



Introducing

Purimmune™
PREBIOTIC GOS

Ingredient Solutions

Scientific Expertise

Marketing Ingenuity

Applications Innovation

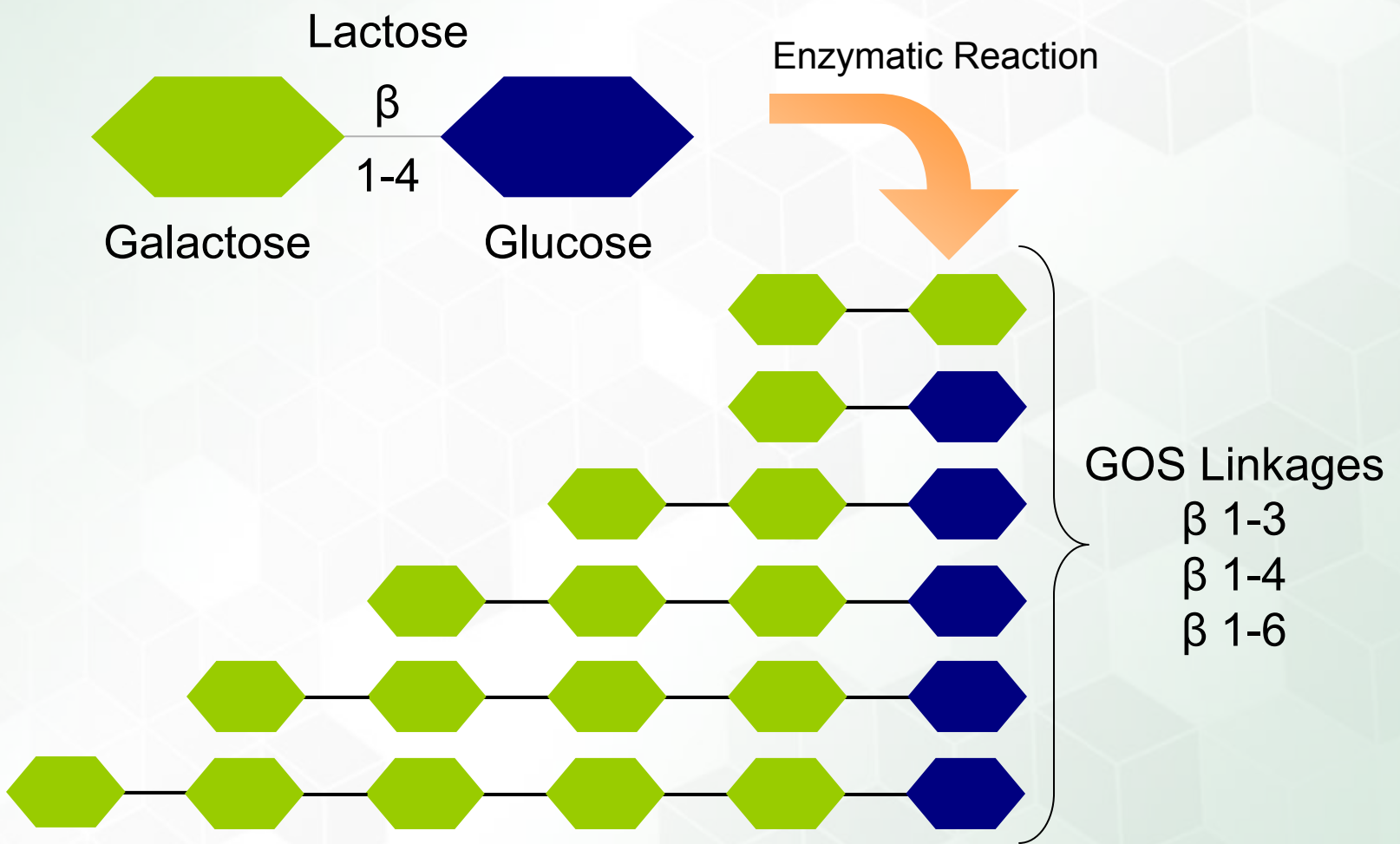
QA and Regulatory Support

Personal Customer Service

Product Description

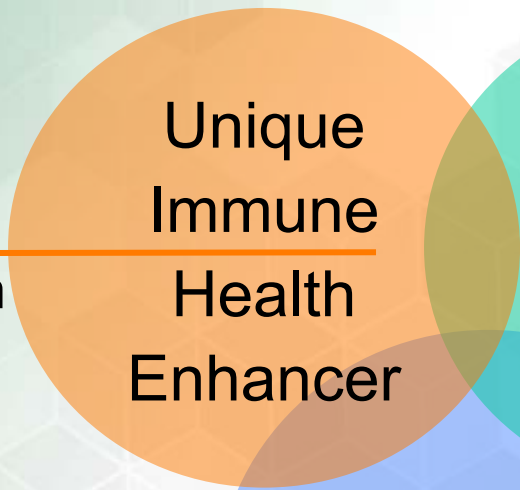
- ❑ Oligosaccharide enzymatically derived from lactose
- ❑ Comprised of di-, tri-, tetra-, penta-, and hexasaccharides, mainly consisting of galactose units (Chen et al, 2003; Matsumoto et al, 1993)

Process and Chemical Structure

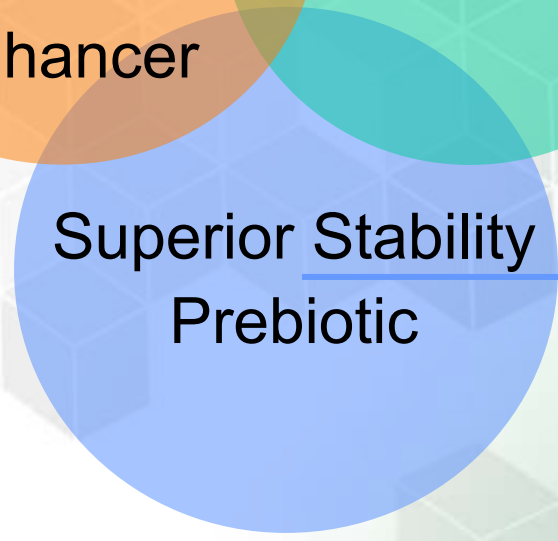


Value Proposition

Oligosaccharides naturally occurring in human milk with unique mechanism for immune health enhancement



High purity product in a dry form for easier handling and efficacy at lower inclusion levels



Highly stable prebiotic suitable for high temperature and low pH conditions

Purimmune™

PREBIOTIC GOS

Health Benefits

Health Benefits Overview

- ❑ GOS is naturally occurring in human breast milk
- ❑ Promotes digestive comfort
- ❑ Easily tolerated prebiotic
- ❑ Reinforces immune system function
- ❑ Reduces inflammatory response
- ❑ Enhances calcium absorption

Prebiotic and Immune Health Trends

Immune



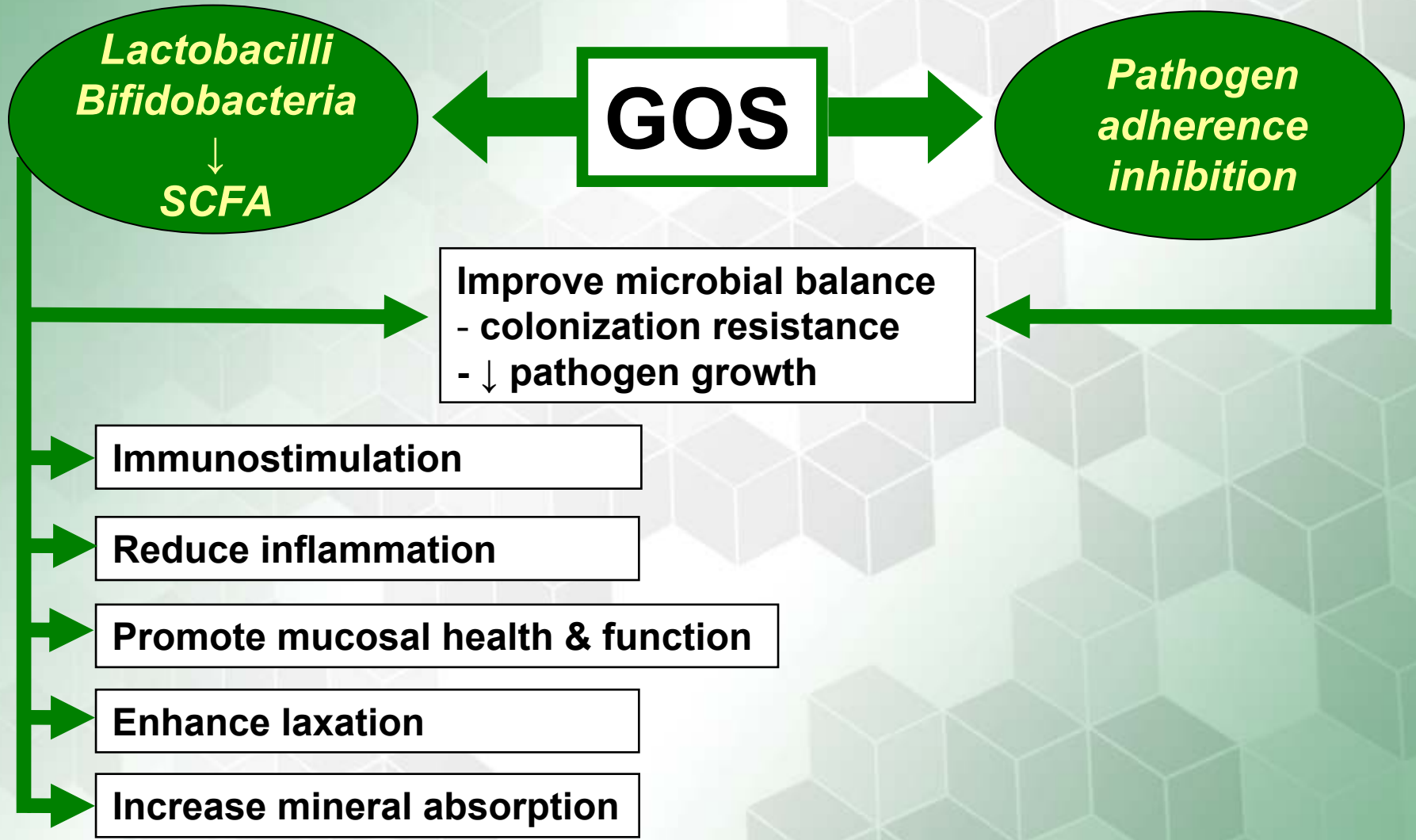
H E A L T H

- The number of functional food consumers in major European markets is growing each year by around 6–7%.
– Global Consumer Trends, Datamonitor, 2005
- New EU regulations aim to build consumer confidence in the claims made for functional food and drink products, which is undoubtedly at the root of future growth and success for this market sector. – Mintel, 2005
- In 2007, more than 150 prebiotic and probiotic commercial food products were introduced in the U.S. compared with about 100 in 2006 and only 40 in 2005. – Datamonitor, 2007

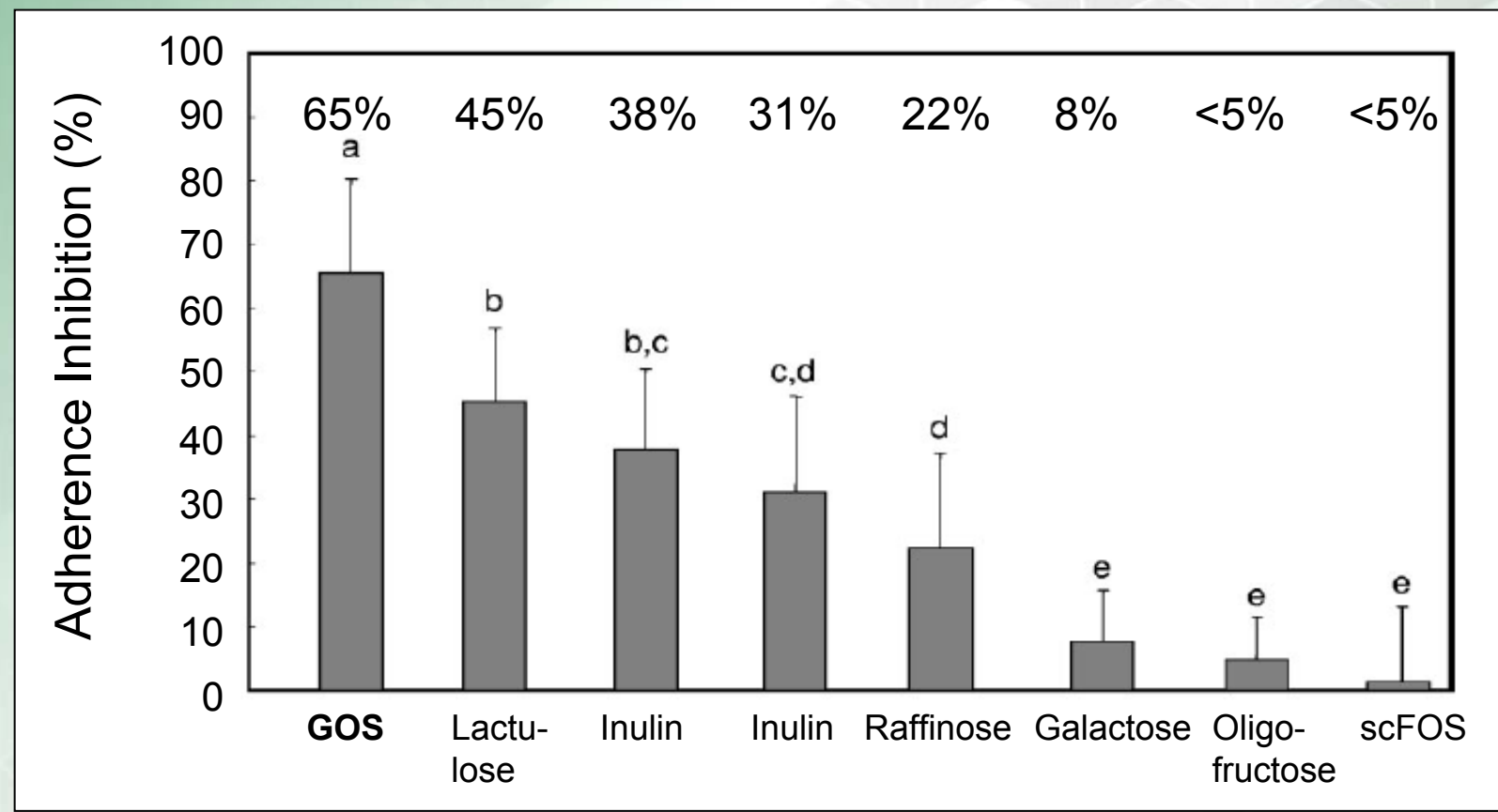
Importance of GOS in Breast Milk

- ❖ Oligosaccharides account for approximately 1% of breast milk
 - 3rd largest solid component
 - Over 100 different oligosaccharides have been identified
- ❖ GOS is an important human milk oligosaccharide
 - Prebiotic, anti-infective and allergy-preventive properties
 - GOS has been called the ‘Bifidus Factor’
 - ❖ Breast fed babies have higher levels of Bifidobacteria

Health Benefits - Mechanisms



Pathogen Adherence Inhibition *E. coli*



Escherichia coli strain E2348/69; E.coli added to HEp-2 tissue monolayer; no. HEp-2 cells with adherence after 30min incubation; 16mg/ml oligosaccharide; p<0.05

Pathogen Adherence Inhibition

E. coli

Oligosaccharide	Mean no. of E.coli organisms / microcolony	Mean no. of microcolonies / HEp-2 cell
Control	14.5 ± 2.2 ^a	2.0 ± 0.4 ^a
scFOS	13.2 ± 2.1 ^{a,b}	1.9 ± 0.4 ^a
Oligofructose	12.4 ± 1.9 ^{a,b}	2.1 ± 0.3 ^a
Galactose	12.2 ± 1.5 ^{a,b}	1.5 ± 0.1 ^b
Raffinose	11.6 ± 3.9 ^b	1.4 ± 0.1 ^b
Inulin	8.6 ± 3.3 ^c	1.5 ± 0.3 ^b
Inulin	7.6 ± 2.6 ^c	1.5 ± 0.1 ^b
Lactulose	8.0 ± 3.8 ^c	1.4 ± 0.2 ^b
GOS	4.2 ± 1.8 ^d 71% reduction	0.9 ± 0.3 ^c 55% reduction

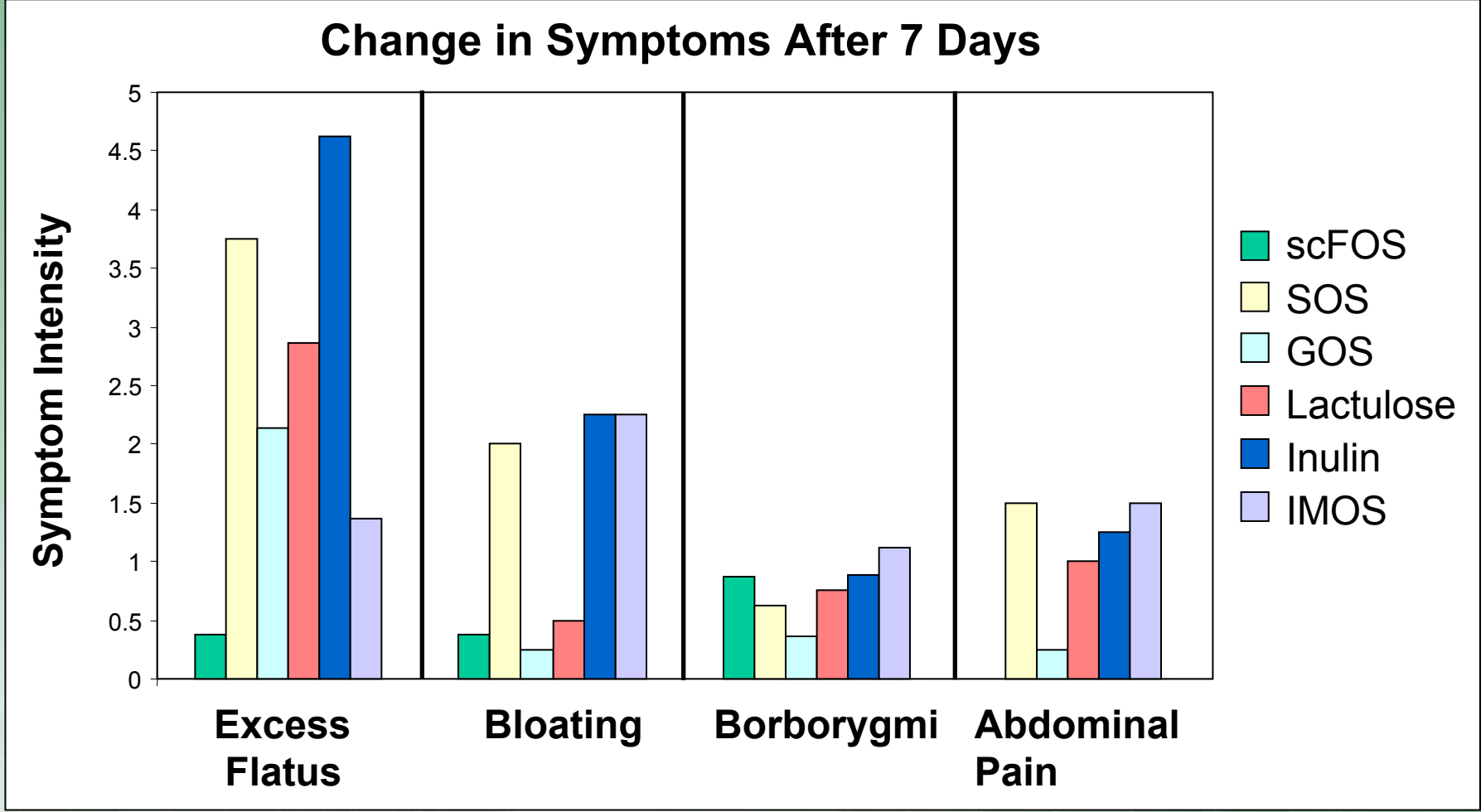
Escherichia coli strain E2348/69; E.coli added to HEp-2 tissue monolayer; no. HEp-2 cells with adherence after 30min incubation; 16mg/ml oligosaccharide; mean±SD; p<0.05

Digestive Comfort

- Easily tolerated ^{1,2}
 - Adults: typically no adverse gastrointestinal distress
 - Infants: typically no effect on regurgitation, vomiting, crying, colic
- Increased fecal frequency ^{1,2}
- Softer stools ²

Digestive Tolerance

Change in Symptoms After 7 Days



n=8 per group; healthy volunteers; parallel; 10g dose for 7d; scale 0-21

Prebiotic Benefit

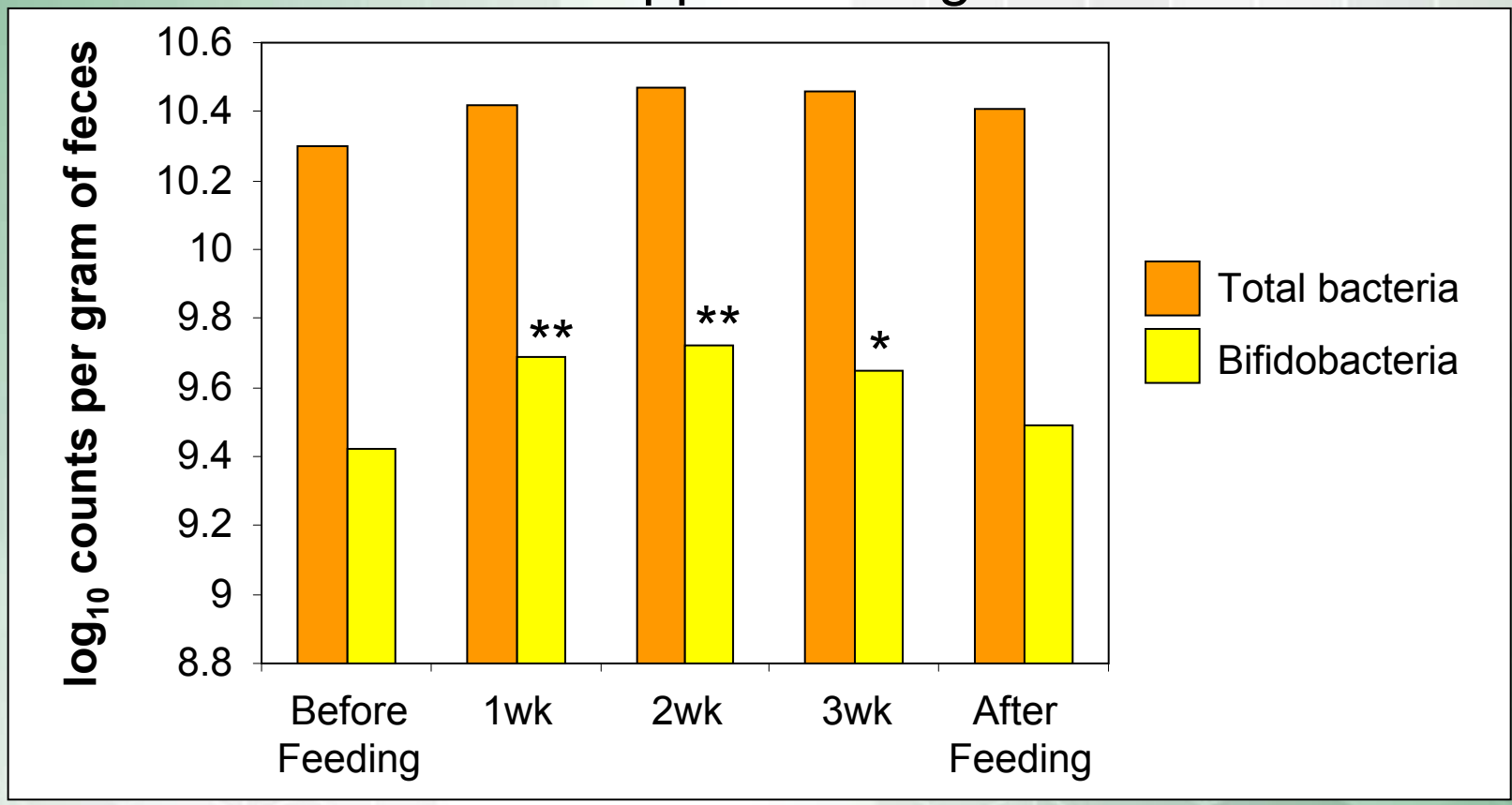
- 1 of only 3 recognized prebiotic carbohydrates ¹
 - GOS
 - Fructans: scFOS, oligofructose, inulin
 - Lactulose
- Promotes growth of Bifidobacteria ^{2,3}
- Promotes growth of Lactobacilli ³
- Low effective dose: 2.5 g/d increased Bifidobacteria ²

GENUS	UTILIZATION	UTILIZATION EXTENT	SPECIES UTILIZING GOS
Bifidobacterium	8 of 8 species/strains	+++	B.bifidum, B.infantis, B.lactentis, B.liberorum, B.breve, B.longum, B.adolescentis
Bacteroides	5 of 5 species/strains	+ to +++	B.fragilis, B.ovatus, B.vulgatus, B.distasonis
Fusobacterium	0 of 3 species	-	
Eubacterium	0 of 6 species	-	
Clostridium	1 of 8 species	- to +	C.difficile
Propionibacterium	0 of 1 species	-	
Lactobacillus	8 of 14 species/strains	- to +++	L.plantarum, L.casei, L.fermentum, L.acidophilus, L.salivarius
Streptococcus	5 of 14 species/strains	- to ++	S.faecium, S.salivarius, S.mitis, S.durans
Enterobacteriaceae	5 of 6 species/strains	- to +++	E.coli, Klebsiella pneumoniae, Citrobacter freundii
Staphylococcus	0 of 1 species		

Incubation 37°C 5days, growth measured by bromocresol purple color change;
1% GOS; acid from GOS +++ 1 day, ++ 2-3 days, +4-5 dyas, - negative

Prebiotic Effects - Clinical

More than 20 studies support bifidogenic effects of GOS



12 healthy volunteers with low Bifidobacteria counts, 35-55 years old; 2.5g/d GOS in apple juice before lunch each day; 21d treatment; sequential design; * p<0.05, ** p<0.01

Immune and Inflammatory Function

- Increased intestinal antibody production ¹
- Decreased incidence of infections ¹
- Decreased incidence of infection-associated fever ¹
- Decreased need for antibiotics ¹
- Decreased incidence of atopic dermatitis / eczema ¹

Immune and Inflammatory Function

Subjects

- Healthy term infants with a parental history of allergic hypersensitivity

Design

- Fed formula with/without (0.8%) GOS + long chain FOS for the first 6 months of life
- Follow-up until 2 years of life

Outcomes

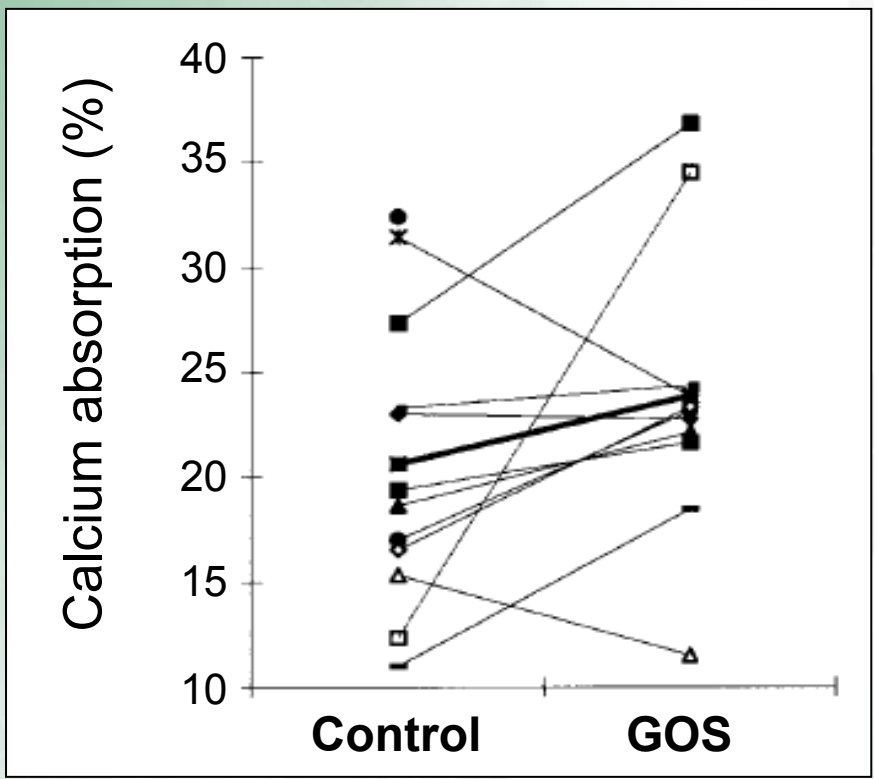
- Lower incidence of allergic symptoms
 - ▣ atopic dermatitis and allergic urticaria
 - ▣ recurrent wheezing
- Lower incidence of infection symptoms
 - ▣ physician diagnosed infections, & upper respiratory tract infections
 - ▣ fever episodes
 - ▣ reduced need for antibiotic

Mineral Absorption

- Increased calcium absorption ^{1,2}
 - Postmenopausal women
 - Preterm infants

Mineral Absorption

- 16% increase in true calcium absorption
- Calcium absorption increased from 20.6% to 23.9% (p=0.04)



Individual changes in calcium absorption, expressed as a % of intake. The bold line represents the mean change of calcium absorption.

Postmenopausal women; double blind randomized X-over; 9d treatment with washout; 20g GOS, 2 dose split in yogurt; control=sucrose; ⁴⁴Ca ⁴⁸Ca isotopes;

Purimune™

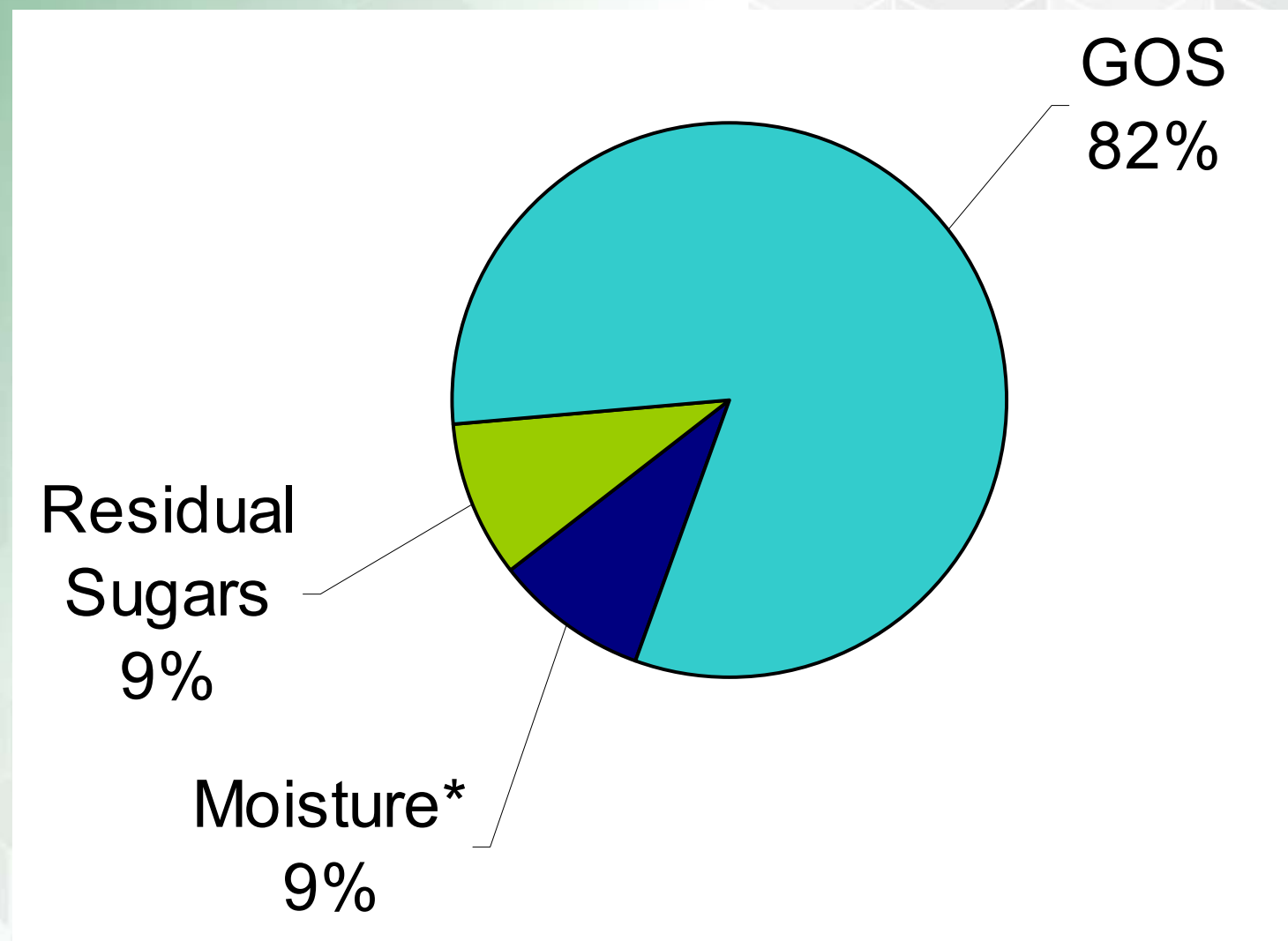
PREBIOTIC GOS

Technical Features and Benefits

Product Specification

	Purimune	Other GOS	Molecular Structure
Moisture, %	5.0 max	24.0-26.0	
Dextrose, % DB	0.0-1.0	18.0-23.0	
Galactose, % DB	0.0-0.5	1.0-2.0	
Fructose, % DB	0.0	0.4-0.6	
Lactose, % DB	7.0-10.0	13.0-17.0	Gal-β1,4-Glu
GO-2(3'-GL and 4'-GL) , % DB	7.0-9.0	4.0-13.0	Gal-β1,3-Glu Gal-β1,4-Gal
GO-2(6'-GL) , % DB	9.0-12.0	6.0-9.0	Gal-β1,6-Glu
GO-3(4'-GL) , % DB	16.0-20.0	9.5-9.6	Gal-β1,4-Gal-β1,4-Glu
GO-3(6'-GL) , % DB	8.0-13.0	3.7-3.8	Gal-β1,6-Gal-β1,4-Glu
GO-3(3'-GL) , % DB	14.0-19.0	13.0-13.1	Gal-β1,3-Gal-β1,4-Glu
GO-4 ≥, % DB	25.0-29.0	9.8-9.9	(Gal) _n -β1,4-Gal-β1,4-Glu n=2-4
Total GOS	90.0-92.0	57.0-62.0	

Purimune Composition

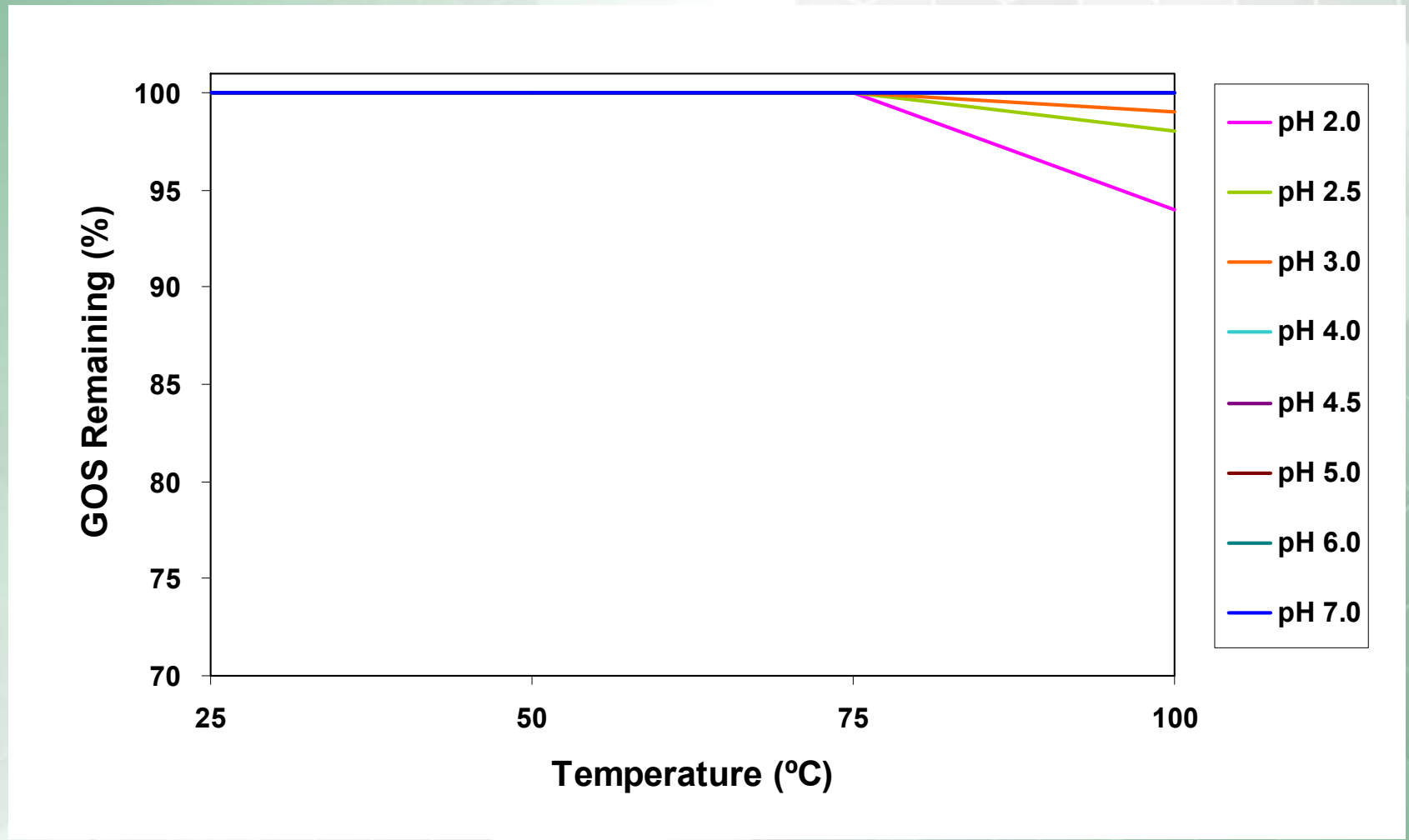


*Final specification target: max 5% 23

Product Characteristics

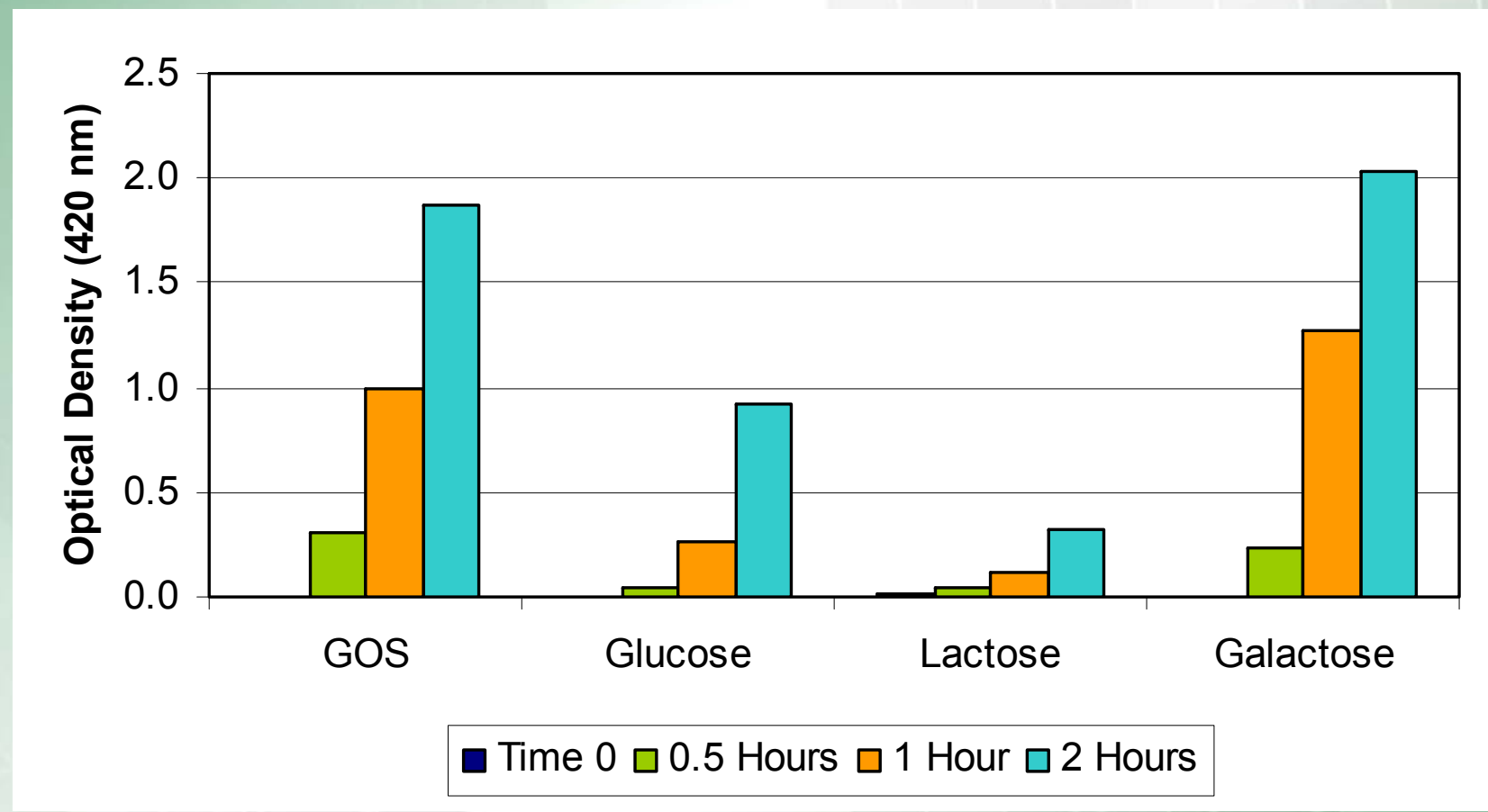
- ▣ Highly pure and effective at low inclusion levels
- ▣ Form: white powder
- ▣ Caloric value: 2 kcal/g
- ▣ Particle size: 100% pass through 40 mesh
- ▣ Flavor: clean, slightly sweet
 - Relative sweetness: 30 - 35% compared to sucrose
- ▣ Density:
 - 0.78g/ml tapped
 - 0.63g/ml untapped
- ▣ Glass transition temperature: 65.76°C
- ▣ Melting point: 224.26°C
- ▣ Water activity at 23.52°C: 0.1051

Temperature and pH Stability



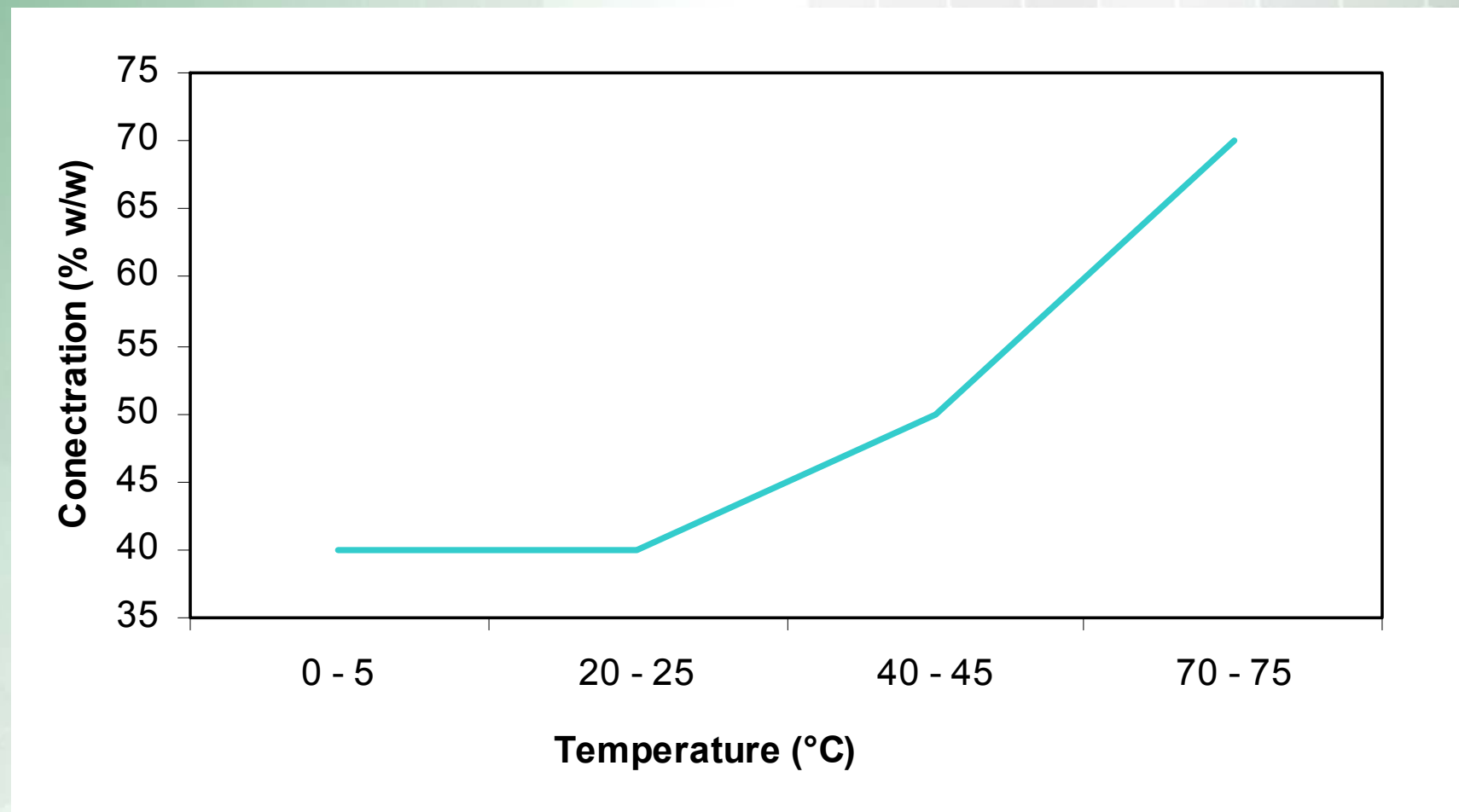
Hold time: 60 minutes

Maillard Reaction

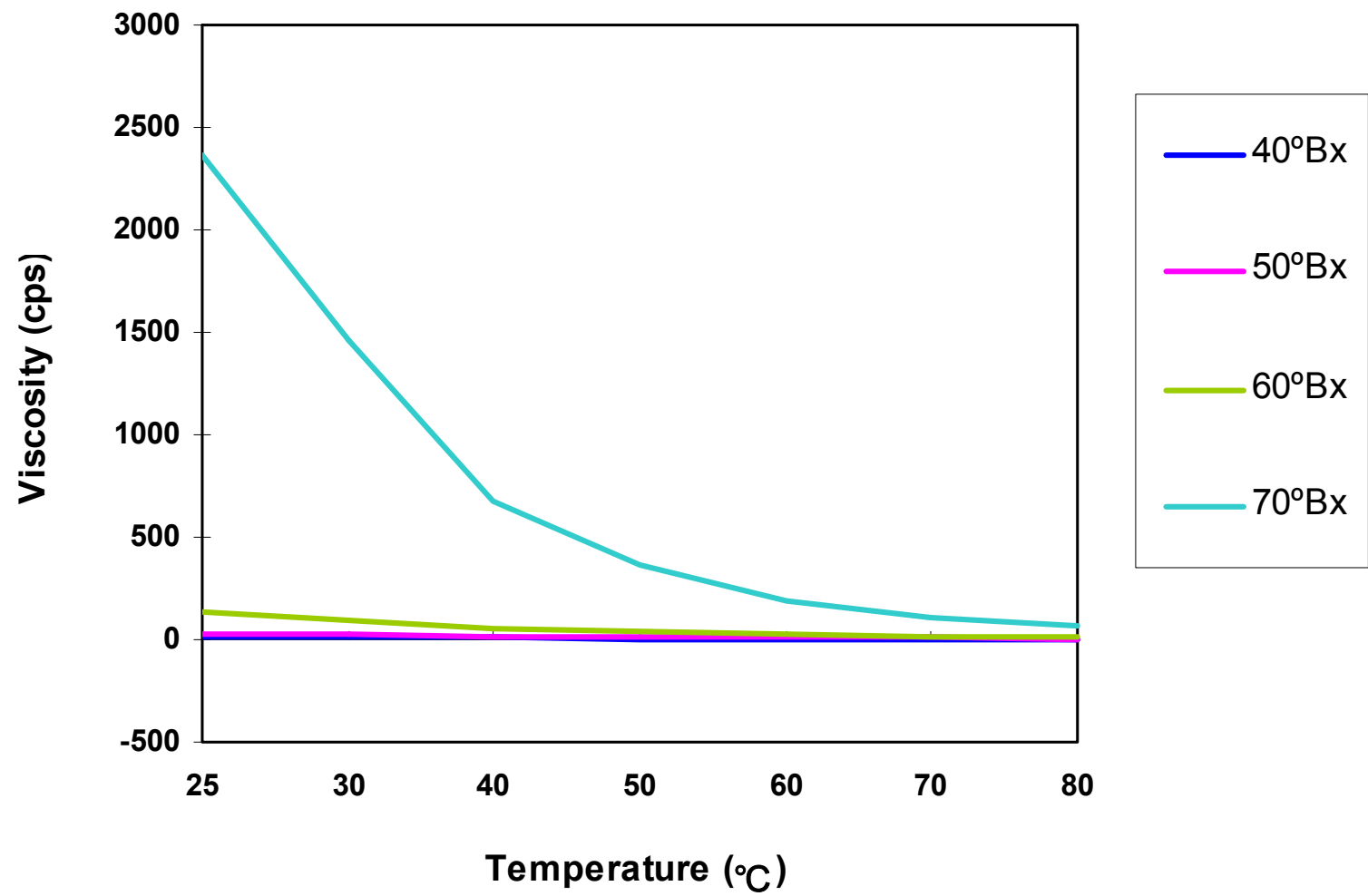


Carbohydrate Concentration: 10%

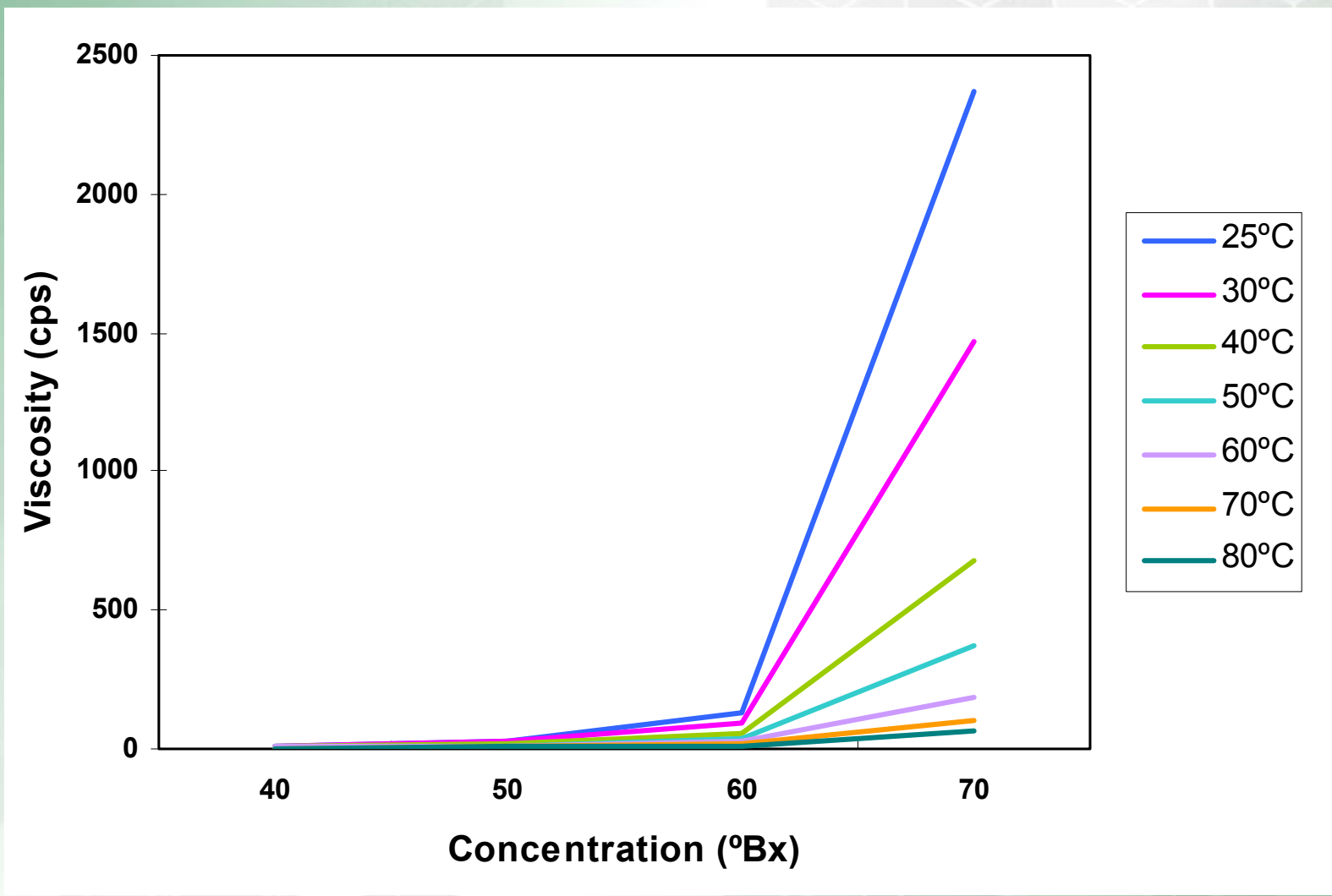
Solubility



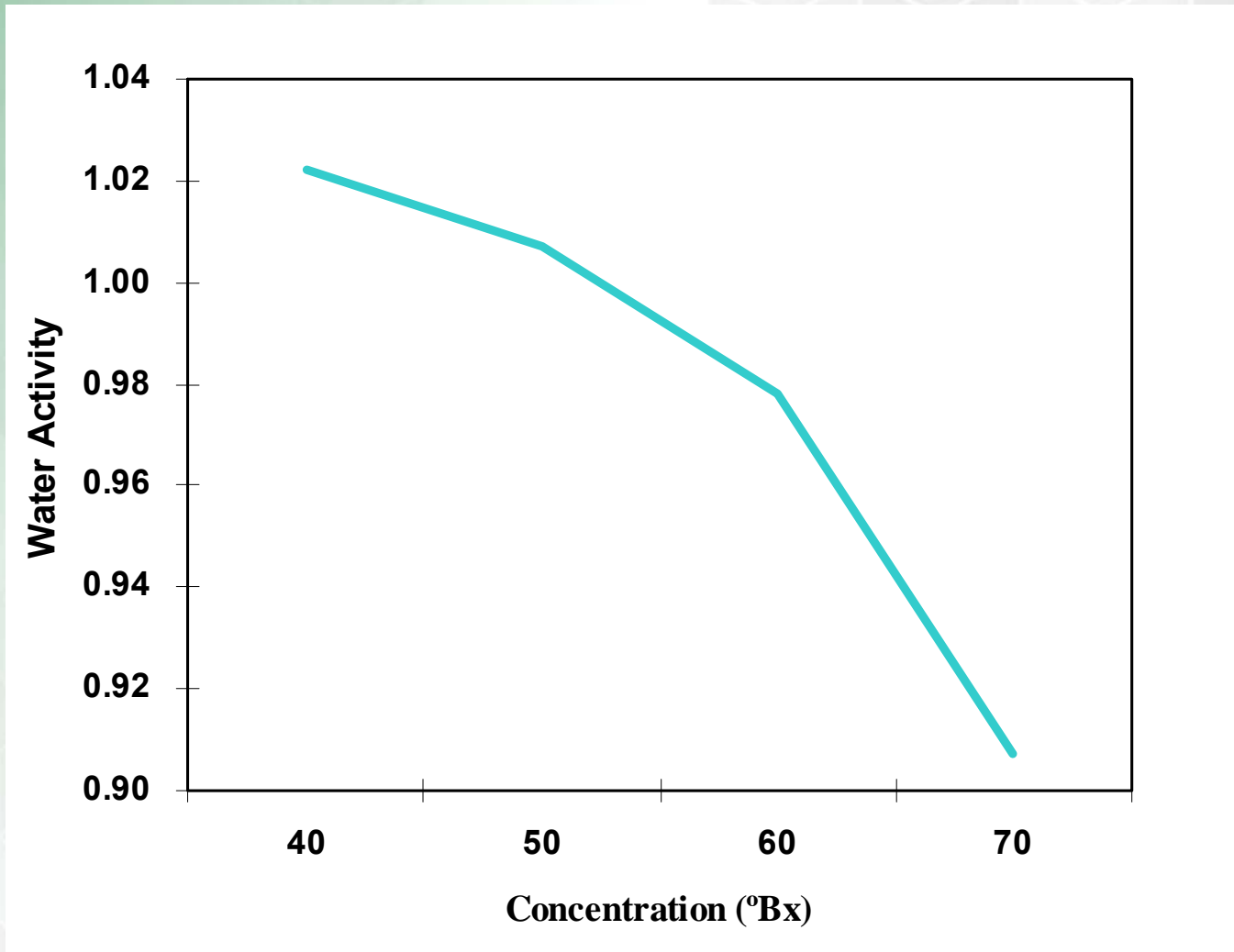
Viscosity



Viscosity



Water Activity



Purimune™ Possible Applications



Beverages



Infant Formula



Dairy

Bars



Bakery



Supplements



Extruded Cereals



Purimmune™ Pomegranate-Lime Beverage



Nutrition Facts	
Serving Size 8 fl oz (250 ml)	
Amount Per Serving	
Calories 80	Calories from Fat 0
% Daily Value*	
Total Fat 0g	0%
Saturated Fat 0g	0%
Cholesterol 0mg	0%
Sodium 0mg	0%
Total Carbohydrate 20g	7%
Dietary Fiber 1g	5%
Soluble Fiber 1g	
Sugars 20g	
Protein 0g	
Vitamin A 0%	Vitamin C 0%
Calcium 0%	Iron 0%
*Percent Daily Values are based on a 2,000 calorie diet. Your daily values may be higher or lower depending on your calorie needs:	
	Calories: 2,000 2,500
Total Fat	Less than 65g 80g
Saturated Fat	Less than 20g 25g
Cholesterol	Less than 300mg 300mg
Sodium	Less than 2,400mg 2,400mg
Total Carbohydrate	300g 375g
Dietary Fiber	25g 30g
Calories per gram:	
Fat 9 • Carbohydrate 4 • Protein 4	

Nutrition Solution Advantages

❏ Immune and Digestive Health Benefits

- Easily tolerated prebiotic
- Reinforces immune system function
- Promotes digestive comfort

❏ Application Innovations

- High solubility
- Stable in processing
- Minimal contribution to viscosity
- Clear in solution
- Clean flavor



Beverages

Benefits

- High Solubility
- Minimal contribution to viscosity
- Clear in solution
- Clean flavor

Considerations

- Requires low shear mixing to disperse and solubilize
- When pH is ≤ 3.0 refrigeration is suggested to prevent hydrolysis

General Tips

- Easy to incorporate
- Add while mixing and pre-blend with other powders



Purimune™
PREBIOTIC GOS

Summary

- ❖ Consumers are increasingly aware that prebiotics can help reinforce the immune system and promote digestive comfort
- ❖ Purimune prebiotic GOS is an easily tolerated prebiotic that reinforces immune system function and promotes digestive comfort

Thank You

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