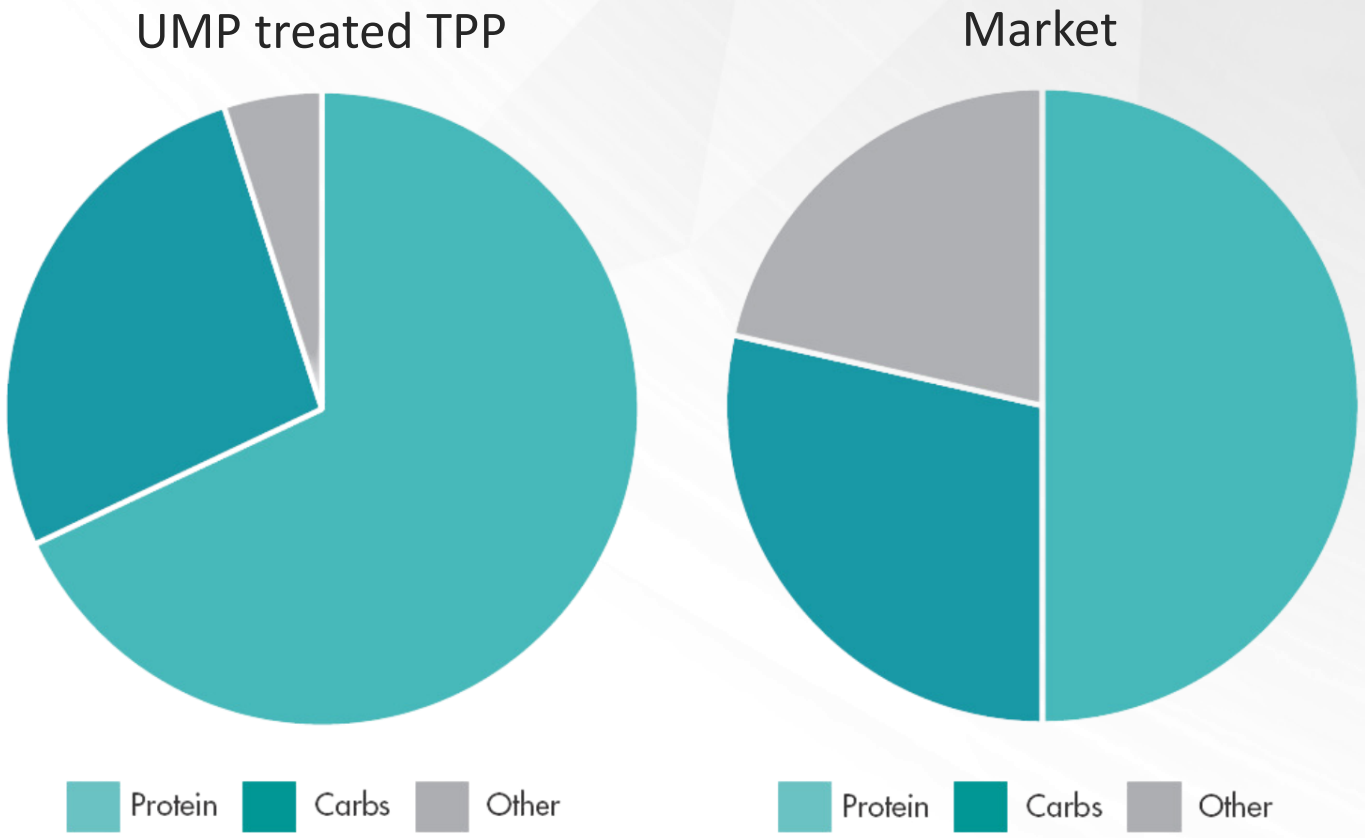
Control

UMP treated

UMP treated TPP delivers more protein per gram

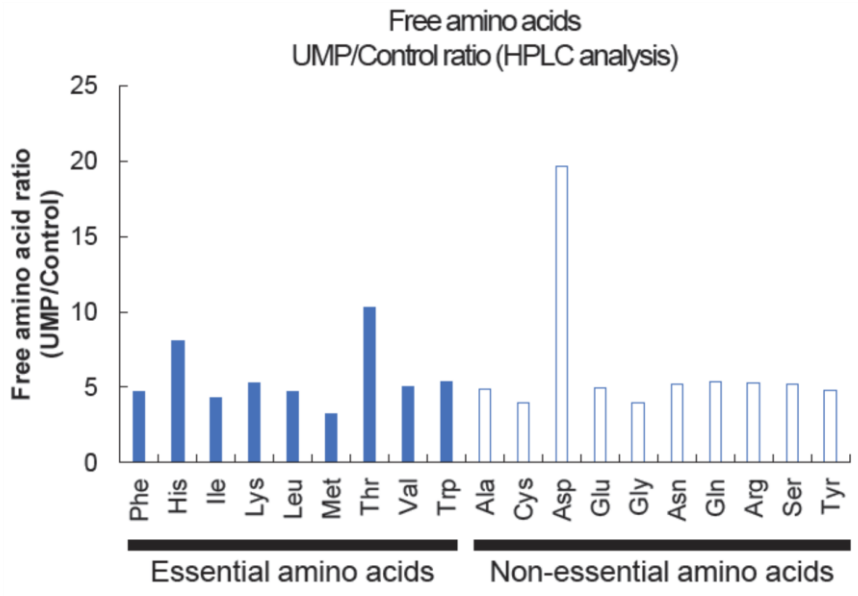
UMP increased the digestibility and PDCAAS of proteins in TPP

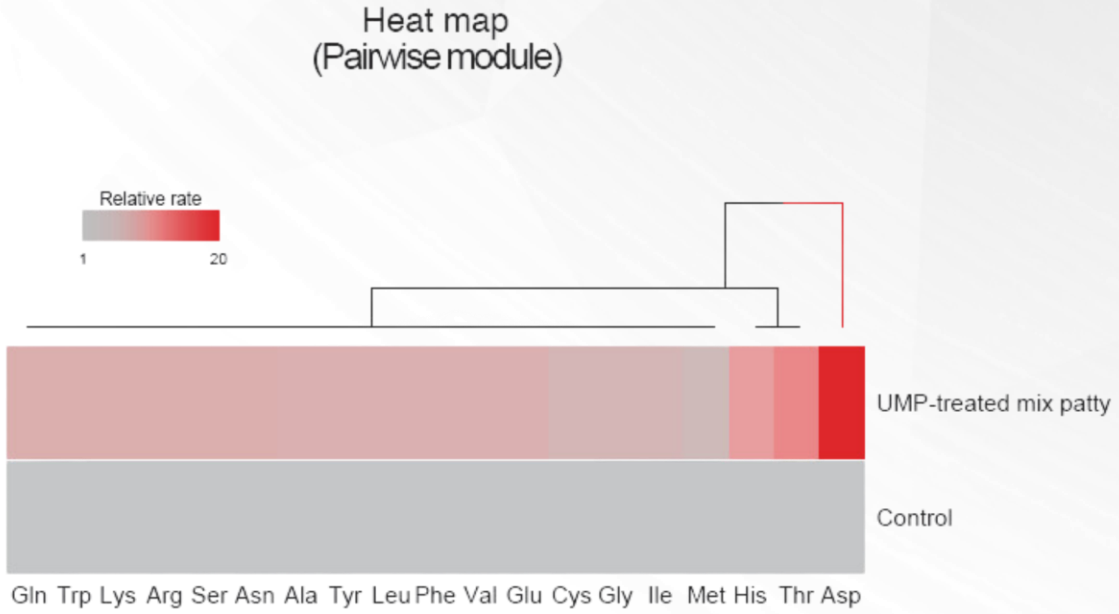
- ~50% protein to ~70% protein
- More protein per gram of TPP



UMP treated TPP releases more amino acids after in vitro digestion

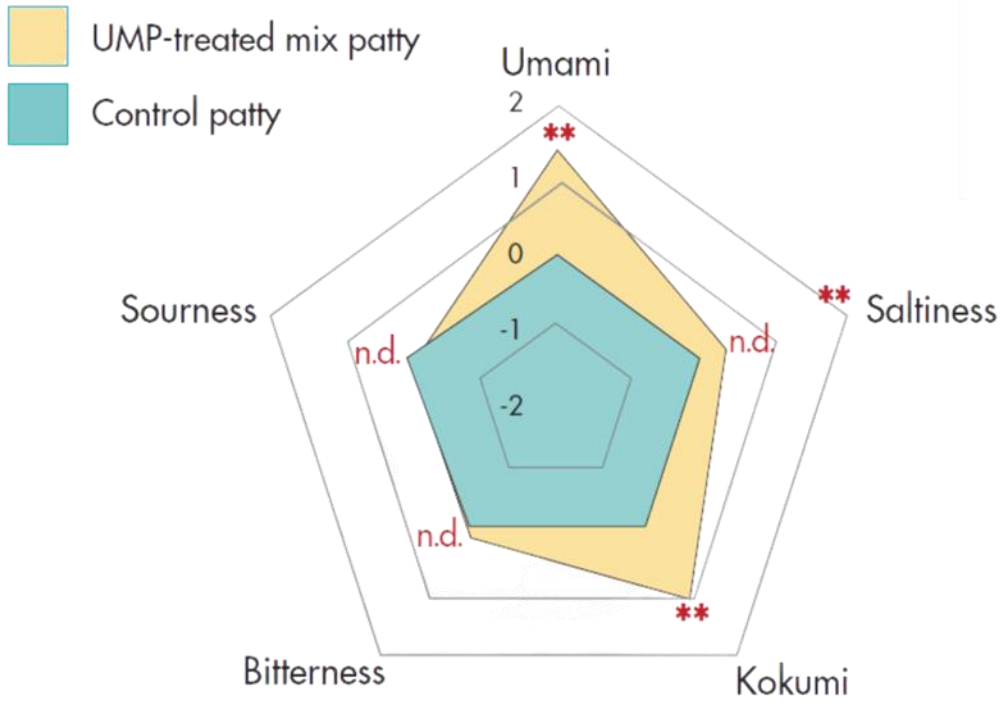
In vitro digestion test (INFOGEST method) of UMP-treated TPP and control TPP were examined. Free amino acids were analyzed after intestinal digestion by HPLC.

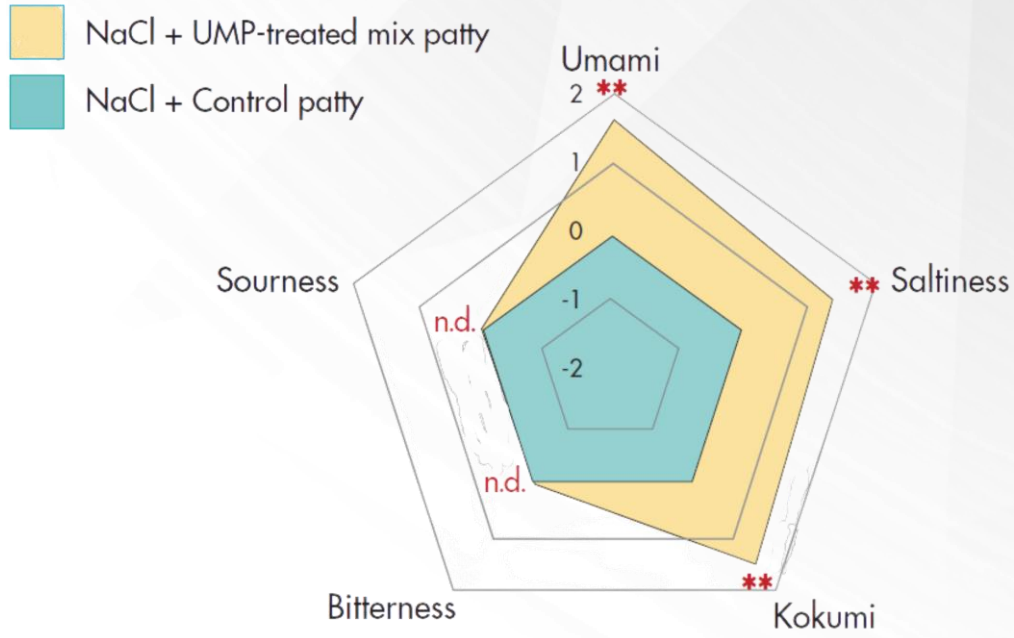




All amino acids released from UMP-treated TPP were higher than control. Especially Asp, Thr, and His were enhanced.

Sensory profile comparisons (+/-) NaCl





NaCl enhanced the effects of UMP-treated TPP on taste, especially umami, saltiness and kokumi

Hydrolysis

Proteins hydrolyzed for flavor and health ingredients

- We can create desired molecular weight distribution for application (infant nutrition, human nutrition, flavors)
- Match target degree of hydrolysis
- All while reducing bitterness

Lipids hydrolyzed for unique flavor notes and fatty acid profiles

- We can help develop flavor notes for your products
- Help achieve specific fatty acid profiles

Flavors

Yeast extracts in less time

CURRENT PRODUCTION PROCESS

Lysis
60° C
16 hours

Hydrolysis
70° C
3 hours

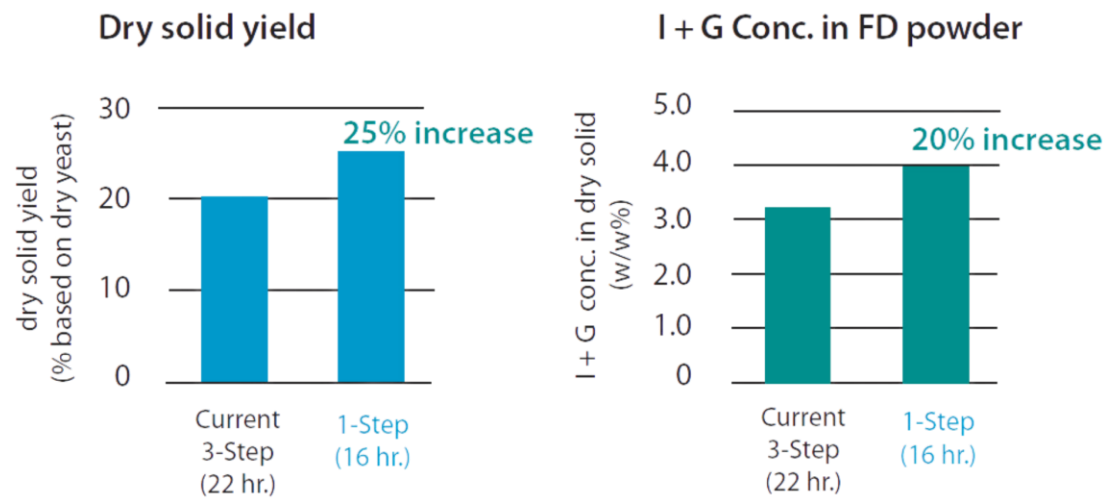
Conversion
55° C
3 hours

AMANO'S ONE STEP PROCESS

YL-T, Nuclease
Deamizyme
60° C
16 hours

Cuts production time by 27%

Increased yields using Amano one-step process



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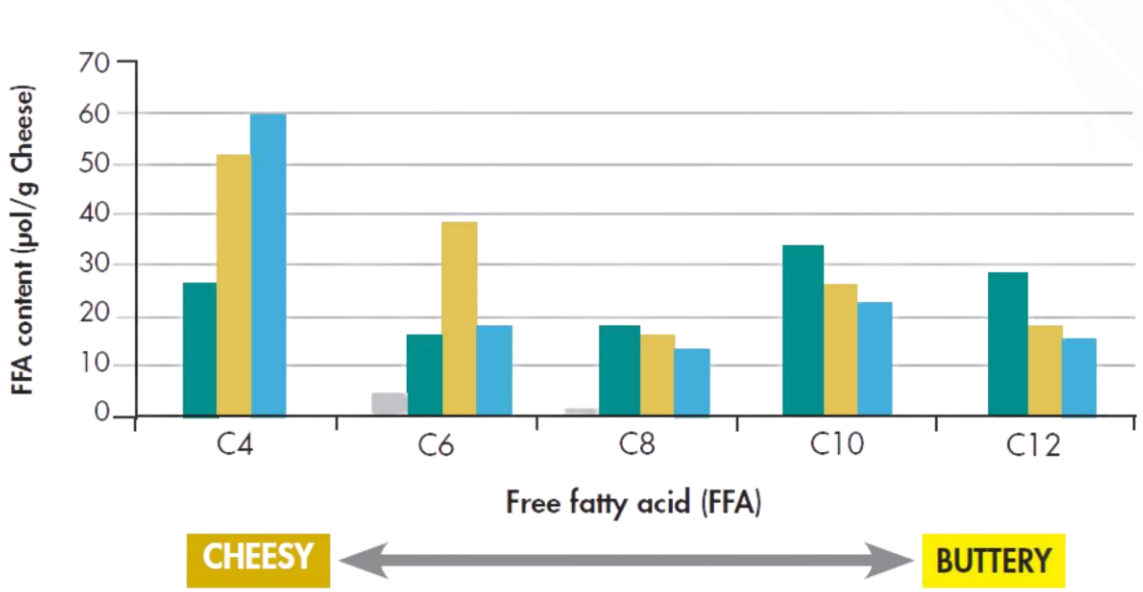
Enzyme modified cheeses with unique flavor profiles



Control
Lipase AY "Amano" 30SD
CheeseMax™
Lipase DF "Amano" 15

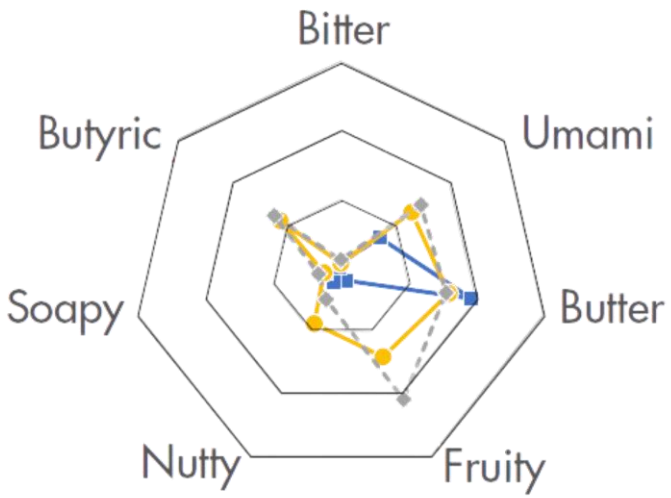
Fatty acids	Chain Length	Typical Flavor
Short chain	C2–C6	Cheesy
Medium chain	C8–C14	Buttery
Long chain	>C16	Soapy

From Cheddar and Swiss to Parmesan and Blue, we have tailored solutions for your needs. We also have a selection of **gluten free enzymes** to support dietary needs.

AMANO Amano Enzyme

Amano CheeseMax enzymes designed to enhance and amplify flavor notes characteristic of natural cheese

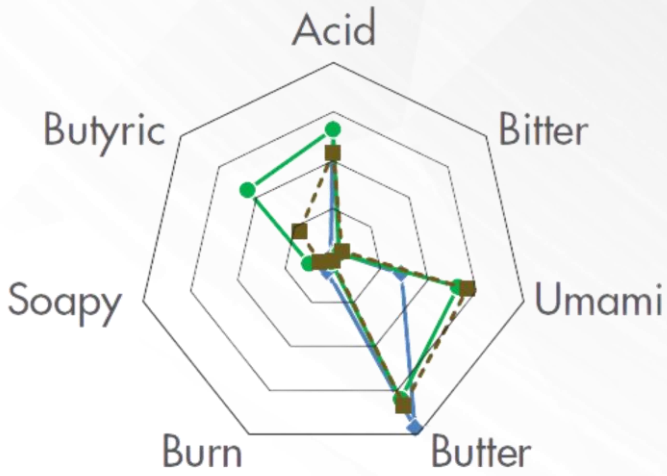
CheeseMax™ Parm



Plain cheese
Plain cheese + EMC*
Plain cheese + Parmesan

* EMC prepared by CheeseMax Parm

CheeseMax™ Cheddar



Plain cheese
Plain cheese + EMC*
Plain cheese + Sharp Cheddar

* EMC prepared by CheeseMax Cheddar

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Oils and Fats


Beverages

CoffeeMax™

- CoffeeMax increases filtration speed and extraction yield
- Maximize production for both hot and cold brew coffees, without compromising on quality

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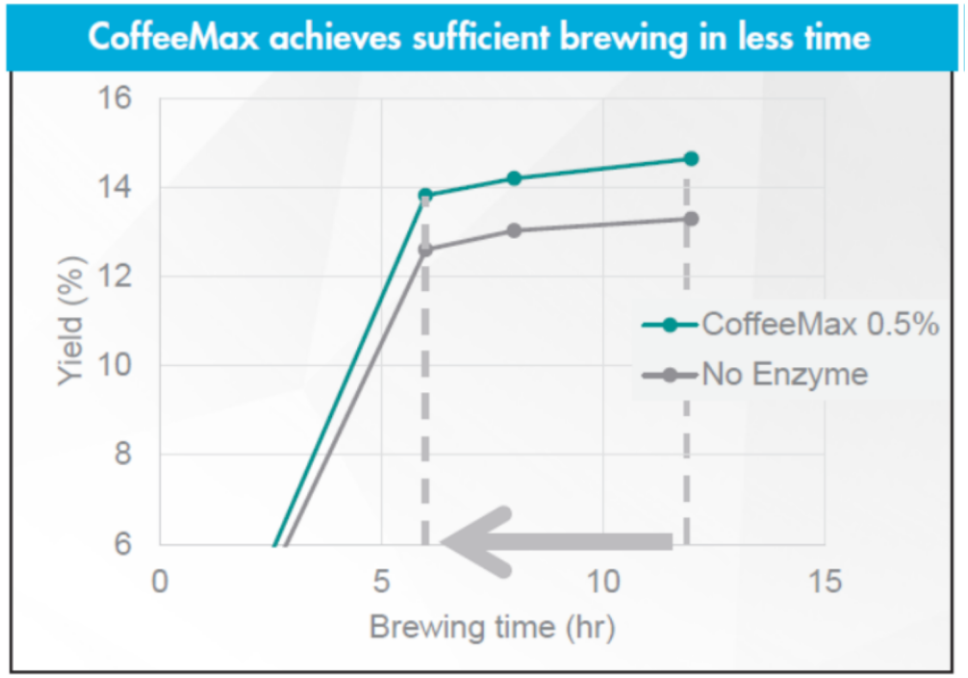
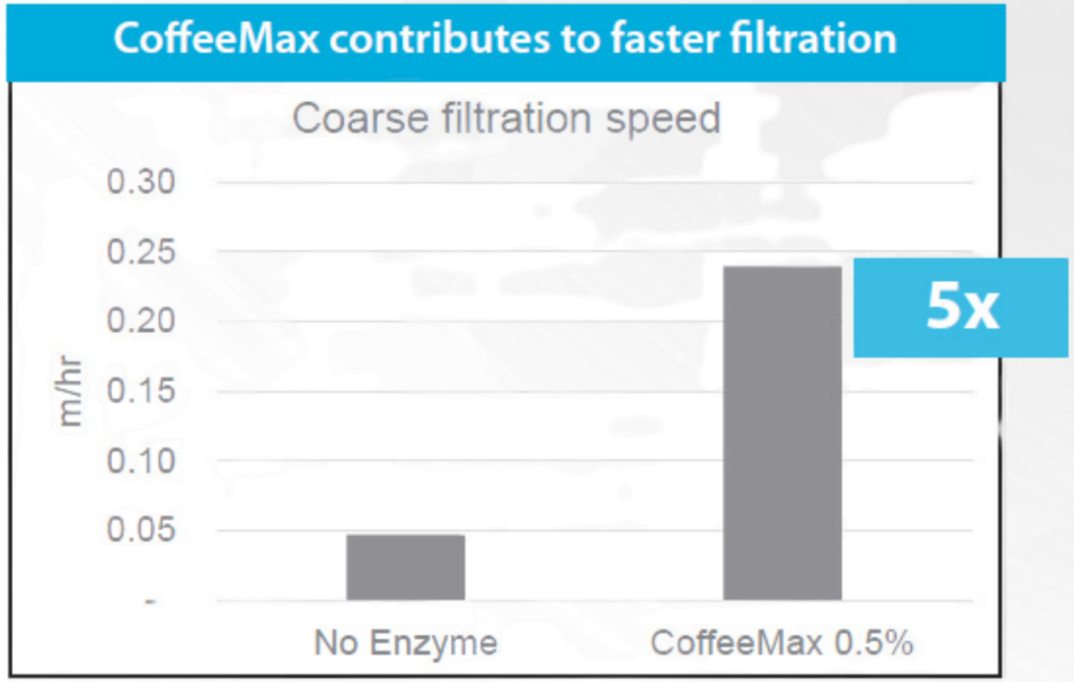
Get more coffee from your beans





- Achieve target yield faster with CoffeeMax
- Extract more of each coffee bean faster
- Less risk of microbial growth
- Less energy

- Reduce total cold brewing process with CoffeeMax
- Faster extraction through filter

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Increase DHA and EPA in your fish or algal oils

- Lipases are used to release and separate ω-3 fatty acids from other oils allowing for concentration of EPA and DHA

Give palm oil the taste and mouthfeel of cocoa butter

- Create cocoa butter equivalents from palm oil
- Enzymatic interesterification transforms palm oil to have fatty acid profile similar to cocoa butter

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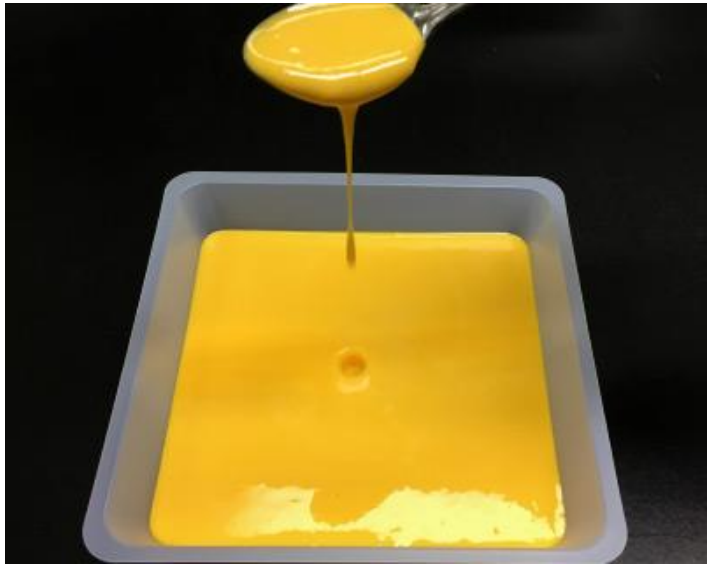
Dairy and Eggs

Lactose free dairy for better digestion

- Our lactase enzymes help eliminate lactose from dairy milk for easier digestion

Stabilize and improve texture of processed eggs



enzyme treated

control

Eggs can be heat treated and sterilized without coagulation of proteins, extending their application range

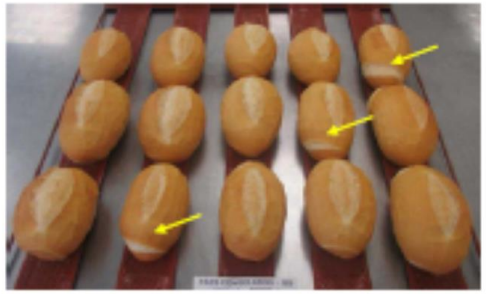
Starches

GO-ACNL is an effective dough conditioner

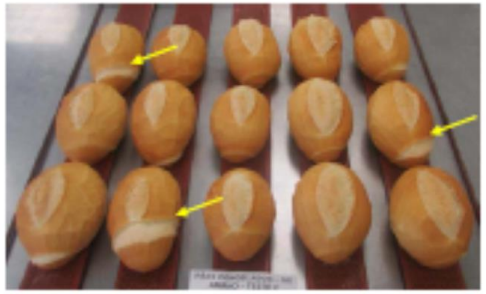
- Unlike other glucose oxidases, GO-ACNL oxidizes a wide range of oligosaccharides
- Helps strengthen gluten network
- Helps reduce browning from Maillard reaction
- Especially effective with frozen, par-baked (ready to bake) dough
- All without added ingredients

GOACNL extends shelf life of frozen dough

Timeframe	Test category	No enzyme	Glucose oxidase	GO-ACNL	
			20 ppm	4.8 ppm	7.2 ppm
Frozen 1 Week	Volume (mL/g)	9.60	8.85	9.27	9.64
	Cut opening	+	+	++	++
	Crispiness	++	++	+++	+++
Frozen 6 Weeks	Volume (mL/g)	8.80	7.89	8.25	8.49
	Cut opening	+	+	++	+++
	Crispiness	+	++	+++	+++



No enzyme



GO, 20ppm

GO-ACNL, 7.2 ppm

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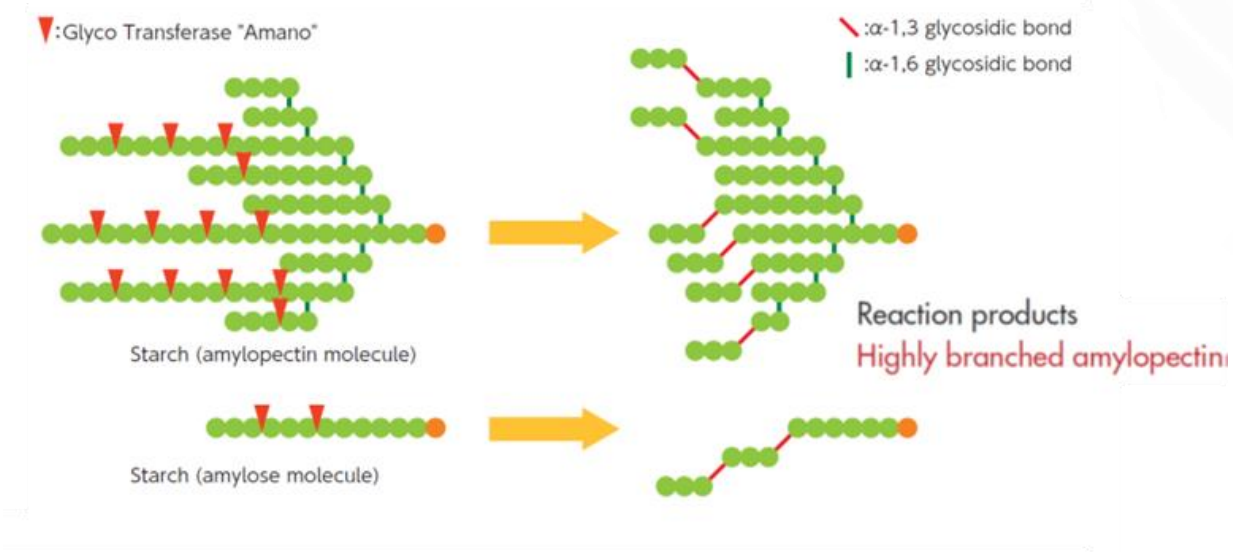
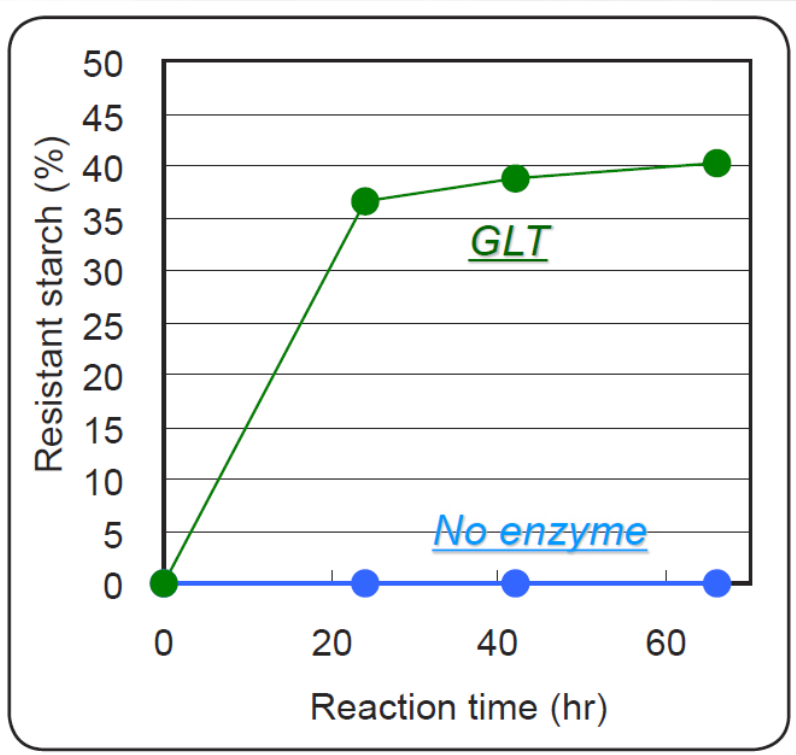
GLT extends shelf life of cooked starches by preventing retrogradation

- Cooked starches such as prepared rice, noodles, mochi dishes revert to a more crystalline structure upon colling resulting in diminished quality
- Glycotransferase “Amano” (GLT) reduces starch retrogradation in processed foods
- Converts starch to a highly branched glucose polymer resistant to retrogradation

GLT produces resistant starch by forming α-1, 3 bonds





Enzymes for tea processing

- Reduce bitterness and astringency in tea
- Improve the flavor of tea with our specialty proteases
- Enhance the aroma of RTD tea
- Increase the dark color of brewed tea
- Reduce cloudiness and cream down of RTD tea
- Increase extraction efficiency of tea leaves

Enzymes for brewing

- Improve process, yield and flavor of sake

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Enzymes for juice processing

- Reduce bitterness in citrus juices
- Increase yield of juice from fruit pulp
- Clarify and stabilize juice

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For a world with tastier foods

We have a long history of using nature's enzymes in our food culture even before we discovered enzymes and their properties and functions. Amano will continue applying enzyme technology to solve various challenges in food processing.

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Amano Enzyme

Quality Assurance

We deliver consistent, high-quality products meeting compliance standards worldwide.

Manufacturing the products with consistency and high quality

- GMP for API
- FSSC22000
- ISO13485
- ISO14001
- SQF Food Safety Code

Meeting various requirements

- Kosher/Halal
- Vegan-friendly
- Non-GMO

Regional regulatory requirements:

※OUマークの付いている製品
またはロット証明書の発行されている製品に限ります
Only if the product bears the OU symbol or has an OU lot certification.

※一部の製品を除く

Contact Information

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Questions?

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