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Valida: Natural Cellulose as source of Innovation in paints and coatings

Sappi - A diversified woodfibre group

- Global Presence
- 165 years of history
- Core business: pulp and paper
- Continued investments in high quality functional biomaterials
- Leadership position in woodfiber technologies

At a glance: Sappi solutions

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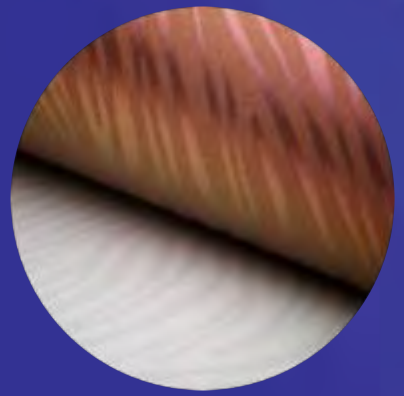
We are a diversified, innovative and trusted leader that unlocks the power of renewable resources for use in:

Dissolving pulp

Graphic papers

Packaging and speciality papers



Casting and release papers

Valida Fibrillated Cellulose

Forestry

Valida– Natural cellulose as inspiration

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Picture: Sappi Lothair plantation, South Africa

Cellulose is the most abundant organic polymer on earth!

Valida is fibrillated cellulose

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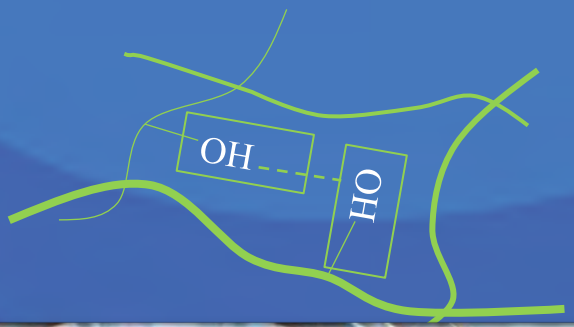
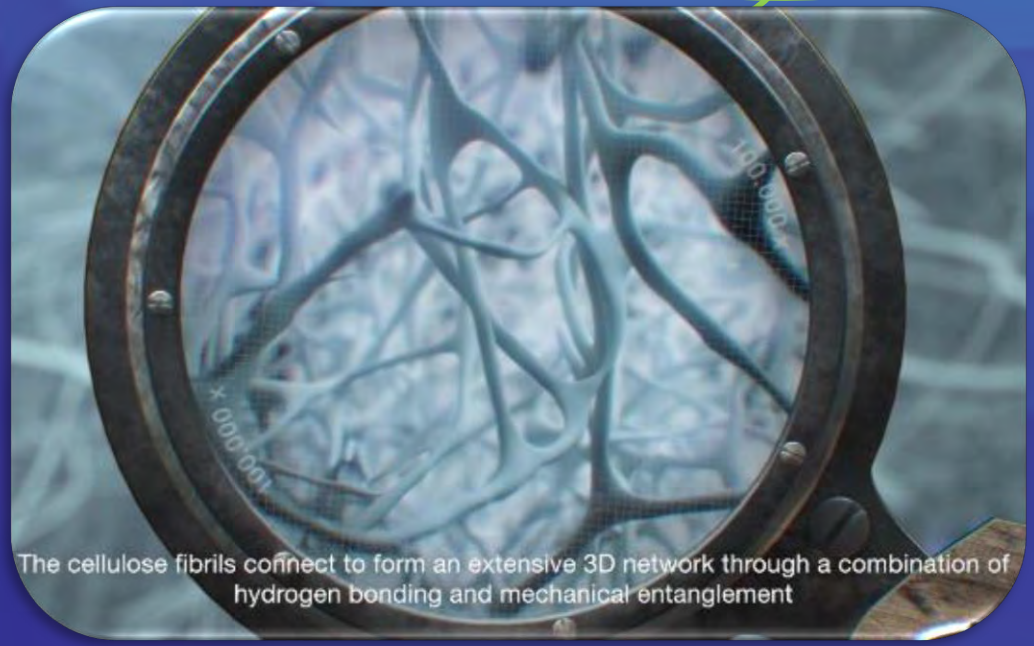
- Valida forms a 3D network based on physical entanglements of the fibers and hydrogen bonding.





Produced by mechanical processing of woodfibers. No chemicals are added

Valida: another thickener?

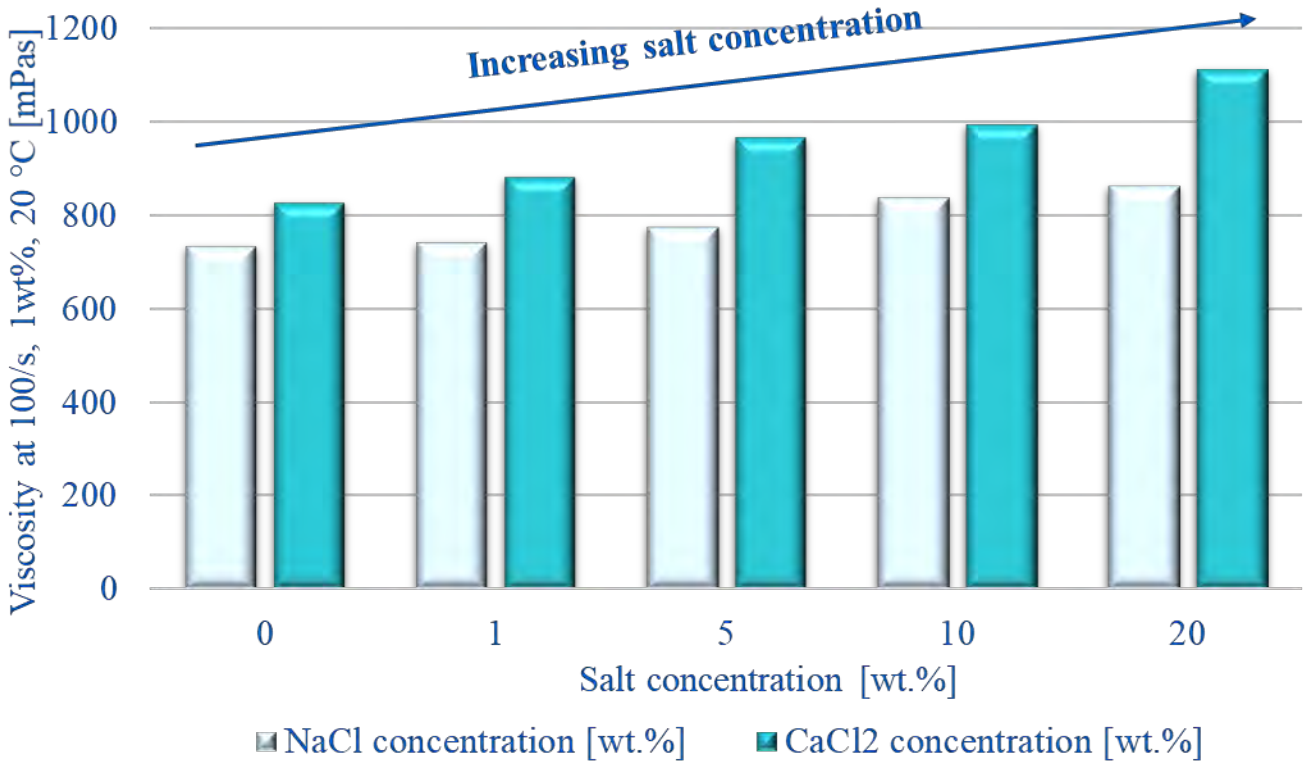
Natural Cellulose

- Not soluble
- ***Translucent***
- ***Effective stabilizing at low active dosage***
- ***Non-sticky***
- ***Stable at pH 1-13,***
- **Stable towards electrolytes**
- Compatible with polar solvents
- **Pre-hydrated**

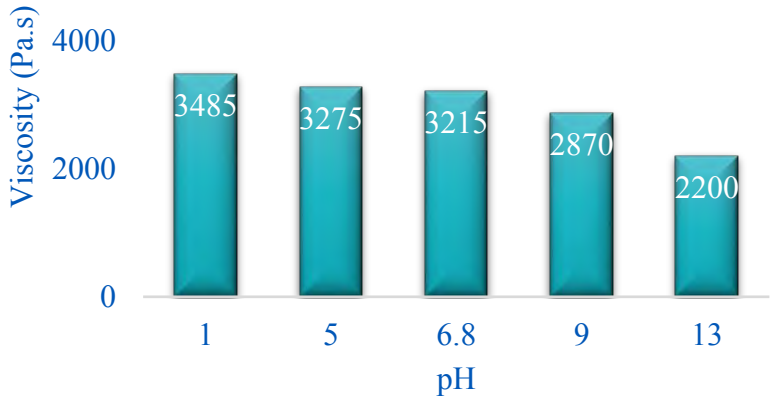
Chemically modified cellulose

- Water soluble
- Transparent
- Thickener – Not a Stabiliser
- Sticky
- Limited pH stability Instable vs electrolytes
- Powder

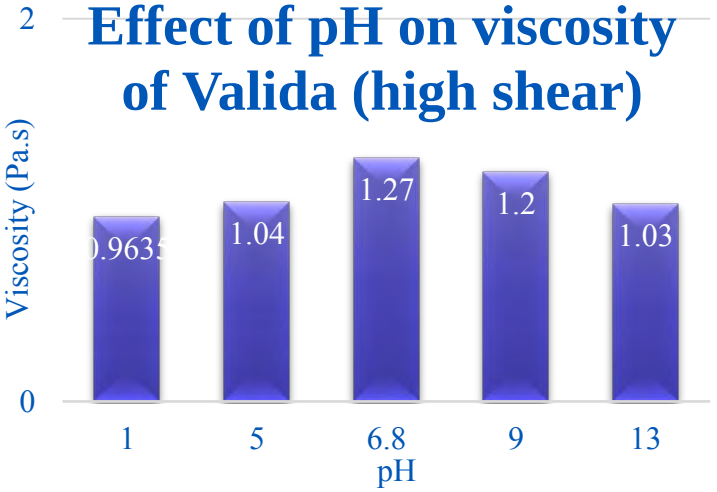
Valida is robust



Effect of pH on viscosity of Valida (low shear)



Effect of pH on viscosity of Valida (high shear)



- Valida dosage: 1% active content in water

3D fibrils network as scaffold for particles

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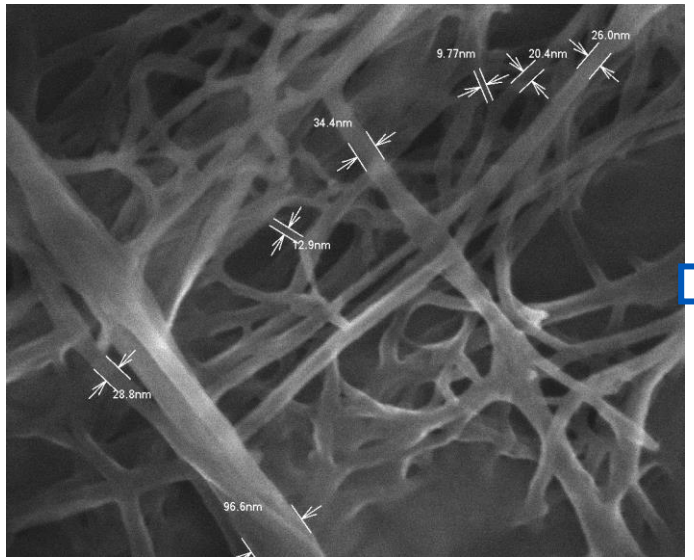
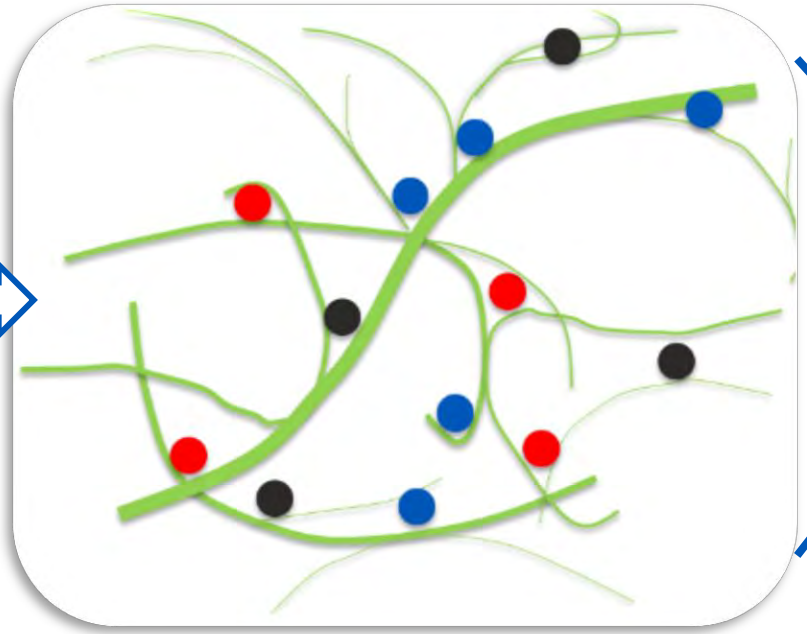
Valida's unique stabilising property relies on its ***strong physical network*** & its ***large surface area***.





Valida in Building and Constructions

- Natural
- Versatile
- Multifunctional Stabiliser

- Paints and Coatings

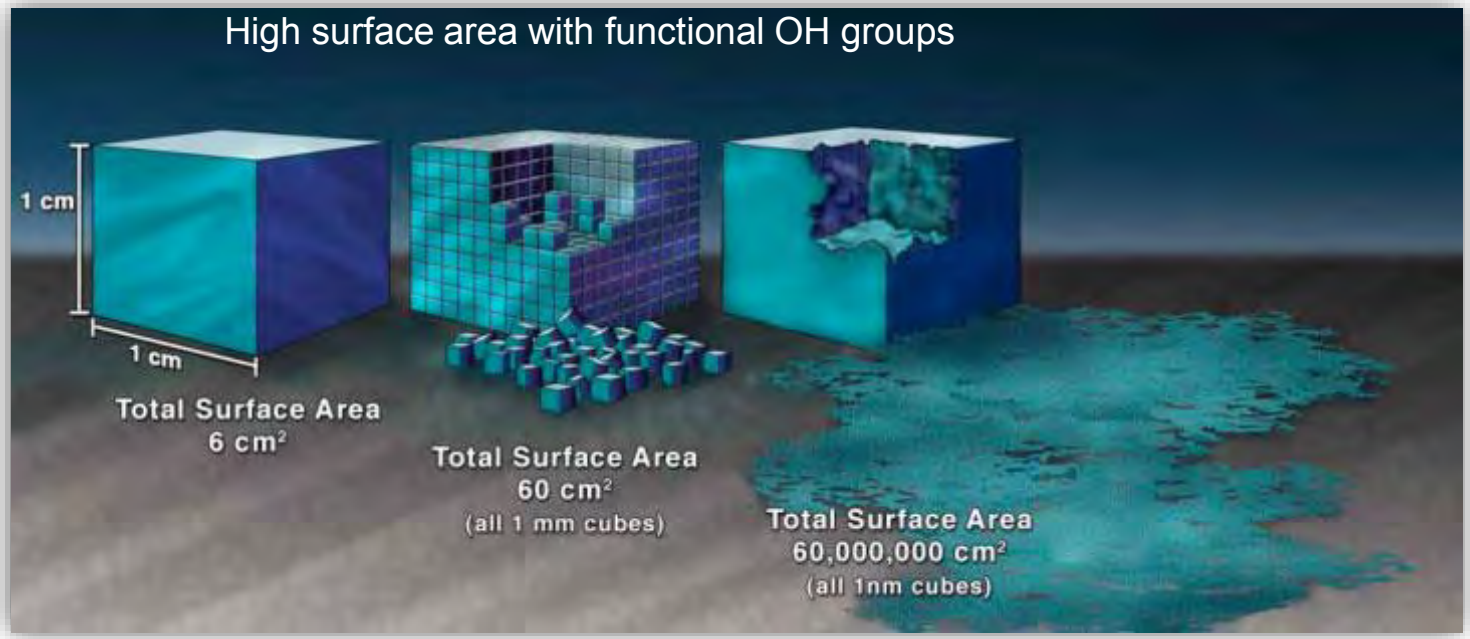
- Concrete
  - Admixture, lightweight, SLU
- Adhesive and Sealants
- Others

Valida in Paints and Coatings

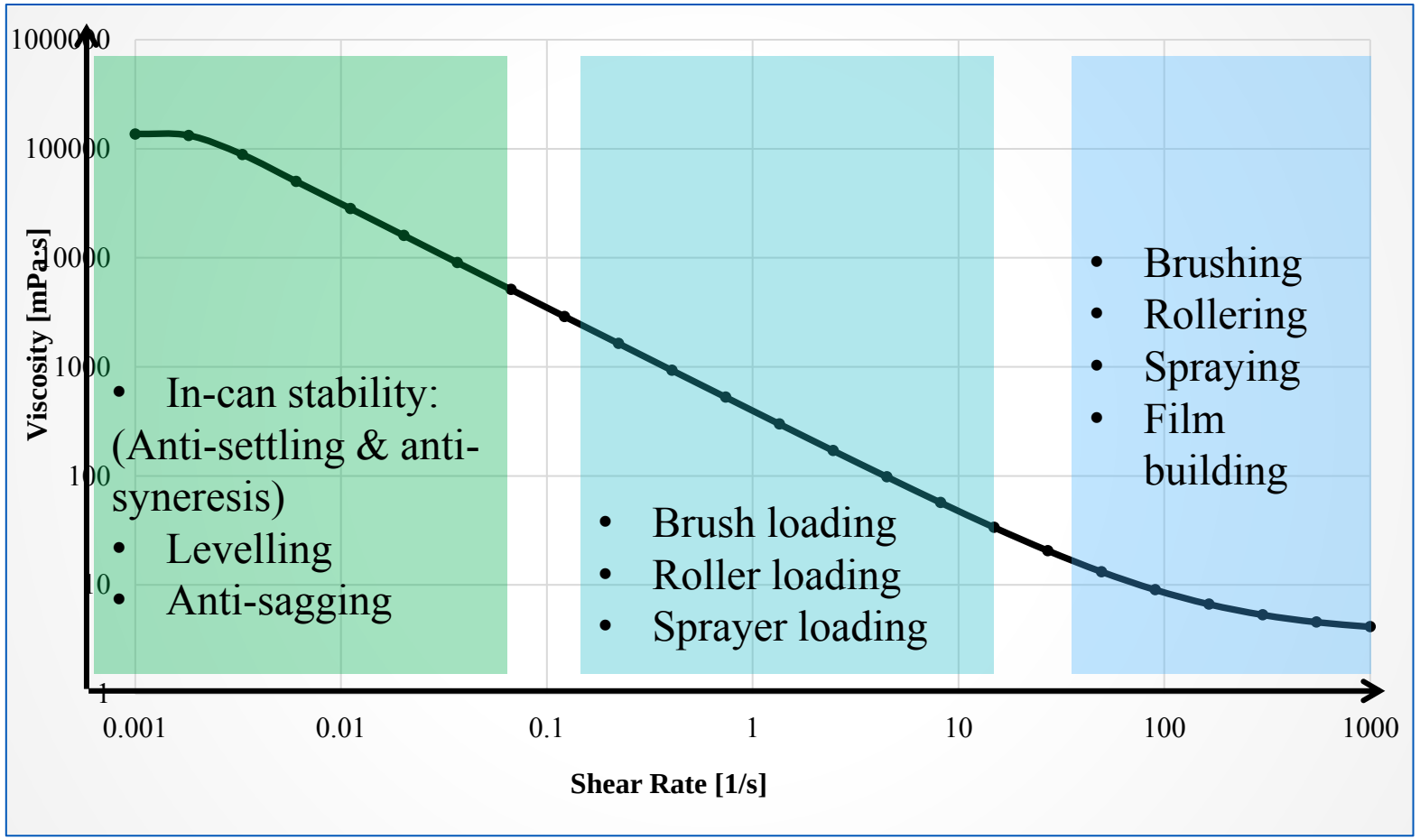
Valida – Features

- Insoluble 3D - network of cellulose fibrils suspended in water
- High stabilising capacity
- Highly shear thinning, Thixotropic, Sprayable
- Robust: pH, electrolytes, polar solvents, surfactants..

- Synergy with conventional rheology modifiers
- Compatible with Acrylic, Styrene Acrylic, Water Based Epoxy, VAE and PU resins



Valida: Highly Shear thinning and Sprayable



High Stabilising Potential

Ref.

Ref. + Valida

- Good dispersion of pigments
- Good in-can stability, no sedimentation
- Passed 1 month freeze-thaw stability test (ASTM D2243)

Case study:

Interior wall paint

Interior wall paint formulation

	Raw Material	Functionalities	Control	Valida based formulation	Valida based formulation
	PVC (reference formulation) = 75%				
			wt.%	wt.%	Wt%
Dispersion stage	Demineralised water	Solvent	15	15	15.0
	Vegetable oil and emulsifier	Defoamer	0.1	0.1	0.1
	Amino alcohol, 90% sc	Neutralising agent	0.1	0.1	0.1
	Polyacrylate Sodium salt, 40% sc	Dispersing agent	0.2	0.2	0.2
	Add under high stirring (2000rpm = 6m/s)				
	Valida, gel	**Biobased multifunctional stabiliser**	**0**	**6.7**	**13.33**
	Dispersion for 10 minutes at 1800rpm				
	Calcium carbonate, D50 = 5µm	Filler	40.5	40.5	40.5
	Rutile titanium dioxide	Pigment	10	10	10
Let down Stage	*Dispersion for 15 minutes at 1000 - 1500 rpm*				
	Styren Acrylic Emulsion, MFFT 22° C, 50% sc	Binder	10	10	10
	DiIsoButyl ester	Coalescing agent	1.5	1.5	1.5
	High molecular (PU) non ionic rheology modifier, 32% sc	Associative thickener	***1.25***	***0.8***	***0.2***
	Acrylic copolymer dispersion, 30% sc	Non associative thickener	***0.25***	***0.2***	***0.1***
	Demineralised Water	Solvent	21.10	14	9.0
	Total		100	100	100

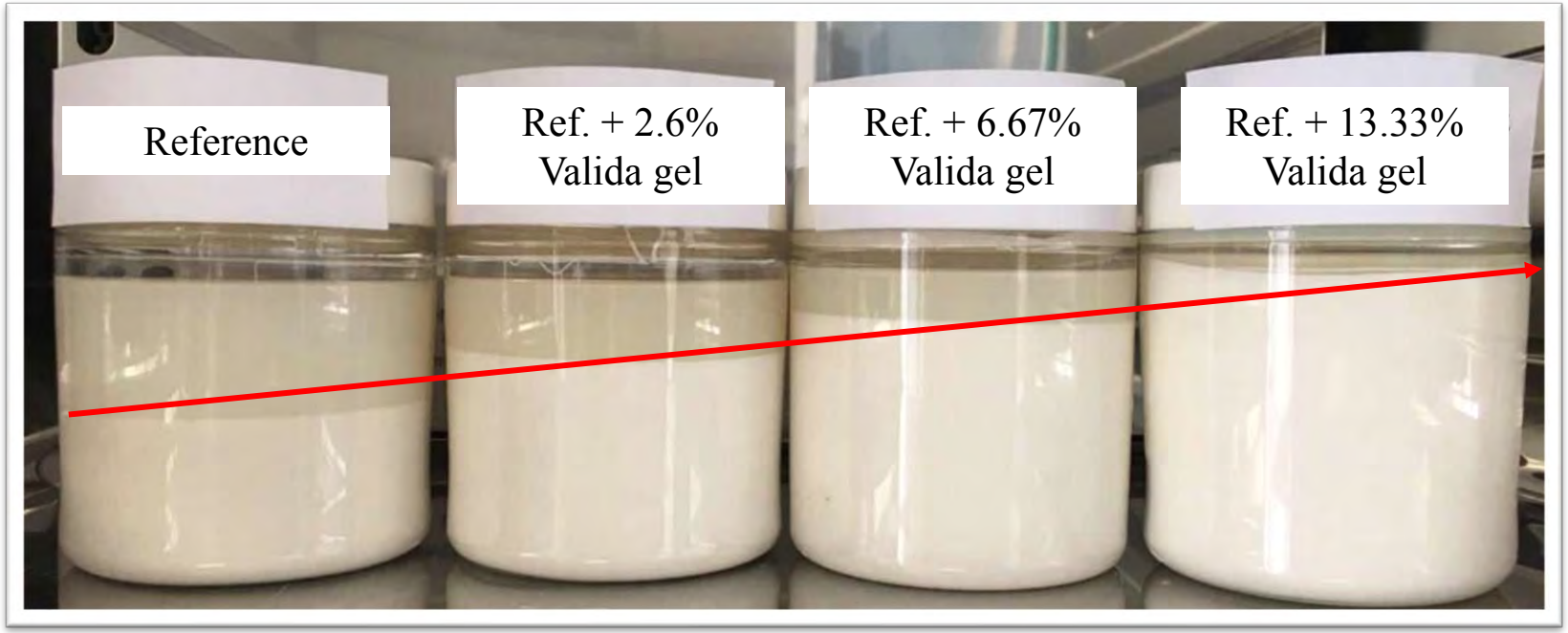
- Valida, gel consists of 3% fibers suspended in 97% water
- Valida was added during the dispersion step.
- Speed adjusted to 2000 rpm

- Lowered the dosage of conventional rheology modifiers

Benefits

Improving in-can stability

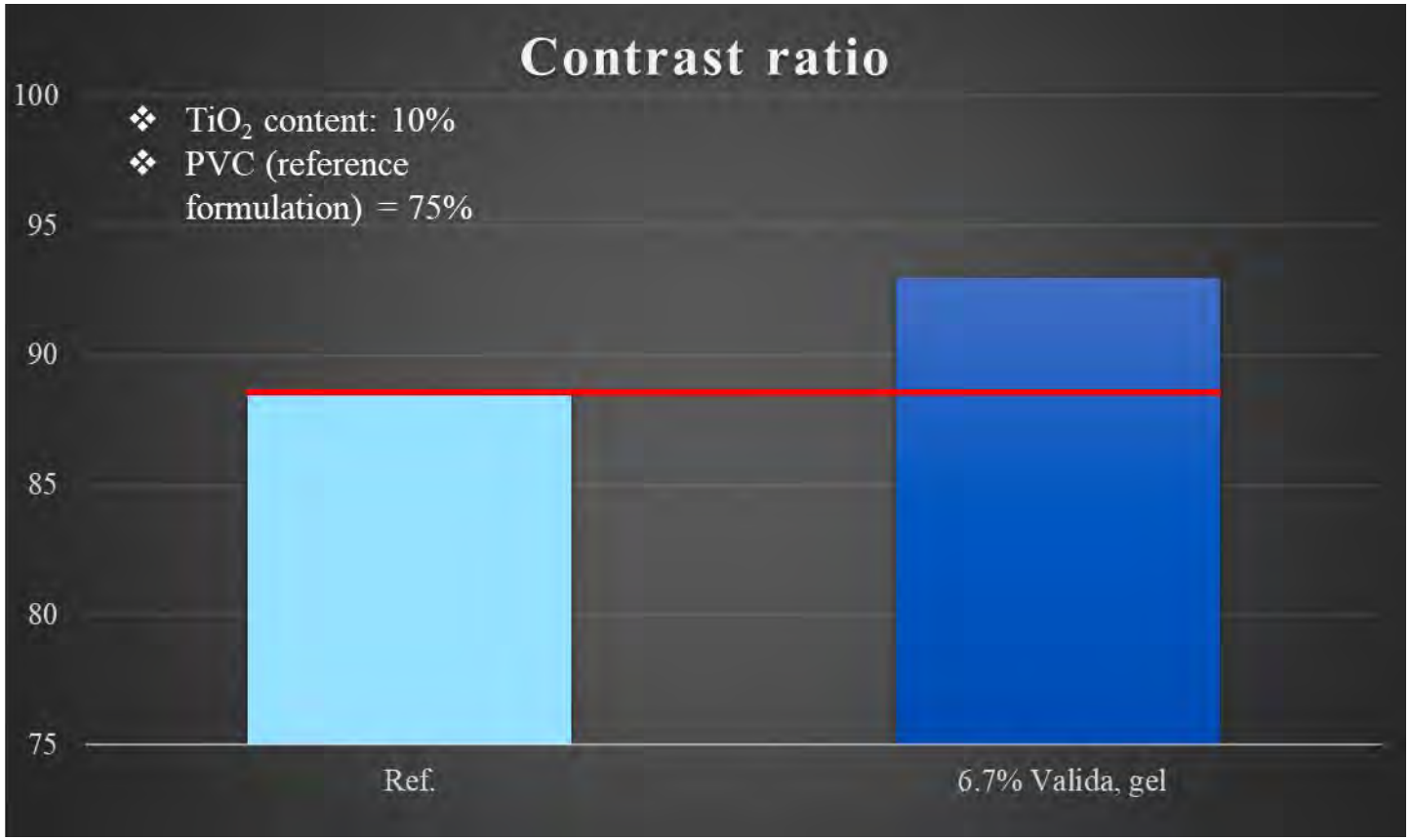
- Testing conditions: 6 months stability test in an oven under 40ºC



*Dosage based on Valida gel, which consists of 3% active fiber in 97% water

Booster for contrast ratio – hiding power

- Valida acts as a stabilizer and could potentially act as *physical spacer* for TiO_2

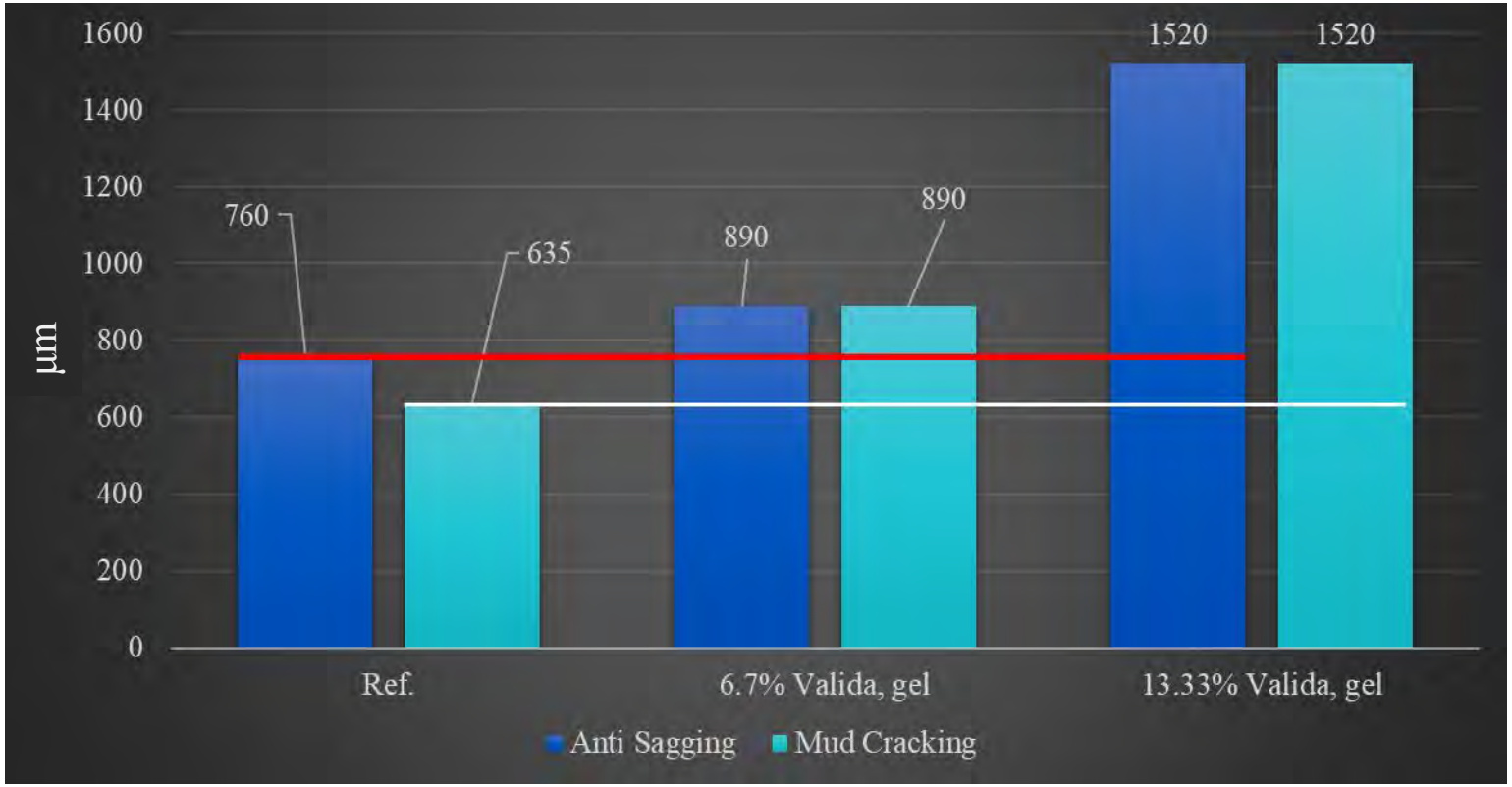


Potential for complementing TiO_2 in formulation

*Dosage based on Valida gel, which consists of 3% active fiber in 97% water

Improved Anti-Sagging & Anti Mud-Cracking

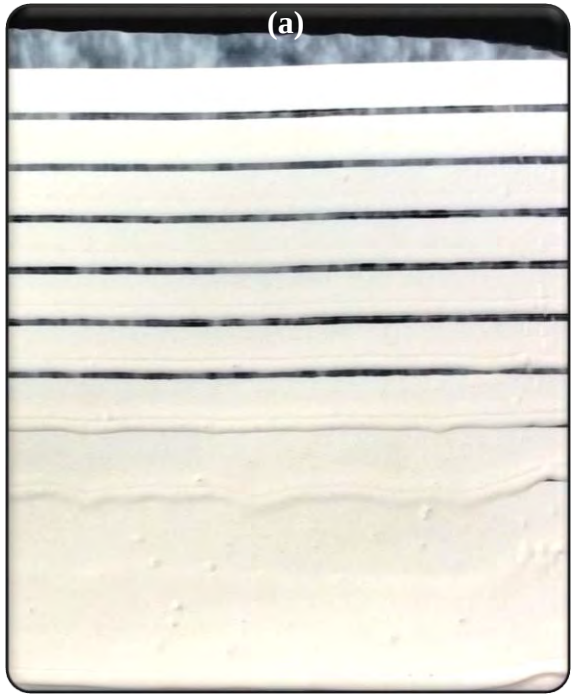
Valida improves sag resistance and mud-cracking resistance



*Dosages based on Valida gel, which consists of 3% active fiber in 97% water

Anti-Sagging

Reference

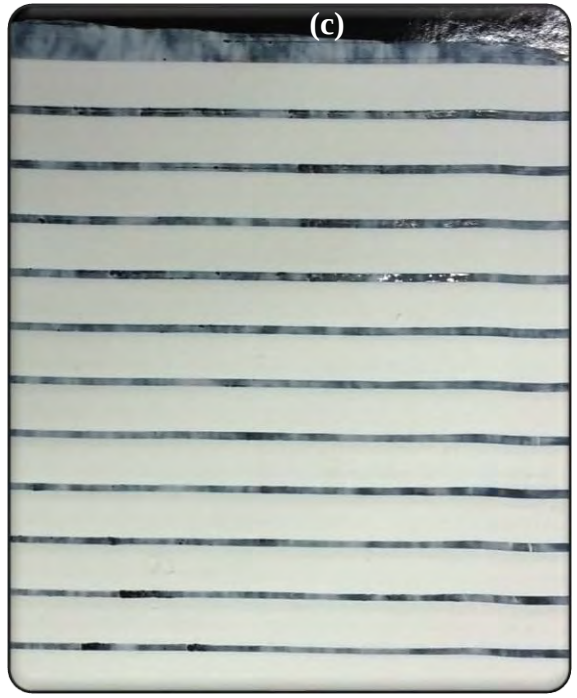


Sagging limit 760µm

6,67% Valida

Sagging limit 850µm

13.33% Valida



Sagging limit 1520µm

Figure 1: (a) Reference, (b) 6.7% Valida gel, (c) 13.33% Valida gel

Mud-cracking does not crack anymore!

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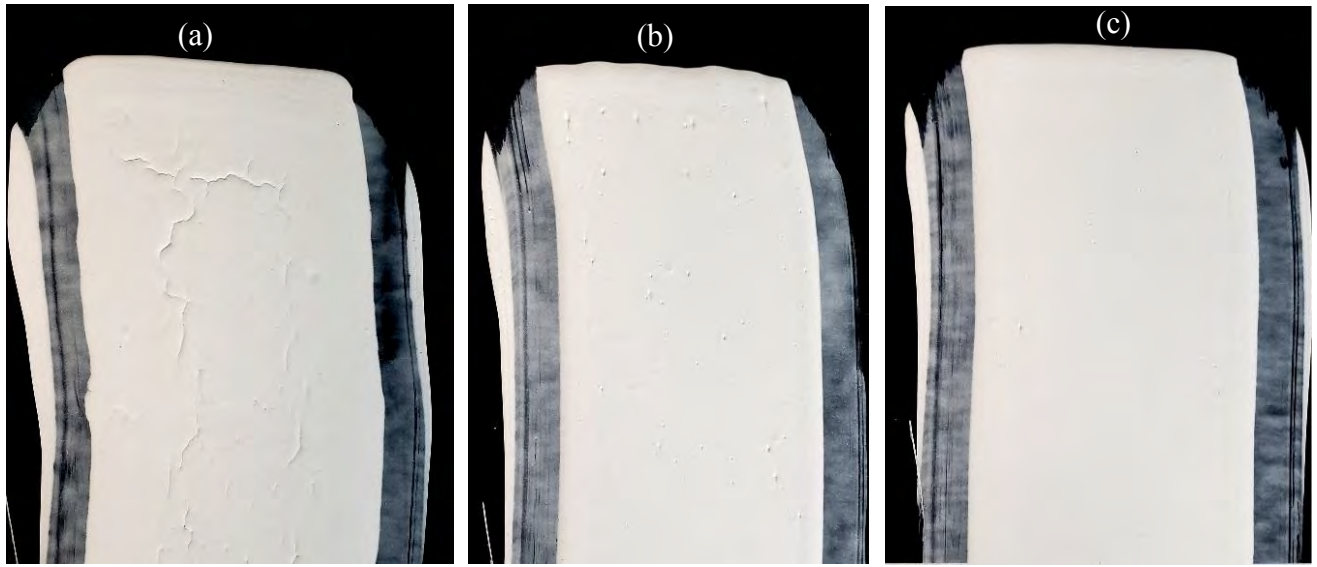
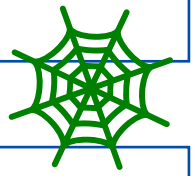
- Valida **eliminates** Mud-Cracking



- Thickeness: 1270 µm

Figure 1: (a) Reference, (b) 6.7% Valida gel, (c) 13.33% Valida gel

3D network can be seen as spiderweb: delocalizes the stress across the coating surface



Water retention slows down evaporation rate

Valida improves mud-crack resistance significantly

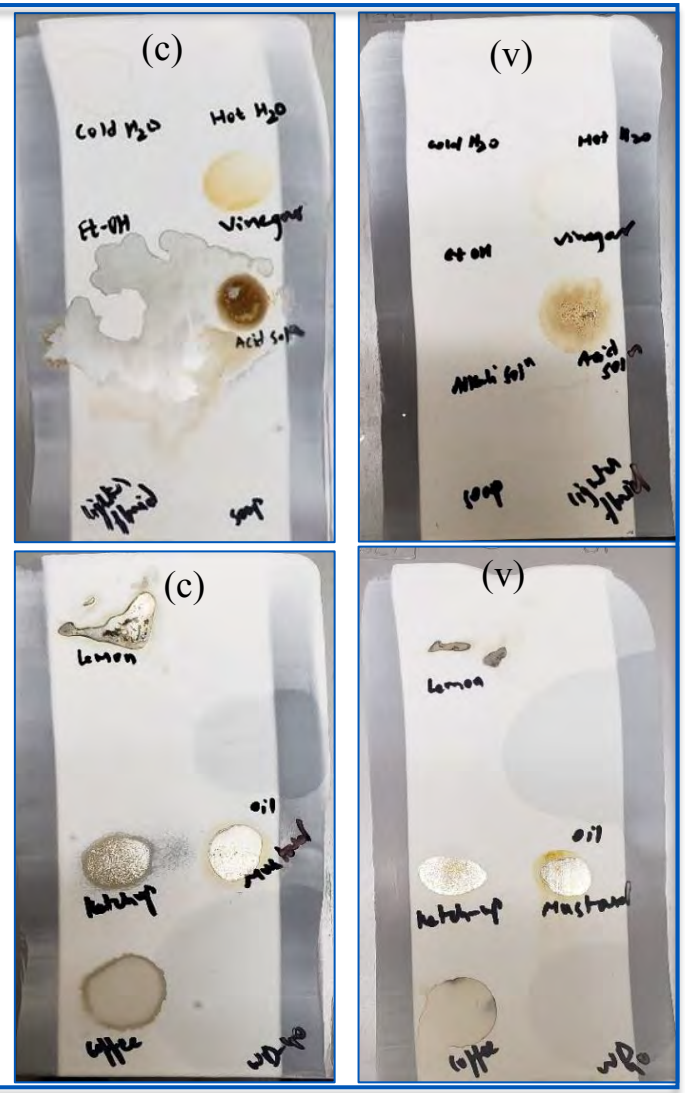
Enhanced resistance to stains in interior wall paint

Households chemicals	Reference formulation	Fibrillated cellulose formulation
Vinegar	✘	●
Alkali solution, 50 wt.% NaOH in water	✘	●
Acid solution, 30 wt.% HNO_3 in water	✘	●
Lemon fruit	✘	●
Ketch-up	✘	●
Coffee	✘	●
Distilled water, cold Distilled water, hot Ethyl alcohol (50% volume) Diluted soap solution Lighter fluid Lemon fruit Vegetable oil Mustard Lubricating fluid (WD-40)		=

*ASTM D1308 Stain Resistance

Formulation with Fibrillated cellulose showed better resistance to household chemicals especially acidic solutions compared to control (Vinegar, nitric/sulfuric acid solution)

Control: (c)
Fibrillated cellulose: (v)



Valida: Typical applications

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Architectural paint

Silicate Paint

Textured Paint

Elastomeric roof coating

Wood Coating

Intumescent Paint

THANK

YOU!

QUESTIONS?

Rheology:

- In-Can stability
- Anti-Sagging
- Sprayability

Surface:

- Contast-Ratio
- No Mud-Cracking
- Anti-Staining

And…

- Reinforcing
- Robust

Thank you!

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