



# High-Performance Polymers for Laundry & Automatic Dish Detergents

- ▶ Learn about the importance of biodegradability in detergent formulations
- ▶ See how polymer choice impacts real-world performance
- ▶ Review third party lab validated performance results in laundry and autodish formulations

# Performance without Tradeoffs

Detergent formulators today face a tightening set of constraints. Products must deliver strong cleaning performance in hard water, protect fabrics and glassware, and work effectively with modern surfactant and enzyme systems. At the same time, ingredient choices are under pressure from regulators, retailers, and consumers who expect biodegradability, gentleness, and transparent safety profiles.

Historically, these demands have forced uncomfortable compromises. High performance at the expense of biodegradability, or sustainable positioning that comes with measurable performance loss.

Soltellus™ performance polymers were developed to eliminate this trade-off. Built on a differentiated polyaspartate platform, Soltellus™ lets formulators achieve robust, multi-functional performance in laundry and automatic dish detergents while remaining readily biodegradable and suitable for free-from and gentle product positioning.





## Lygos: A Specialty Chemical Company

Lygos is a specialty chemical company that delivers high-performing solutions from sustainable materials. We focus on material science and application performance, with sustainability as a functional outcome of good chemistry.

**Biodegradability and sustainability are built in, but always as performance attributes. For us, the question is never “is it greener?” but “does it work better?”**

Lygos operates a home care laboratory in Hayward, California, where application development, polymer characterization, and formulation support take place. Commercial production is based in Hazleton, Pennsylvania, providing scalable US manufacturing and reliable supply for global customers. This integrated model allows Lygos to support partners from early formulation work through commercial scale-up with confidence.

# The Importance of Biodegradability in Detergents

Biodegradability has become a central requirement in detergent formulation. Market data consistently shows that products making credible environmental and social claims experience faster traction and higher repeat purchase rates than those that do not. In addition, within detergents specifically, biodegradability is closely linked to perceptions of gentleness, skin compatibility, and overall product safety, strengthening related claims such as hypoallergenic and free-from positioning.

Achieve faster product growth

**>35%**

faster growth of products that make ESG (Environmental, Social, and Governance) claims compared to products that do not

Enjoy greater brand loyalty

**>25%**

Brand sales repeat rate for brands with >80% of sales from products with ESG claims compared to those with <20%

Source: Consumer Study, McKinsey & NielsenIQ

Strengthen adjacent claims

**“What constitutes a gentle detergent?”**

*“...uses non-irritating, biodegradable ingredients...”*

**“Top ingredient attributes of a ‘free-from’ detergent?”**

1. Hypoallergenic
2. Biodegradable

This shift is reinforced by regulatory momentum, particularly in Europe. Over the past two decades, regulations have steadily narrowed the acceptable ingredient landscape, first banning non-biodegradable surfactants, then insoluble non-biodegradable polymers. Today, soluble non-biodegradable polymers such as acrylics are increasingly scrutinized. For formulators and brand owners, the question is no longer if additional restrictions will arrive, but when.

## Formulating with biodegradable polymer technologies now reduces future reformulation risk and protects long-term product strategies.

Consumer expectations mirror this regulatory direction. In Europe, biodegradable claims account for a significant share of new detergent launches and continue to expand at a strong pace. Consumers expect detergents to combine cleaning power with ingredient profiles they perceive as safer and more responsible, making polymer selection a strategic decision rather than a purely technical one.



### Not "IF" But "WHEN"

- 2004** Banned non-biodegradable surfactants
- 2023** Banned insoluble nonbiodegradable polymers
- TODAY** Non-biodegradable soluble polymers (acrylates) under scrutiny

### EU Biodegradable Claims

- > 25%** of new launches
- > 15%** 5yr CAGR

Source: Mintel '24 Fabric Care

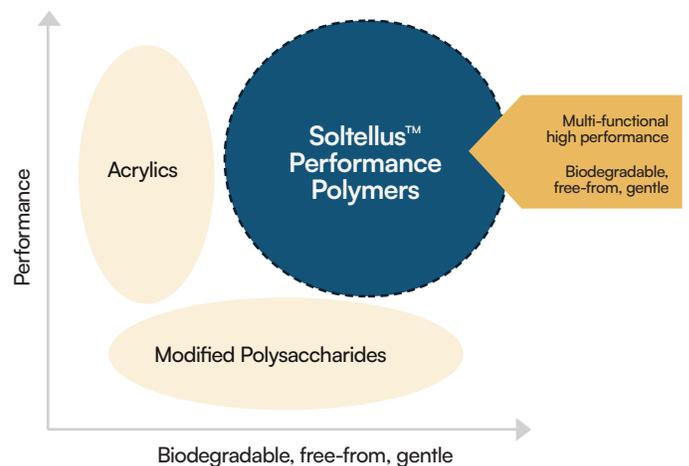
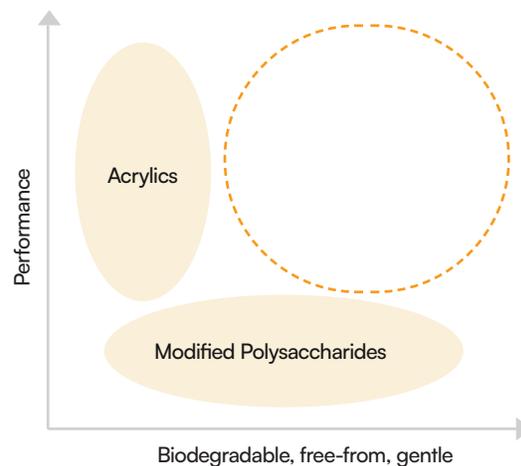


# The Persistent Polymer Trade-Off in Detergents

Polymer options for detergents have remained constrained by tradeoff between performance and biodegradable, free-from and gentle formulation claims. Acrylic polymers are strong in challenging conditions like hard water but lack biodegradability and face developing regulatory pressure. Modified polysaccharides offer biodegradability and a gentle profile but often fall short when performance demands increase.

This gap is especially problematic in laundry and automatic dish detergents, where polymers must simultaneously control hardness ions, prevent soil redeposition, enhance cleaning, and stay compatible with surfactants and enzymes.

**Until recently, formulators have been forced to choose which attributes matter most. The Soltellus™ platform was developed specifically to close this gap.**



# The Soltellus™ Performance Polymer Platform

Soltellus™ polymers are differentiated polyaspartates. While polyaspartates have been used in detergents for years, Lygos has reengineered this chemistry for significantly improved performance and manufacturability. By controlling molecular weight, branching, functional group distribution, and production process conditions, Lygos has created polyaspartates that outperform market-standard versions while retaining the critical advantage of readily biodegradability.

## These design choices translate directly into formulation benefits.

Soltellus™ polymers deliver stronger detergent performance, lighter color suitable for free-and-clear formulations, and improved granule consistency for easier handling and processing. The result is a polymer platform that raises performance expectations without introducing new formulation or regulatory trade-offs.



**BETTER DETERGENT PERFORMANCE**



**LIGHTER COLOR FOR FREE-AND-CLEAR CLAIMS**



**IMPROVED GRANULE PROCESSABILITY**

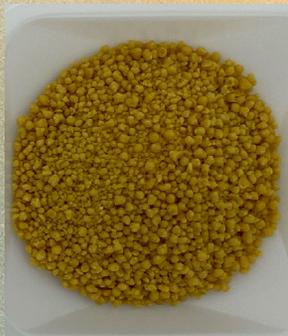
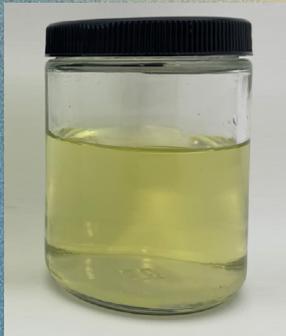


**READILY BIODEGRADABLE**

OECD 301B, EU Ecolabel DID-list



Standard Polyaspartates



Soltellus 2101



# Soltellus™ 2101 in Laundry Detergents

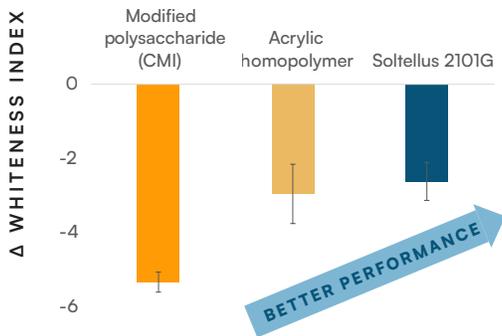
Soltellus™ 2101 is available in both liquid and granular forms for flexibility across a wide range of laundry formats. It was designed to address the most pressing performance challenges in modern laundry detergents.

Hard water is a key driver of performance issues in both North America and Europe. Calcium and magnesium ions deactivate surfactants, reducing detergency and leading to soil redeposition, dull colors, and fabric encrustation. Soltellus™ 2101 binds hardness ions, restoring surfactant activity so detergents perform as intended even under demanding conditions.

Testing demonstrates that Soltellus™ 2101 delivers leading anti-redeposition performance compared to acrylic homopolymers and modified polysaccharides. Fabrics washed with formulations containing Soltellus retain higher whiteness and color vibrancy over repeated cycles, extending garment life and improving perceived product quality.

Soltellus™ 2101 also enhances stain removal across a range of soils and increases enzyme activity and stability. In hard water conditions, Soltellus™ 2101 activates anionic surfactants resulting in measurable gains on both enzyme-sensitive and surfactant-sensitive stains.

## Market-leading properties



Univar Solutions Application Lab  
 1% active polymer: 0.65 g/L detergent, 32°C, 12min wash; 120ppm CaCO<sub>3</sub>  
 Poly/cotton (65/35); dust sebum (2.5g/pot) and redart clay (0.63g/pot)  
 Three tergotometer wash/dry cycles; n=4

## Keep whites, colors, and brights vibrant



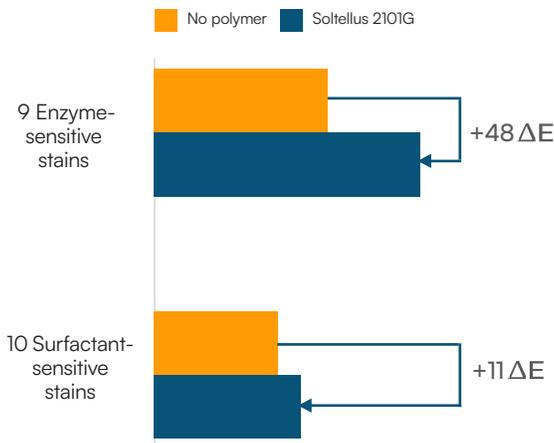
No polymer



Soltellus 2101G

Lygos test method  
 1% active polymer; 300 ppm CaCO<sub>3</sub>; 25°C  
 30 minutes wash cycle: 1 cycle; 200ml, 0.4 g detergent,  
 100% cotton; 6g 50/50 dust sebum/black clay slurry

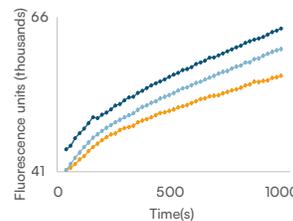
## Stain Removal Performance



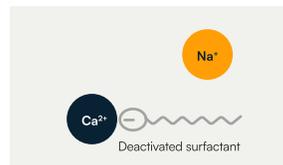
Tandell Research Lab  
 ASTM D4265; front loader at 16°C; 300ppm CaCO<sub>3</sub>; 2:1 Ca:Mg; 45mL detergent dose  
 1% active polymer; 19 common stains

■ Soltellus 2101G (1% actives)    ■ Acrylic homopolymer (1% actives)    ■ No polymer

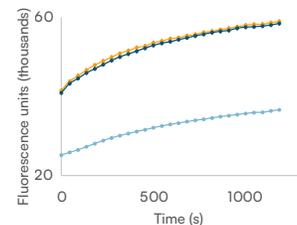
### Protease



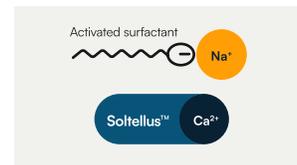
No polymer: hard water deactivates surfactants



### Amylase



Soltellus 2101G: surfactant activity increases



# Soltellus™ 2101

LAUNDRY

## Formulation Guidelines

- Applications: Laundry detergents, laundry boosters
- Formats: Liquids, tablets, powders, unit dose packets, sheets
- Recommended dosage: 0.5 to 2% (as actives)
- After dissolution, stable at least one week at pH 3-6 and over the shelf life at pH 7-12
- Not recommended for use with cationic ingredients
- Storage: keep in a cool dry place away from humidity and direct light
- Shelf Life: 1 year from date of manufacture

## Formulation Benefits

### PERFORMANCE

- Prevents redeposition of soils to keep whites, colors, and brights vibrant
- Boosts enzyme activity for better stain removal
- Boosts anionic surfactant efficacy in hard water for better stain removal
- Works in all water conditions, including cold water to save money

### GENTLE AND SUSTAINABLE

- Readily biodegradable<sup>1</sup>
- Gentle on sensitive skin
- EU Ecolabel and Safer Choice compatible
- Enables free-from acrylates and free-from phosphates claims
- Safe for septic tanks

<sup>1</sup> OECD 301B, EU Ecolabel DID-list

	Acrylic Homopolymer	Modified polysaccharide (CMI)	Soltellus 2101L
Prevents redeposition of soils	●	●	●
Enhance stain removal	●	●	●
Biodegradability EU Ecolabel DID-list	●	●	●
Environmental Working Group (EWG) Skin Deep Status	●	●	●

Grey: No Data

# Soltellus™ 2101 in Automatic Dish Detergents

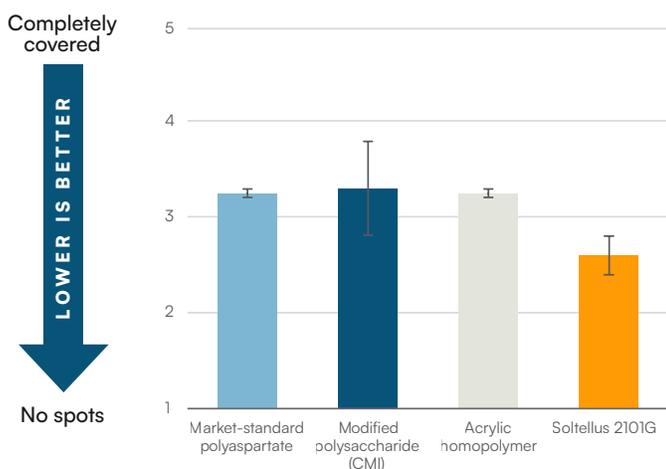
In automatic dishwashing, performance issues are very visible to consumers. Hard water leads directly to spotting and filming on glassware. These challenges are widespread across both North American and European markets.

Soltellus™ 2101 addresses these issues directly. In automatic dish formulations, it delivers strong anti-spotting and anti-filming performance while maintaining a readily biodegradable, free-from formulation. Third-party testing shows that Soltellus™ 2101G outperforms acrylics, modified polysaccharides, and market-standard polyaspartates on glassware clarity.

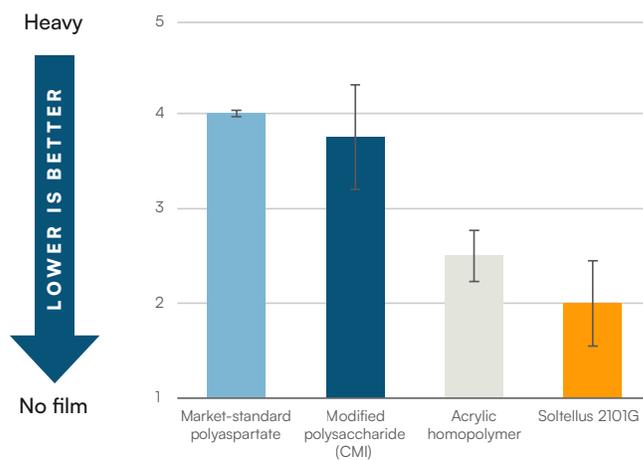
**These design choices translate directly into formulation benefits.**



**Spotting on glass tumblers after 10 cycles**



**Filming on glass tumblers after 10 cycles**



SGS Labs  
 ASTM D3556: 3 Whirlpool machines on 1 hour cycle; 300pm CaCO<sub>3</sub>; 2:1 Ca:Mg; 16g dose with 5% active polymer with sodium citrate builder; 55°C +/- 5°C; margarine and dry milk soils (80/20) added to each cycle; 2 glasses evaluated per cycle; n=6; 3 evaluators

# Soltellus™ 2101

**AUTOMATIC  
DISHWASHER**

## Formulation Guidelines

- Applications: Automatic dishwasher detergents, automatic dishwasher cleaners
- Formats: Unit-dose packets, tablets, powders
- Recommended dosage: 3 to 5% (as actives)
- After dissolution, stable at least 1 week at pH 3-6 and over the shelf life at pH 7-12
- Can be used in combination with other dispersants to further enhance performance
- Storage: keep in a cool dry place away from humidity and direct light
- Shelf Life: 1 year from date of manufacture

## Formulation Benefits

### PERFORMANCE

- Spotless glassware
- Sparkling dishes
- Excellent performance in hard water
- Prevents scale formation
- Water softening
- Leaves no visible residue and keeps machine clean

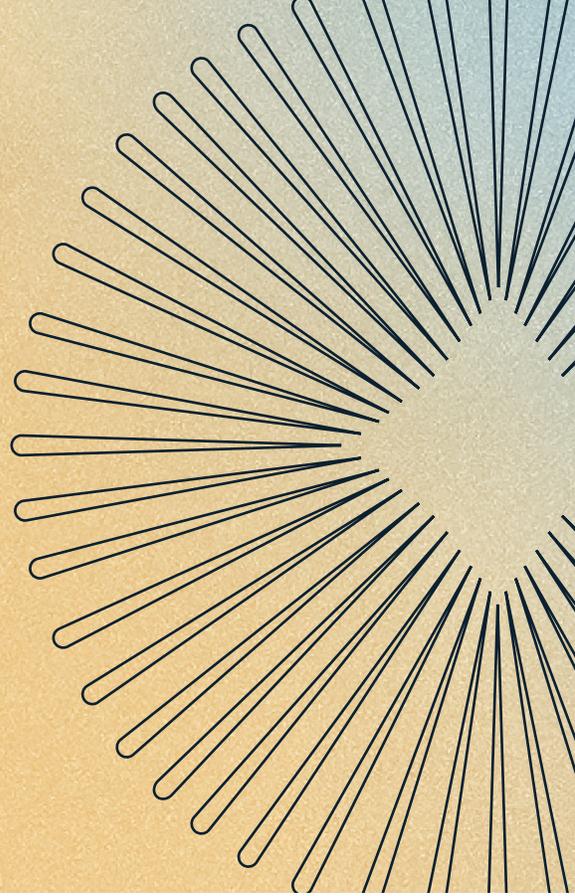
### GENTLE AND SUSTAINABLE

- Readily biodegradable<sup>1</sup> and free from persistent chemicals
- Enables free-from acrylates, phosphates, and phosphonates claims
- EU Ecolabel and Safer Choice compatible
- Safe for septic tanks

1. OECD 301B, EU Ecolabel DID-list

	Acrylic Homopolymer	Modified polysaccharide (CMI)	Soltellus 2101L
Anti-spotting	●	●	●
Anti-filming	●	●	●
Biodegradability EU Ecolabel DID-list	●	●	●
Environmental Working Group (EWG) Skin Deep Status	●	●	●

# From Proven Chemistry to Formulation Advantage



Soltellus™ performance polymers address application needs and performance gaps in laundry and automatic dishwashing - delivering measurable results

Soltellus™ 2101 has demonstrated its value across redeposition control, stain removal, anti-spotting, and anti-filming, while maintaining biodegradability and compatibility with free-from and gentle detergent positioning.

Supported by Lygos' application expertise, and collaborative development capabilities, Soltellus™ empowers formulators to eliminate the traditional trade-offs between performance and sustainability.

## Ready to Evaluate Soltellus™ in Your Formulations?

Partner with Lygos to access formulation support, performance data, and scalable solutions for next-generation detergents.

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