



What sustainability means today for a personal care ingredient supplier

The balance between sustainability and performance

Dr. Michael Franzke

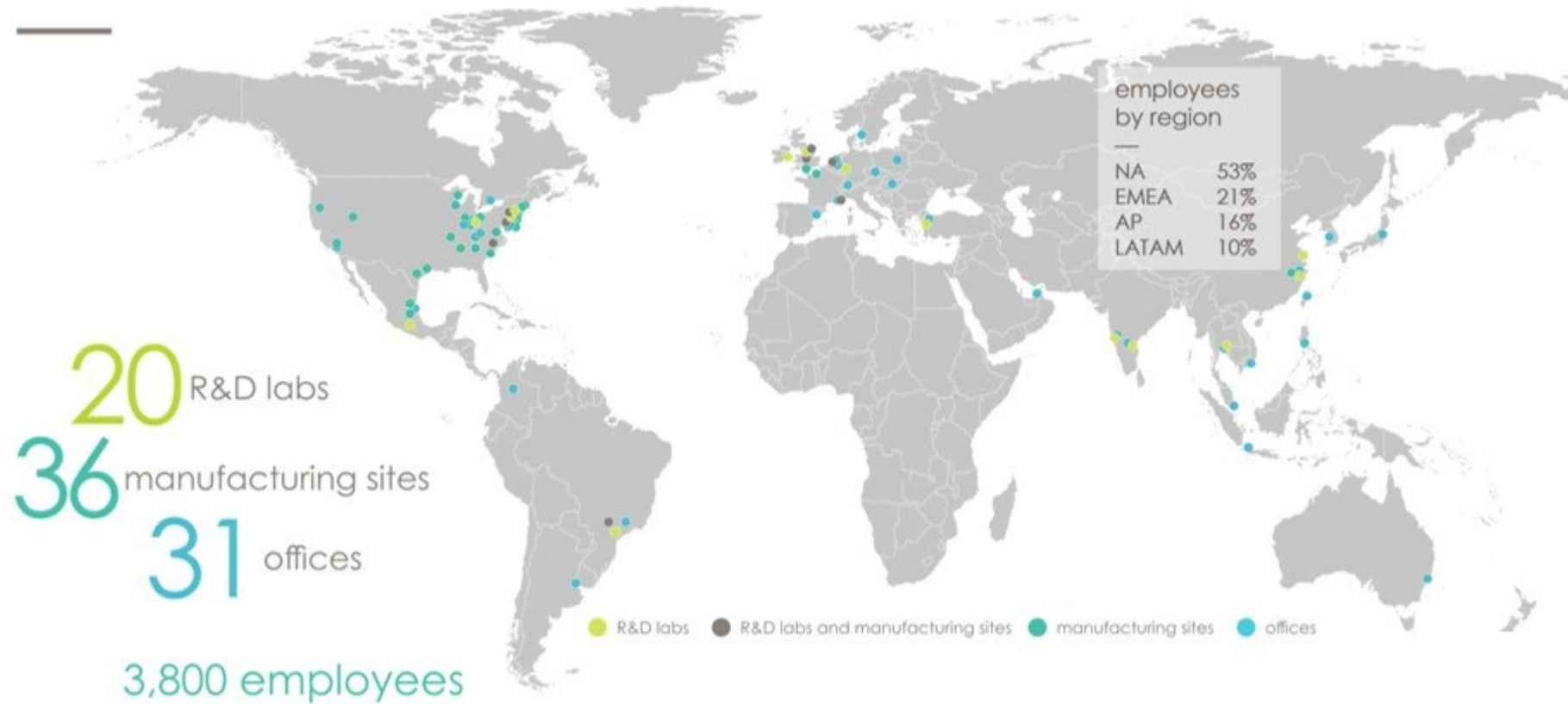
Principal scientist

Ashland personal care R&D

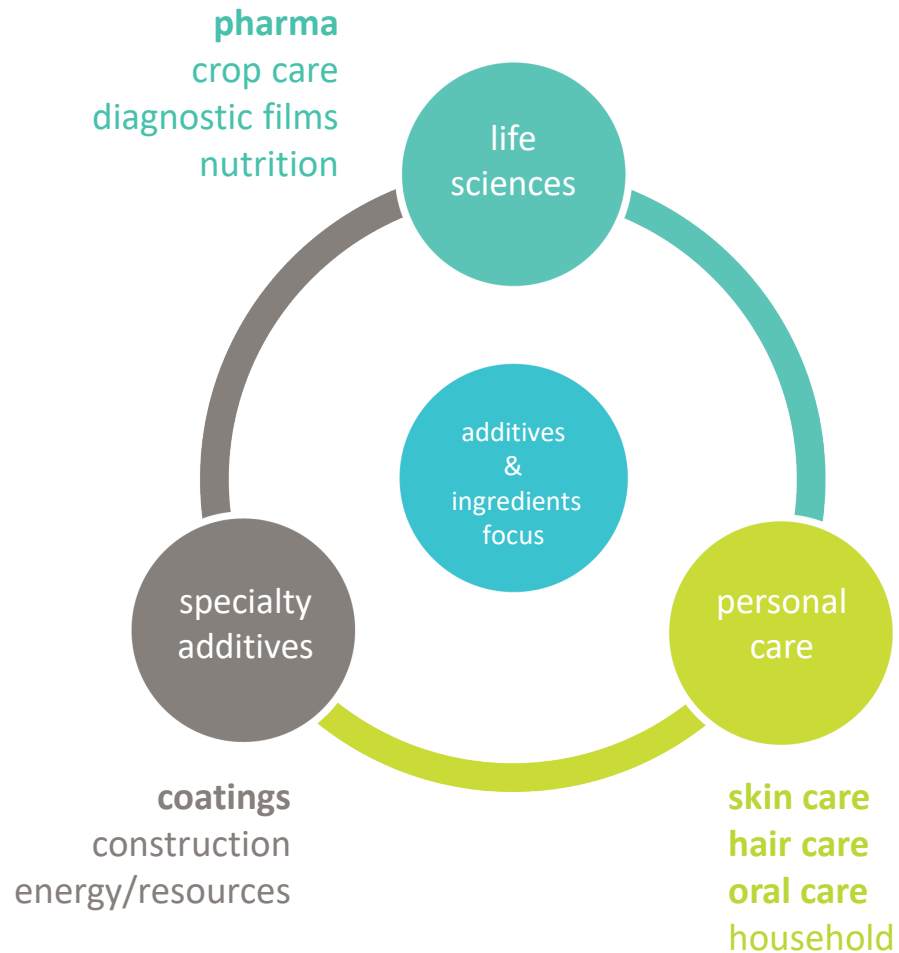


Who is Ashland

far reaching global footprint



Ashland's product focus-additives and ingredients



“big 3”

pharma

- leading position in high-purity excipients (oral solid dose)
- building injectables & new drug delivery modality offerings
- API² manufacturing consumables

personal care

- industry leading product portfolio for oral, hair, skin care ingredients
- strong offering of natural and nature-derived products
- leading the ESG³ transition

coatings

- leading product offering in rheology
- expanding new additives beyond rheology
- well-positioned in architectural. expanding in industrial

global technology and a global technology team

global technology infrastructure to support customer innovation and growth

Small organic molecules

Esters, ethers, alcohols



3 pilot plants

Synthetic polymers

Repe chemistry-
VP,VCAP polymers
acrylates chemistry

biofunctionals

natural based active
molecules for skin and
hair



21 R&D labs

polysaccharides

Cellulose derivatives,
polygalactomannanderiv
atives

captivates

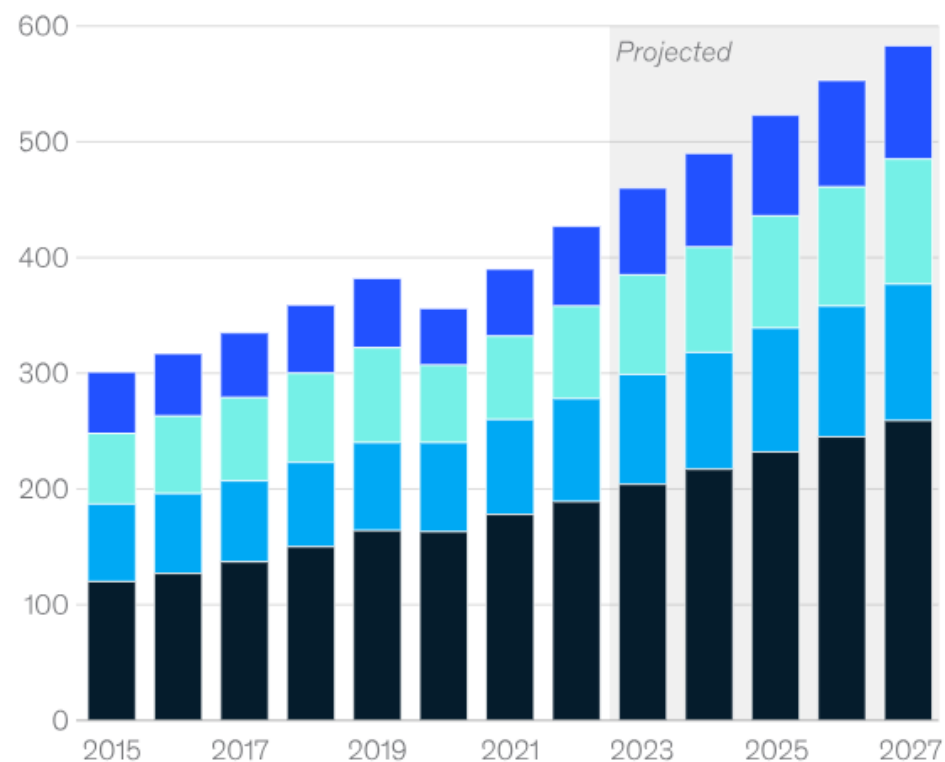


360 R&D staff

The personal care (ingredients) market size

The four main beauty categories are projected to grow in the next few years.

Global beauty market retail sales, by category, \$ billion



Year-over-year growth, %

	2015–19	2019–22	2022–27 projected
Total	6	4	6
Fragrance	3	5	7
Makeup	8	-1	6
Hair care	3	6	6
Skin care	8	5	6

Source: Euromonitor; McKinsey analysis; McKinsey Global Institute analysis

Projected personal care ingredients market development

2021 10.4Bn\$

2031 18.5Bn\$*

cagr ~6%/yr

* allied marketresearch
Industry forecast 2031



sustainability commitments – the actual challenge for personal care

100% of main renewable materials from sustainable sources by 2025

CO₂ neutral in 2040

-50%

By 2030, our strategic suppliers will reduce their direct emissions (scopes* 1 and 2), by 50% in absolute terms, compared to 2016.

100% sustainable sourcing of our key agricultural crops

Replace fossil-fuel derived carbon with renewable or recycled carbon in all our cleaning and laundry product formulations by 2030

BIODEGRADATION CLASSIFICATIONS

'Readily and Ultimately' biodegradable – achieving this classification confirms the ingredient will rapidly and completely biodegrade by the action of micro-organisms in the environment, usually in hours/days.



GOLD STANDARD

'Inherently and Ultimately' biodegradable – achieving this classification means that the ingredient has a slower rate of degradation in the environment but that it will completely degrades, usually in hrs/days/weeks.



SILVER STANDARD

100% of our ingredients will be biodegradable by 2030

95%

By 2030, 95% of our ingredients in formula will be bio-based, derived from abundant minerals or from circular processes.

100% renewable by 2030

-25%

By 2030, we will innovate to enable our consumers to reduce the CO₂ emissions resulting from the use of our products by 25% compared to 2016, on average and per finished product.

Halve greenhouse gas impact of our products across the lifecycle by 2030

100% biodegradability by 2030





How to react to the new challenges and extended sustainability requirements

ESG innovations

aligned with the UN Sustainable Development Goals



innovation capabilities and focus

global technology team

adapt global technology infrastructure to support sustainable innovations and growth



3 pilot plants



21 R&D labs



360 R&D staff

Add new capabilities and extend already existing ones in terms of ESG requirements

Expand field of existing “sustainable” chemistries

Look for new “sustainable” Chemistries

digital innovation now



modeling and AI capabilities are key to accelerating projects - already embedded in Ashland's innovation process



AI and machine learning

- ingredient discovery
- rational design
- accelerates discovery

new AI technology is currently being applied to accelerate ingredient design, targeting specific performance



in silico lab

- critical insight
- property prediction
- customer engagement

modeling is key to the elucidating mode of action of ingredients when interacting with the substrate or behavior and influencing the formulation



digital transformation

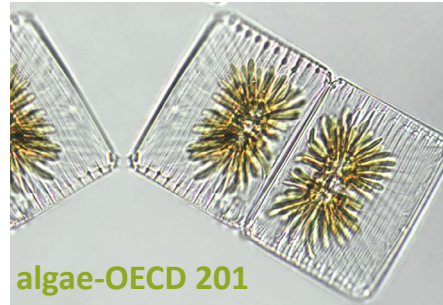
- competitive advantage
- data utilization

enabling sustainable innovations

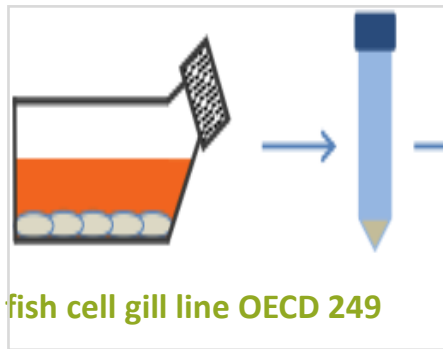
in house biodegradation testing



in house ecotoxicity testing



algae-OECD 201



fish cell gill line OECD 249

strong in house capabilities

- **OECD306D** seawater test
- **OECD301D** surface water/secondary effluent
- **OECD301F** surface water/activated sludge
- **OECD302B** Zahn-Wellens activated sludge
 - **EN 13432** 'compostable packaging'
 - Structure/ property impact on biodegradability, aquatox knowledge
 - Iso 16128 Naturalness definition and calculation
 - Green chemistry principles
 - LCA (in development)
 - CO2 emission factors (according to ISO 14067)
 - etc

new technology platforms

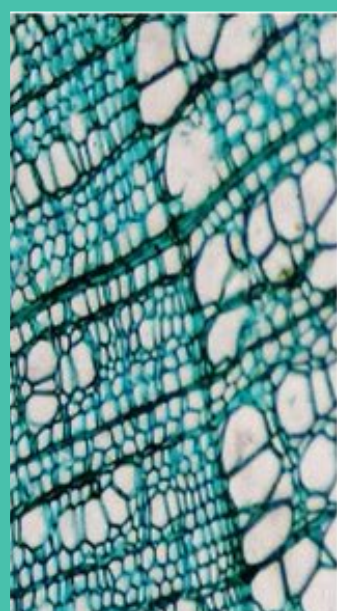
expanding our technology toolbox and market participation



transformed
vegetable oils



super wetters



novel
cellulosics



liquid
cellulose+



multifunctional
starch



pH neutralizer



bioresorbable
polymers



scalable, tunable, profitable technologies that excite our customers

platform benefit ambition – hair care



care

- high performance deposition polymers
- novel rheology solutions for thickening and suspension across product formats
- damage prevention
- superior conditioning



styling

- film formers for aerosol applications
- multifunctional polymers for styling and protection
- novel rheology solutions across product formats
- manageability



colour

- superior pigment dispersion and retention
- novel rheology solutions for colourants

super wetter

novel cellulosics

transformed vegetable oils

multifunctional starches



target is readily-biodegradable with a minimum of inherently biodegradable. All solutions to be nature derived or natural

platform benefit ambition – skin care



target is improved biodegradability over benchmarks with focus on nature derived technologies



Rinse-off

- deposition polymers
- novel rheology solutions for thickening and suspension
- superior sensorials
- moisture retention
- foam boosters



Leave-on

- polymeric emulsion stabilizers
- superior sensorials
- novel rheology solutions for thickening and suspension across product formats
- reduce formulation whitening



suncare

- SPF boosters
- water resistance
- enhanced sensorials

novel cellulosics

transformed vegetable oils

multifunctional starches

super wetter

innovation examples



transformed vegetable oils

new to the world additive

vegetable oils offer attractive characteristics

- sustainable solution
- renewable and natural
- biodegradable
- non-microplastic
- non-GMO, vegan (as required)
- IP protected



built on the attractive characteristics and created a technology with many functionalities

dissolves in water



precise control on % dissolved in water

multifunctional

4 in 1

dispersant, film former, binder, delivery system

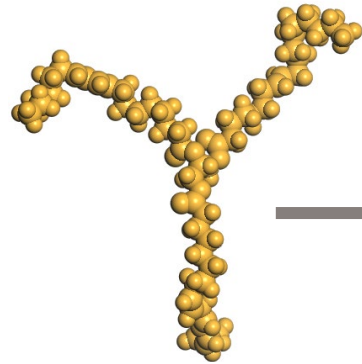


transformed vegetable oils are unique

ESG-driven, AI-powered molecular engineering



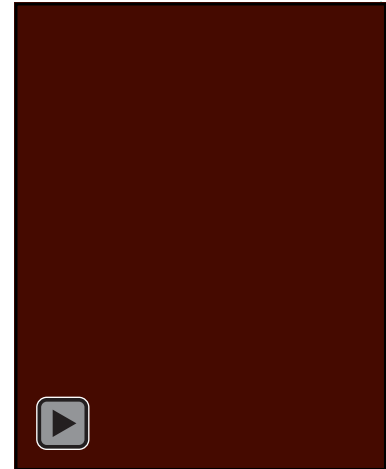
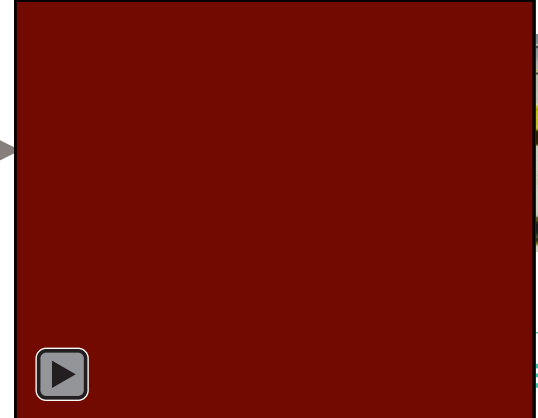
examples vegetable oils
palm
soybean
rapeseed
sunflower
peanut
cottonseed
coconut
corn
olive



vegetable oil



- ### ESG solutions
- renewable, nature-derived (> 80% naturality)
 - inherently biodegradable
 - non-microplastic
 - non-GMO, vegan as needed



- ### Key ingredients and properties
- AI-powered molecular engineering
 - versatile functional modifications
 - tunable hydrophobicity/hydrophilicity
 - differentiated, IP protected
 - innovative process
 - single reaction vessel
 - 100% yield
 - no solvent, no catalyst, no waste

transformed vegetable oils

sustainable, versatile and scalable technology



vary hydrophilicity/hydrophobicity

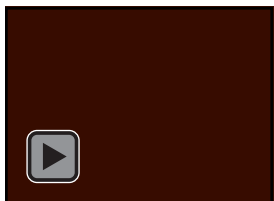
hydrophilic, water-soluble

hydrophobic, water-resistant

gantrez™ soja oral care



- toothpaste and mouthwash
- nature-derived
- biodegradable
- water soluble
- retains actives
- long-lasting benefits



softhance™ mr skin care



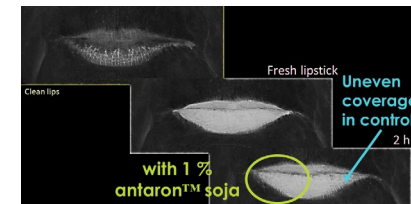
- excellent deposition profile
- skin moisture retention
- creates conditioned skin feel
- nature-derived
- biodegradable, non-microplastic
- non-GMO, vegan suitable



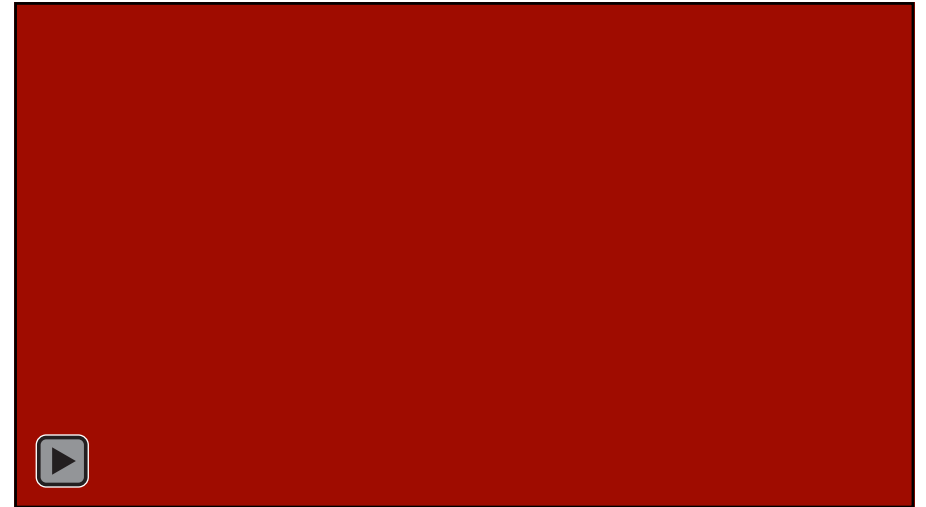
antaran™ soja sun care and color cosmetic



- nature-derived
- biodegradable
- film-former
- water-resistance
- SPF boosting
- long-wear
- color-transfer resistance



antaron™ soja what it does



Hair Care

novel cellulosics



rheology



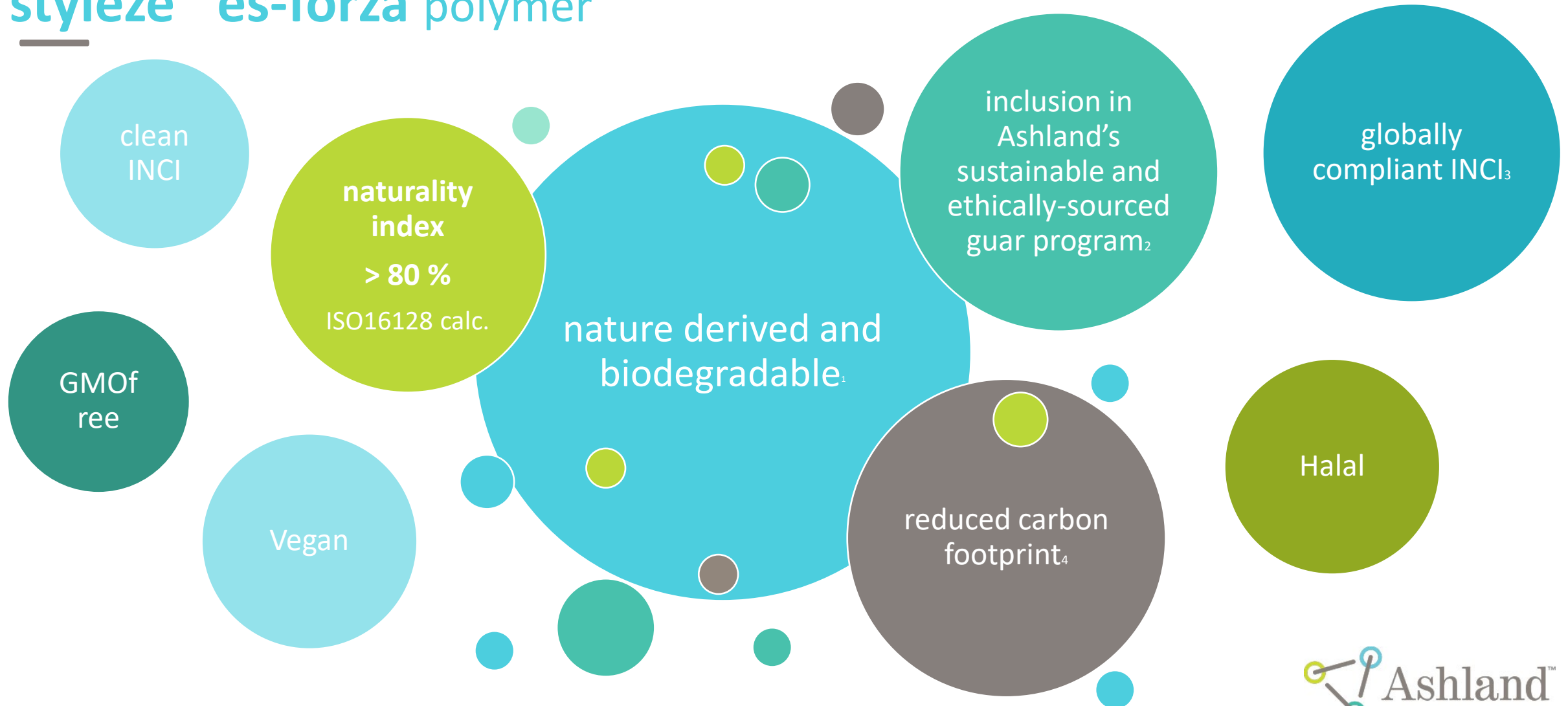
conditioning polymers



styling polymers

natural, ethically sourced and sustainable

styleze[™] es-forza polymer



styleze™ es-forza polymer

INCI: hydroxypropyl guar hydroxypropyltrimonium chloride (and) guar hydroxypropyltrimonium chloride



styling benefits

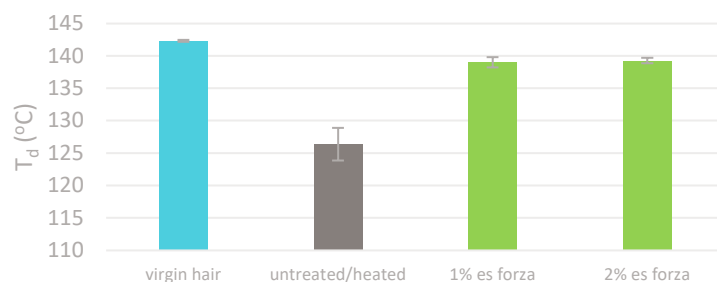
- strong hold
- customizable stiffness & hold
- very high humidity resistance
- heat protection up to 450F
- Deliver thickening properties beside styling benefits

sustainability profile

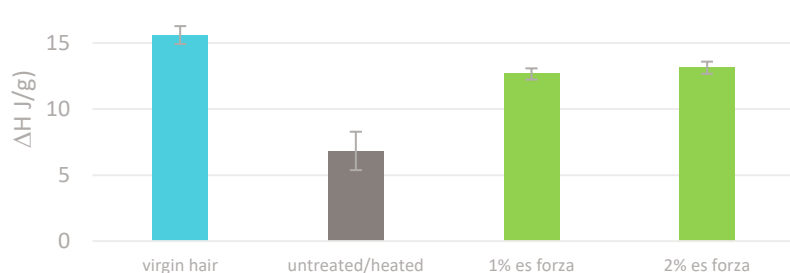
- high naturality
- clean INCI
- responsibly sourced
- nature-derived *
- Inherently biodegradable+
- reduced carbon footprint #



temperature of denaturation



enthalpy of denaturation



applications

- gels
- cremes
- lotions
- waxes

- pomades
- **NOT INTENDED FOR AEROSOLS**

use level: 2.0 – 3.0%

- putties
- pastes

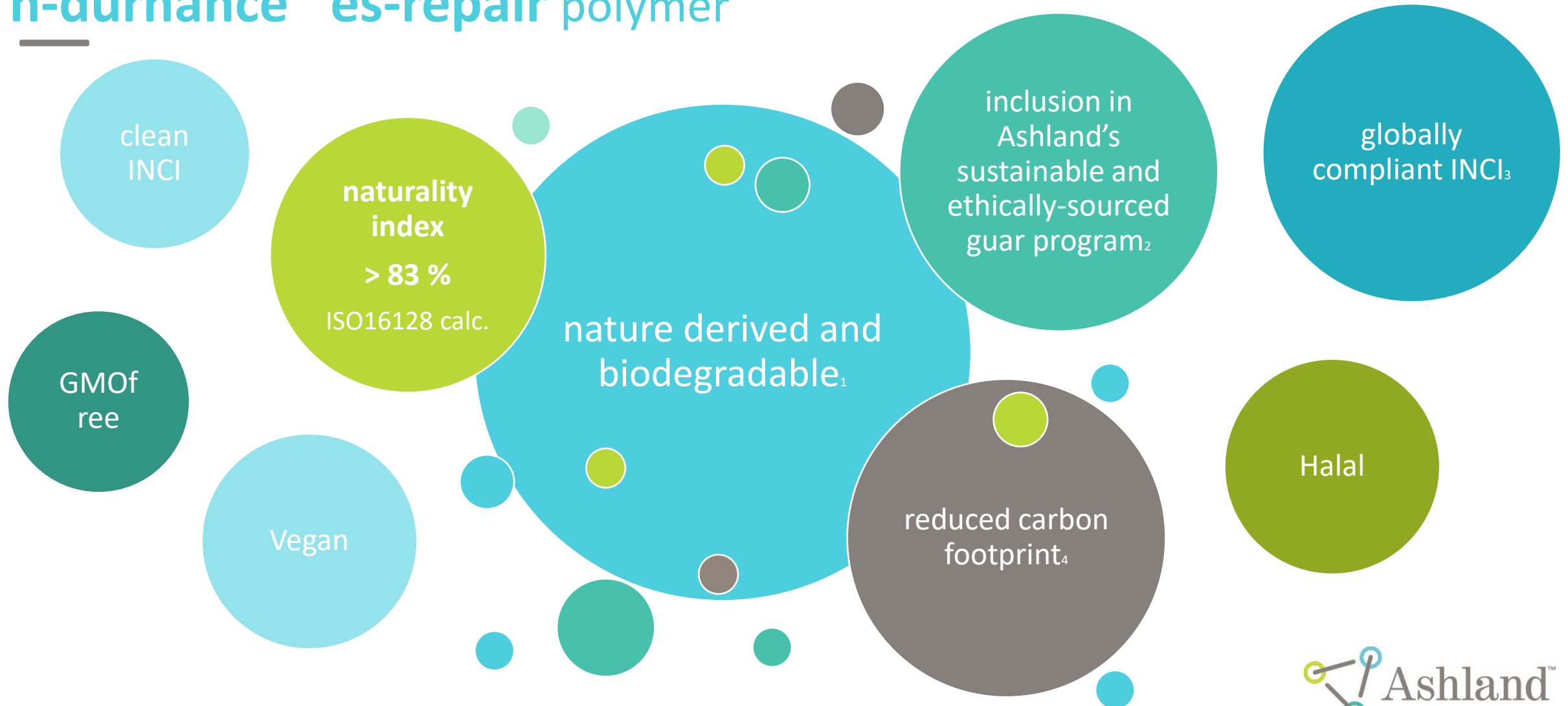


novel nature derived biodegradable polymer that provides **superior** styling performance and versatility

* **80.3** % according to ISO 16128:2-2017; (+)according to OECD testing parameters; # reduced carbon from shipping compared to aqueous solution competitive products;

natural, ethical and sustainable

n-durhance™ es-repair polymer



n-durhance™ es-repair polymer

INCI: hydroxypropyl guar hydroxypropyltrimonium chloride (and) guar hydroxypropyltrimonium chloride



repair & protect

- durable split end mending
- cuticle repair
- improved wet combing
- reduced hair breakage due to combing
- helps prevent frizz
- shine
- fiber alignment (manageability)
- heat protection up to 450F

sustainability profile

- high naturality
- clean INCI
- responsibly sourced
- nature-derived **
- inherently biodegradable ***
- reduced carbon footprint ****

applications

- gels
- cremes
- lotions
- waxes
- serums
- putties
- pastes
- pomades

○ NOT INTENDED FOR AEROSOLS



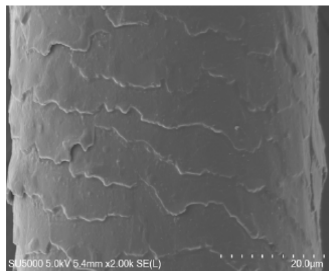
use level: 1 – 2%



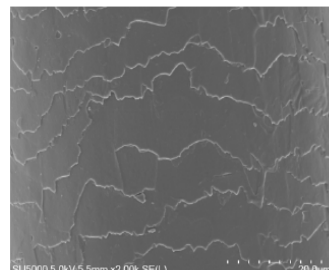
novel nature derived biodegradable polymer that provides superior split end repair benefits

untreated control

lifted cuticles

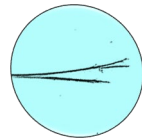


treated with 1% n-durhance™ es-repair

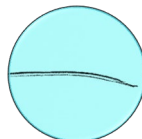


Thermal mechanical protection

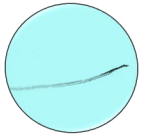
before treatment



after 1x treatment



after combing



Split end mending

** 83 % according to ISO 16128:2-2017; *** according to OECD testing parameters; **** reduced carbon from shipping compared to aqueous solution competitive products;

Summary

There are extended “environmental “ requirements in personal care world.

To meet this challenges Ashland made changes/adaptions in company structure, company capabilities and

Examples of that are the establishment of biodegradation and aquatox testing capabilities.

With establishment of a platform system new chemistries were brought in and existing one were focused better on sustainability aspects

First launches look promising.

Thank you to all Ashland solvers
contributing to that described journey



AshlandTM
always solving