AGRANA STARCH

SURFACTANT THICKENING STUDY with AGENAJEL®

A STUDY CONDUCTED BY AZELIS

AGRANA STARCH

AGRANA – an internationally oriented Austrian company – specialized in processing and adding value to high quality agricultural raw materials such as corn, potatoes and wheat to make a wide range of starch products, tailored to different industrial uses.

The unique and functional starch portfolio from AGRANA gives you the solution to formulate your personal care products.

OVERVIEW AGENAJEL THICKENING STARCHES

	PRODUCT NAME	BONTANICAL ORIGIN	INCI	NATURALITY STATUS
PREGELATINIZED STARCHES (instant thickening in cold water)	**AGENAJEL 20.313** **AGENAJEL 20.306**	maize maize	*hydroxypropyl starch phosphate* *distarch phosphate*	– COSMOS
COOK-UP STARCHES (thickening in hot water)	**AGENAJEL 20.383** **AGENAJEL 20.350**	maize maize	*hydroxypropyl starch phosphate* *distarch phosphate*	– COSMOS

I. OBJECTIVE OF STUDY

Simplistic approach on singular surfactants (no combination studies):
Synthetic thickeners are still used in many surfactant-containing products, such as shampoos and shower gels, to increase viscosity and enhance the micelle stability of surfactants in water. This study aims to investigate the use of starch-based products as a natural "thickener substitute" in surfactant-containing solutions.

SURFACTANTS:
Surfactants are chemical products, with hydrophobic and hydrophilic ends, which decrease the surface tension between two liquids or liquid and a solid. One of the most commonly used products are alkyl ether sulphates. Solutions of such anionic products can be thickened with salt, which promotes viscosity enhancement by increasing micelle concentration, and which deliver clear solutions. But the alkyl ether sulfates are considered as skin irritant and can cause the skin to dry out. This is why alkyl polyglucosides (APGs) and cocoyl glutamates (GLUTAMTES) are preferred used in mild shampoos. Solutions with these surfactants cannot simply be thickened with salt. Due to the naturalness of APGs and GLUTAMATES, it is preferable to thicken and stabilize such solutions with natural products like starch-based thickeners.

SURFACTANTS, USED IN THIS STUDY :

- **SLES**:
  INCI: Aqua, Sodium Laureth Sulphate (SLES)
  Active: 28 %
- **GLUTAMATE**:
  INCI: Aqua, Disodium Cocoyl Glutamate (Glutamate)
  Eversoft UCS-30s
  Active: 30 %
- **APG**:
  INCI: Aqua, Decyl Glucoside (APG)
  Blanova APG 2000
  Active: 50 %

ASSESSMENT OF

- viscosity build
- foam volume and longevity
- foam generation

using different AGENAJEL's in combination with each surfactants (including "Greener options")

STUDY PERIOD NOVEMBER 2018

MATERIAL OVERVIEW

COLD WATER SWELLABLE STARCHES:
This range of starches has been pre-gelatinized, dried, and ground into a fine powder. The material is hydrated in water, stirring intensively for up to 5 minutes to avoid lumping. This will result in viscosity build-up, creating a stable, milky, viscous solution.

AGENAJEL-types used in cold manufacturing process:

- **AGENAJEL 20.313**:
  INCI: Hydroxypropyl starch phosphate
  This type is the preferred thickener in cold water.

- **AGENAJEL 20.306**:
  INCI: Distarch phosphate (COSMOS, NATRUE)
  This type is used in natural formulations.

HOT WATER (COOK-UP STARCHES):
This range of starches is not pre-gelatinized. The material easily hydrates to form a uniform dispersion but will sediment if not heated during the process.

AGENAJEL Type used in hot manufacturing process @ 65°C:

- **AGENAJEL 20.383**:
  INCI: Hydroxypropyl starch phosphate
  Heating is required at 65°C for 5 minutes, or the formula can be adjusted to an alkaline pH during production, allowing lower temperatures (45°C) to achieve the desired properties.

AGENAJEL Type used in hot manufacturing process @ 80°C:

- **AGENAJEL 20.350**:
  INCI: Distarch phosphate (COSMOS)
  AGENAJEL 20.350 is used in natural formulations and requires temperatures of 80°C or higher.

II. STUDY FORMULATION

PHASE	PRODUCT NAME	INCI		% W/W	% W/W	% W/W	SUPPLIER
A	Deionised Water	*Aqua*		To 100,00	To 100,00	To 100,00	
	AGENAJEL-types	***Various***	"VAR 2,5 %" "VAR 5,0 %" "VAR 10 %"	**2,50/ 5,00/ 10,00**	**2,50/ 5,00/ 10,00**	**2,50/ 5,00/ 10,00**	**AGRANA**
	Keltrol CG RD	*Xanthan Gum*	"VAR 2,5 %" "VAR 5,0 %" "VAR 10 %"	0,25/ 0,25/ 0,00	0,25/ 0,25/ 0,00	0,25/ 0,25/ 0,00	CP Kelco
B	SLES 28 %	*Aqua, Sodium Laureth Sulfate*		25,00	0,00	0,00	
	Blanova APG 2000	*Aqua, Decyl Glucoside*		0,00	14,00	0,00	Azelis
	Eversoft UCS-30S	*Aqua, Disodium Cocoyl Glutamate*		0,00	0,00	23,30	Sino Lion
	DMDMH	*DMDM Hydantoin*		0,70	0,70	0,70	Sharon

Remark: Keltrol CG RD was included in variants of AGENAJEL 2,5 % und 5 % to utilise the synergistic effect between starch and XG.

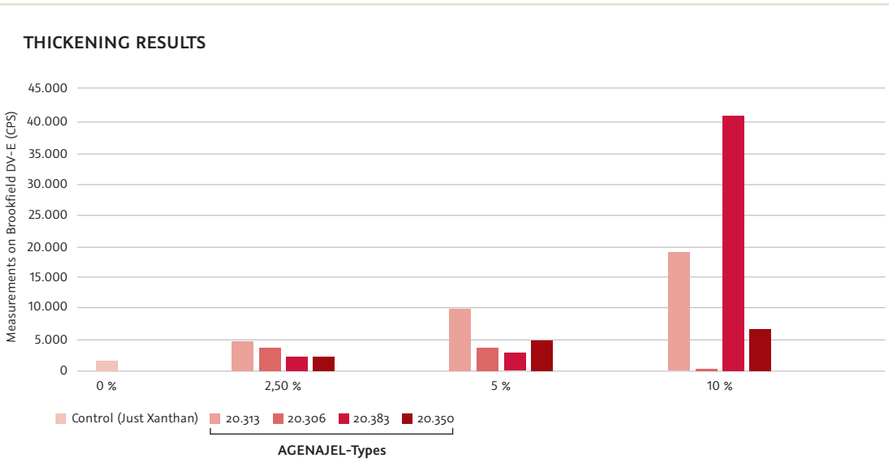
III. OBJECTIVE OF STUDY

VISCOSITY
- SLES
- APG's
- Glutamate

FOAM GENERATION
- SLES
- APG's
- Glutamate

FOAM QUALITY
- Cold Process
- Hot Process

VISCOSITY – SLES

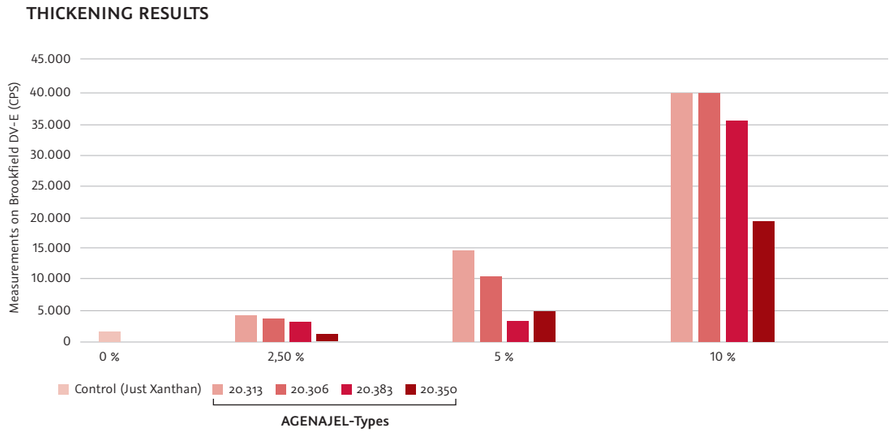


Remark: Xanthan Gum was added to variants 2,5 % and 5 % AGENAJEL's but not to variant 10 %.
Formulation without AGENAJEL and Xanthan gum has a viscosity of 0 cps.

CONCLUSION:

AGENAJEL 20.383, is recommended for SLES systems using a hot manufacturing process.
AGENAJEL 20.313 is recommended for SLES based cold processed formulations.
AGENAJEL 20.306 and AGENAJEL 20.350 show poor thickening effect in solutions with SLES .

VISCOSITY – APG's

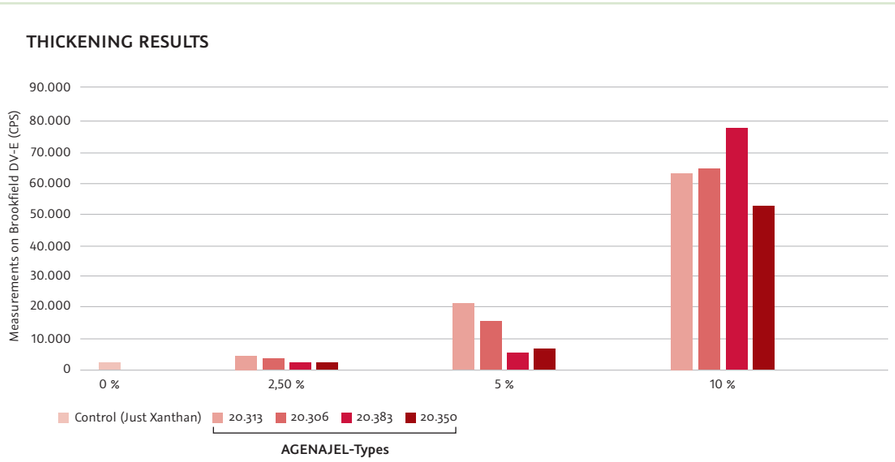


Remark: Xanthan Gum was added to variants 2,5 % and 5 % AGENAJEL's but not to variant 10 %.
Formulation without AGENAJEL and Xanthan gum has a viscosity of 0 cps.

CONCLUSION:

AGENAJEL 20.383, AGENAJEL 20.313 or **AGENAJEL 20.306** give similar viscosity build.
AGENAJEL 20.350 increases viscosity, but other grades are more effective, providing a greater viscosity boost build.

VISCOSITY – GLUTAMATES



Remark: Xanthan Gum was added to variants 2,5 % and 5 % AGENAJEL's but not to variant 10 %.
Formulation without AGENAJEL and Xanthan gum has a viscosity of 0 cps.

CONCLUSION:

AGENAJEL 20.383 gives the highest viscosity build at 10 % inclusion.
AGENAJEL 20.313 or **AGENAJEL 20.306** (cold water) swellable are recommended (best viscosity with variant 5 %).
AGENAJEL 20.350 increases viscosity, but other grades are more effective, providing a greater viscosity boost.

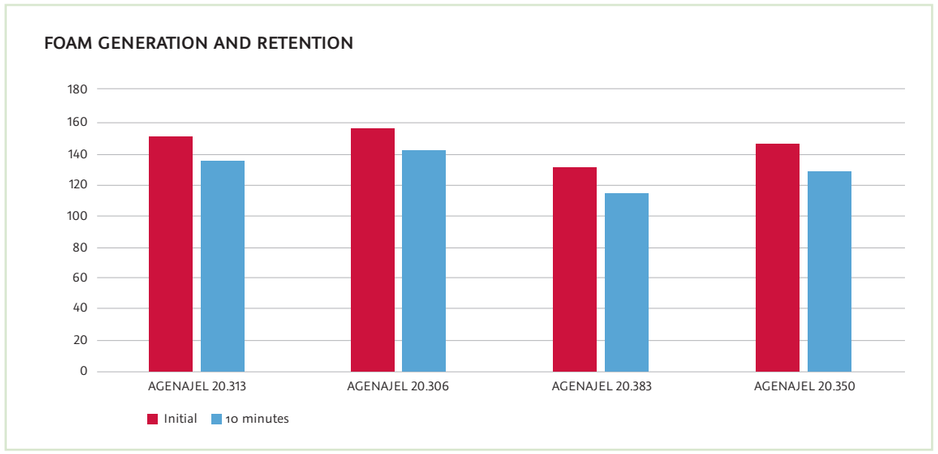
FOAM GENERATION – METHODOLOGY

- **SOLUTION**
  - 1 gr of product
  - 100 ml of water
  - Use 250 ml graduated cylinder
- **Invert 10 times**
- **Timings for measurements/observations**
  - Initial
  - 10 minutes
- **Measure**
  - Water level
  - Foam level

FOAM GENERATION – SLES

- **"Variant 5 % AGENAJEL"** in each simple formulation

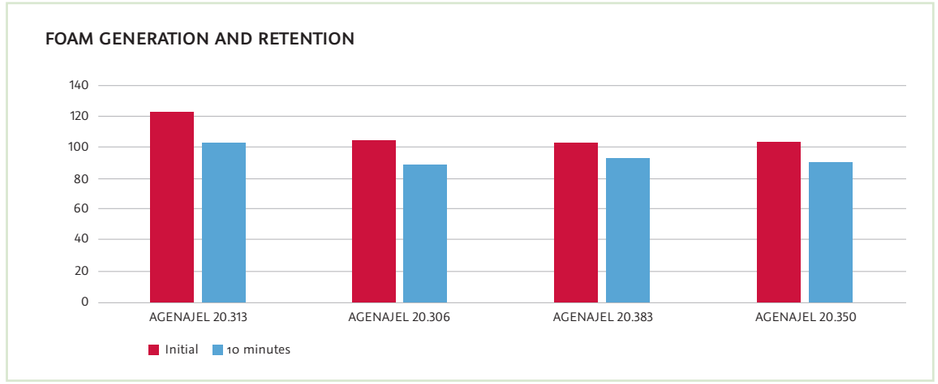
- **COLD PROCESS** – AGENAJEL 20.313 & AGENAJEL 20.306
- **HOT PROCESS** – AGENAJEL 20.383 & AGENAJEL 20.350



FOAM GENERATION – APG's

- **"Variant 5 % AGENAJEL"** in each simple formulation

- **COLD PROCESS** – AGENAJEL 20.313 & AGENAJEL 20.306
- **HOT PROCESS** – AGENAJEL 20.383 & AGENAJEL 20.350

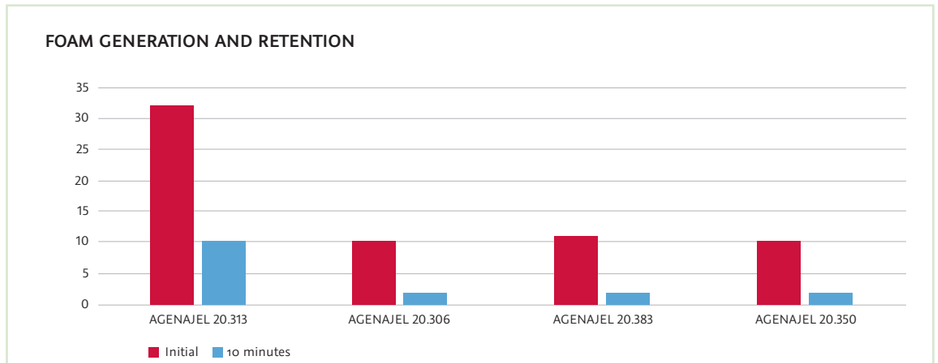


"Variant 5 % AGENAJEL 20.313" performes best for foam generation and retention.

FOAM GENERATION – GLUTAMATE

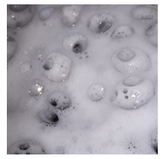
- **"Variant 5 % AGENAJEL"** in each simple formulation

- **COLD PROCESS** – AGENAJEL 20.313 & AGENAJEL 20.306
- **HOT PROCESS** – AGENAJEL 20.383 & AGENAJEL 20.350

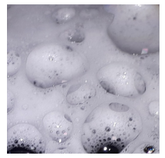


"Variant 5 % AGENAJEL 20.313" performes best for foam generation and retention.

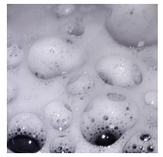
FOAM QUALITY – COLD PROCESS



SLES
AGENAJEL 20.313
Large loose foam bubble

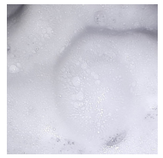


SLES
AGENAJEL 20.306
Large and loose foam



APG
AGENAJEL 20.313
Large loose foam

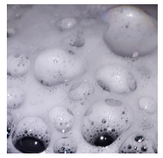
APG
AGENAJEL 20.306
Large and small combination foam



GLUTAMATE
AGENAJEL 20.313
Small dense foam

GLUTAMATE
AGENAJEL 20.306
Small dense foam

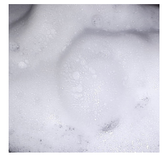
FOAM QUALITY – HOT PROCESS



SLES
AGENAJEL 20.383
Large loose foam bubble

SLES
AGENAJEL 20.350
Tighter richer foam

APG
AGENAJEL 20.383
Small tight dense foam



APG
AGENAJEL 20.350
Rich creamy foam

GLUTAMATE
AGENAJEL 20.383
Small dense foam

GLUTAMATE
AGENAJEL 20.350
Small dense foam

CONCLUSION

PROCESS	PRODUCT NAME	SLES			APG's			GLUTAMATE		
		VISCOSITY BUILT UP	FOAM DENSE	FOAM LONGEVITY	VISCOSITY BUILT UP	FOAM DENSE	FOAM LONGEVITY	VISCOSITY BUILT UP	FOAM DENSE	FOAM LONGEVITY
COLD PROCESS	**AGENAJEL 20.313**	↑↑↑	↑	↑↑	↑↑↑	↑	↑↑	↑↑↑	↑↑↑	↑↑
	AGENAJEL 20.306	↑	↑	↑↑	↑↑↑	↑↑	↑↑	↑↑↑	↑↑↑	↑
HOT PROCESS	**AGENAJEL 20.383**	↑↑↑	↑	↑↑	↑↑↑	↑↑↑	↑↑↑	↑↑↑	↑↑↑	↑
	AGENAJEL 20.350	↑↑	↑↑↑	↑↑	↑↑	↑↑↑↑	↑↑↑↑	↑↑	↑↑↑	↑

AGENAJEL's show the best thickening effect in GLUTAMATE-based shampoos, followed by shampoos with APGs and SLES.

AGENAJEL 20.313 achieves the highest viscosities for all surfactant variants at application levels of 2.5% and 5% (each in combination with 0.25% XG). AGENAJEL 20.383 (hot process) demonstrates better thickening performance only in the 10% variants containing SLES and GLUTAMATE.

For conventional shampoos, **AGENAJEL** 20.313 is therefore the top recommendation.

For mild shampoos suitable for natural cosmetics, especially those with GLUTAMATES and APGs, **AGENAJEL** 20.306 is the best thickening option. It can certainly compete with **AGENAJEL** 20.313 in terms of enhancing consistency.

If a denser foam is required, **AGENAJEL** 20.350 is recommended.

agrana.com

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