

PRACTICAL GUIDELINES TO INUTEC SP1

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1. GENERAL INFORMATION

1.1. Short Overview

INCI:	Inulin Lauryl Carbamate
HLB:	8
Type	Non ionic Polymeric
Emulsion type	O/W and Si/W
Special emulsions	Nano emulsions Multiple emulsions W/O/W and O/W/O

1.2. Obtained viscosity:

Low viscosity			High viscosity		
Tissue Impregnation	Sprayable emulsion	Milk	Lotion	Cream	Butter

Possible
Possible, but difficult
Impossible

1.3. Solubility

Water	< 1g/l
Mineral oil	Dispersable
Vegetable oils	Dispersable
Synthetic oils	Dispersable
Silicone oils	Dispersable
Essential oils	Dispersable

1.4. Dosage

Inutec SP1 has to be used at 0,5% until 2% calculated on the amount of oil phase. The oil phase is the oils, fatty alcohols, perfume,...

Tabel 1 shows the range for each amount of oil phase

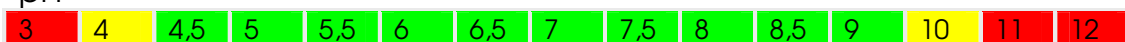
% Oil phase	INUTEC SP1 %	
	Min%	Max%
5	0,05	0,1
10	0,05	0,2
15	0,08	0,3
20	0,1	0,4
25	0,13	0,5
30	0,15	0,6
40	0,2	0,8
50	0,25	1,0
60	0,3	1,2

Tabel1: % of Inutec SP1 in function of the oil phase

1.5. Compatibility with ingredients

Oil components			
Mineral Oils		Silicones:	
Petrolatum		Dimethicone	
Isododecane		Volatile silicones	
Isohexadecane		Silicone polymers	
Polydecene		Phenyl trimethicone	
Esters		Essential oils	
Vegetable oils		Sunscreens	
Jobba oil		Vegetable butters	
Waxes		Fatty acids	
Fatty Alcohols			
Surfactants			
Anionic		Cationic	
Amphoteric		Non ionic	
Thickeners/Colloids			
Carbomer		HEC	
Acrylates		HPMC	
Xanthan gum		Sclerotum gum	
CMC		Microcrystalline Cellulose	
Carrageenan		Pectine	
Guar Gum		Starches	
Preservatives			
Parabens		Phenoxyethanol	
Benzyl alcohol		Phenylethyl alcohol	
Sodium benzoate		Potassium sorbate	
Imidazolidinyl urea		Diazolidinyl urea	
DMDM Hydantoin		Chloorhexidine digluconate	
Ethylhexylglycerin		other	
Humectants			
Glycerin		Propylene Glycol	
Butylene glycol		Pentylene Glycol	
MP Diol		PEG-8	
Caprylyl Glycol		Sorbitol	
Electrolytes			
+ (Na, K, NH ₄)	<25%	++ (Mg, Ca, Zn)	<20%
+++ (Al, Zr)	<20%		
Solids			
Scrubs		ZnO	
TiO ₂		Fe-oxides	
Pearlizing pigments		Starches	
Others			
H ₂ O ₂		Thioglycolates	
Alcohol	<8%	Urea	
PVP		Other styling polymers	
DHA			

pH



2. GENERAL REQUIREMENTS FOR STABILITY

2.1. To avoid oil separation

2.1.1) Combination with a co emulsifier

A small amount (0,1-0,3%) of a co emulsifier (=emulsifier having an HLB of 3 -17) is recommended. The type of co emulsifier influences the final viscosity and the final skin feel. Commonly used types are: GMS, GMS-SE, Polysorbate, Sorbitan Stearate, Sucro Stearate, Sucrose Laurate, Cetearyl Glucoside, Ceteareth, Steareth,...

The co emulsifier can be added to the oil phase or to the water phase

The addition of a co emulsifier influences also on the viscosity (see also further "viscosity build up")

2.1.2) Combination with a fatty alcohol

A small amount (0,5 -1%) of a fatty alcohol is needed. The best stability is obtained with Cetearyl alcohol (50/50), but also Cetyl alcohol, Stearyl alcohol and Behenyl alcohol can be used for this purpose.

The addition of a fatty alcohol has also an influence on the final viscosity (see also further "viscosity build up")

When no co emulsifier nor fatty alcohol is used, the homogenisation step becomes critical and the formula becomes difficult to scale up from labo to production scale.

2.2. To avoid creaming

To avoid creaming Inutec SP1 has to be combined with a colloid. In Tabel2 an overview of different colloids is mentioned.

Description	Trade Name	Compatible with:				
		Cationic	Anionic	Electrolytes		
				+	++	+++
Carbomer	Carbopol					
Acrylate Copolymer	Sepigel Ultrez Aristoflex Aculyn					
Xanthan gum	Keltrol Rodicare					
Hydroxyethylcellulose	Cellosize Natrulol					
Hydroxypropylmethyl cellulose	Methocel Walocel					
Carboxymethyl cellulose						
MgAlSi	Veegum					
Microcristaline cellulose	Avicel					
Guar	Jaguar HP105					
Hydroxypropyltrimonium Chloride						
Gellan Gum	Kelcogel CG-HA					

Table 2: overview of the most commonly used colloids

Colloids that can be used alone:

Xanthan gum, Gellan Gum, Guar gum, HPMC, Carbomer and Acrylate crosspolymers can be used alone.

Colloids that have to be combined with others:

HEC, Microcristalline cellulose, Veegum always have to be combined with a second colloid such as Xanthan gum or Carbomer.

Generally it is better to combine 2 colloids in order to increase the stability, to improve the skin feel and to minimize the concentration of colloid.
In table 3 an indication of the concentration for Xanthan gum is given that can stabilize on it's own:

% Oil phase	%Xanhan gum
10	0,35 – 0,5
20	0,3 – 0,4
30	0,2 – 0,3
40	0,1 – 0,2
50	0,07-0,1

Tabel3: Concentration of xanthan Gum in function with the amount of oil phase

The general rule is that the concentration of the colloid decreases with increasing % of oil phase%.

Following actions decrease also creaming:

- The addition of a co emulsifier
- The addition of Cetearyl alcohol
- The addition of Glyceryl Stearate
- The combination of fatty alcohol, glyceryl stearate and a co emulsifier.

These last 4 actions alone can not avoid creaming, they only support the creaming problem. The addition of a colloid is always necessary.

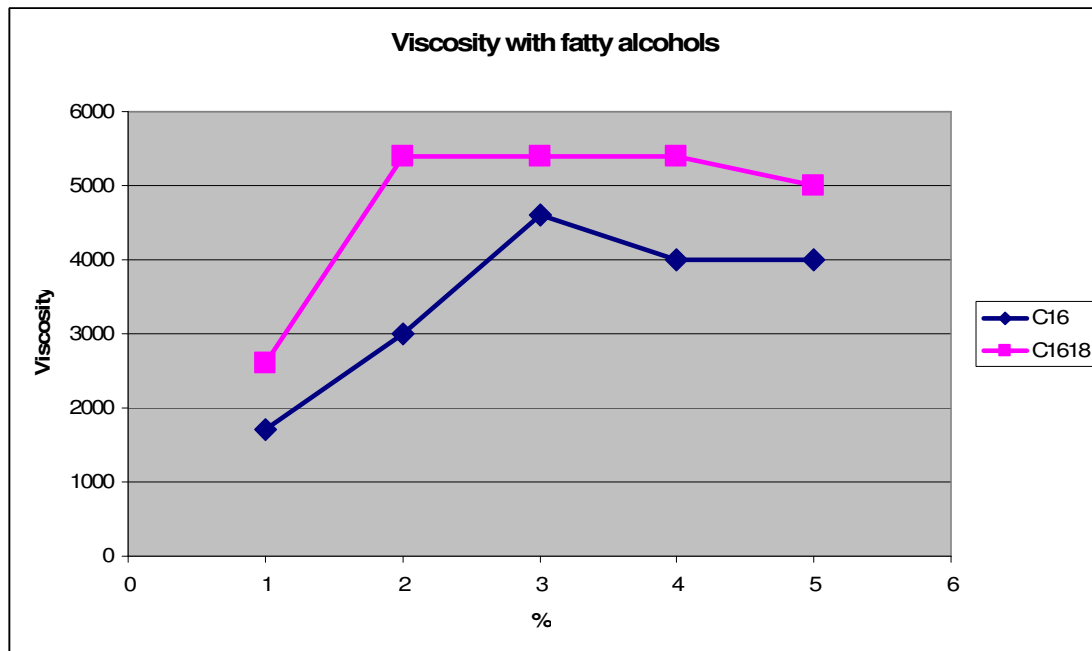
Remark:

The addition of Carbomer (>1%), Ultrez-10, 20, 21(>0,5%) in too high quantity can lead to blubber emulsions

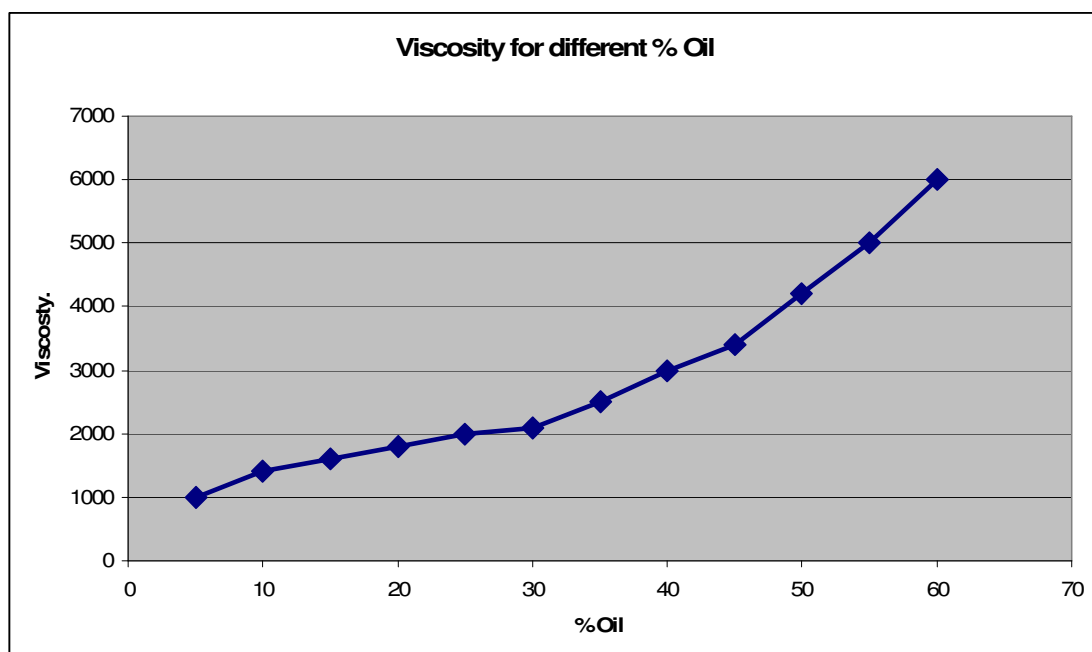
3. GENERAL REQUIREMENTS FOR VISCOSITY BUILD UP

3.1) Viscosity increasing ingredients:

- Cetyl Alcohol (1-5%)
- Stearyl Alcohol (1-5%)
- Cetearyl Alcohol (1-4%)
- Behenyl Alcohol (1-5%)
- Glyceryl Stearate (1-4%)
- Stearic Acid. (1-5%)



3.2) Increasing the oil phase



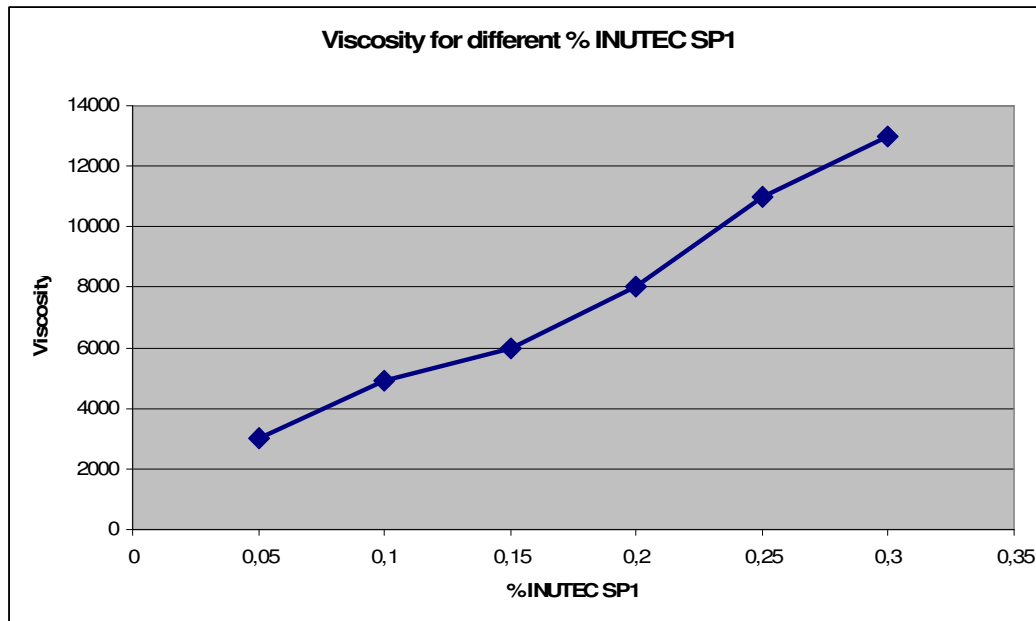
3.3) Increase the viscosity of the oil phase

by using more viscous oils or by the addition of butters or waxes:

- Shea butter
- Hydrogenated oils
- Carnauba wax
- Beeswax
- Petrolatum

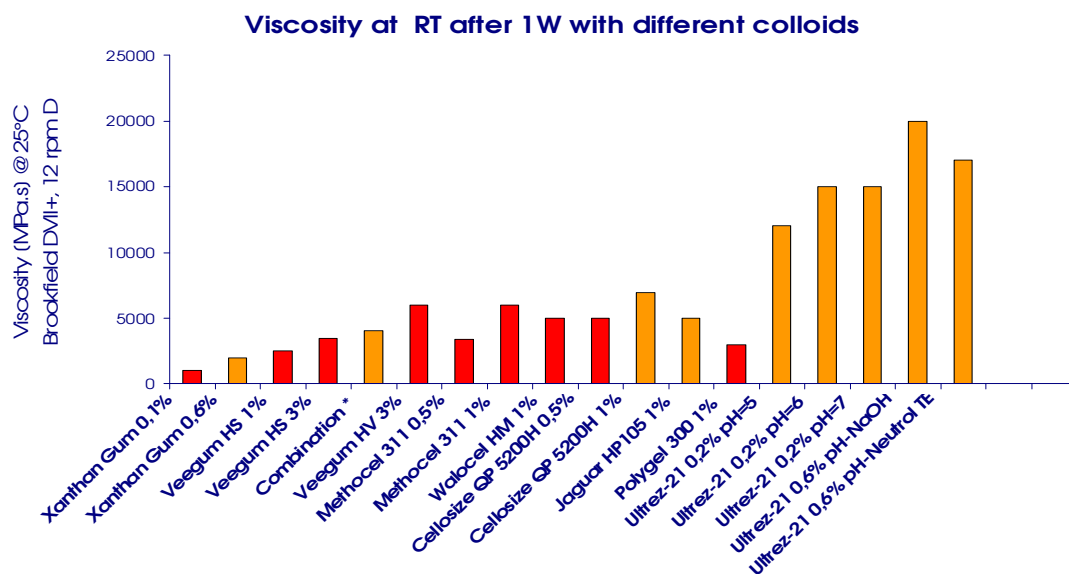
3.4) Increasing the amount of Inutec SP1

(in combination with a fatty alcohol, preferably Cetearyl alcohol and a co emulsifier)

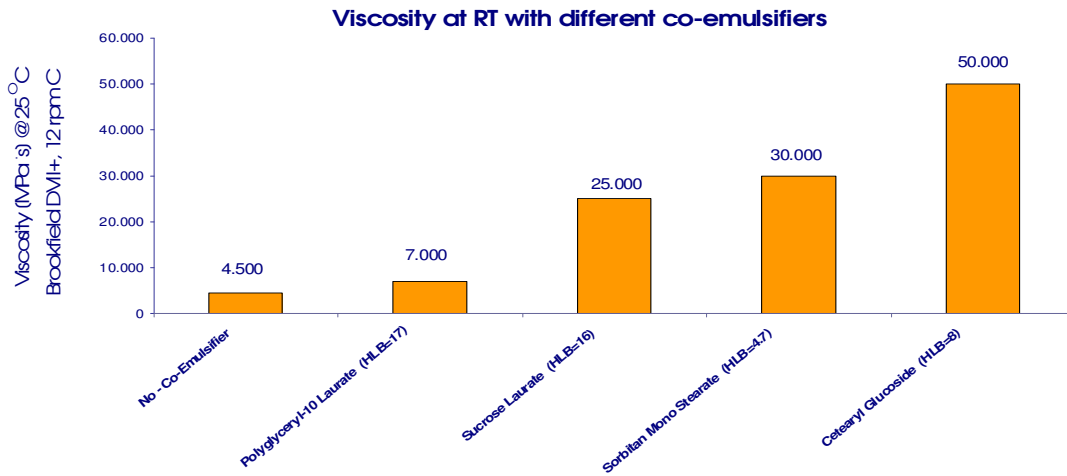


3.5) Increasing the viscosity of the water phase

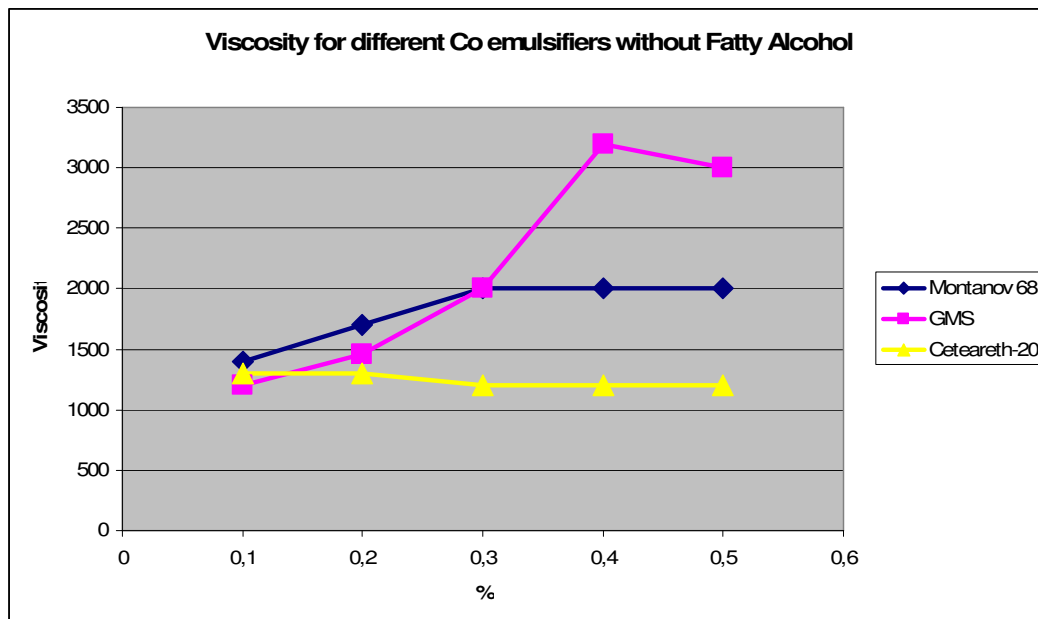
by adding a colloid. The addition of Carbomer (>1%), Ultrez-10, 20, 21 (>0,5%) in too high quantity can lead to blubber emulsions



3.6) Change the type of co emulsifier



3.7) Increase the amount of co emulsifier



4. PROCEDURES TO MAKE EMULSION

4.1. Procedure Cold process

The cold process is only possible in case all ingredients are liquid

Procedure:

- 1) Add Inutec SP1 into the oil phase, which contains already the perfume
- 2) Disperse gently Inutec SP1 into the oil phase. Inutec SP1 does not dissolve in the oil
- 3) Add colloids to the water phase
- 4) Add the co emulsifier into the appropriate phase (see list). The co emulsifier has to be liquid or water soluble. Suitable co emulsifiers are mentioned in table 4:
- 5)

Sorbitan Laurate	Sucrose Laurate (HLB 16)	Polyglyceryl-10 Laurate
Sorbitan Isostearate	Polysorbate-20	Polyglyceryl-3 Ricinoleate
Sorbitan Oleate	Polysorbate-80	PEG-40 Hydrogenated Castor Oil

Table4: Suitable co emulsifiers for cold process

- 6) Add the oil phase to the water phase. The speed of addition is of no importance
- 7) Homogenise. Avoid entrapping of air.
- 8) The emulsion becomes very white. The homogenisation can be stopped when the area around the homogeniser has the same white colour as the area further away from the homogeniser
- 9) Mix still for a while to allow the air go out. Mix gently.
- 10) The emulsion can be conditioned

Discussion:

The skin feel is very light.

The skin feel is determined by the type of colloid used.

The skin feel is determined by the type of co emulsifier used.

The skin feel is determined by the amount of Inutec SP1 used. Increasing amount of Inutec SP1 leads to lighter emulsions.

Whitening on the skin does not appear.

The final viscosity is reached immediately

The final viscosity is determined by the type and amount of colloid.

Remark:

It is important that the perfume is added at the beginning with the other oils.

In case perfume would be added after homogenising, there is a risk that perfume comes out of the formula after some days at higher temperature.

In case perfume is added at the end, it is recommended to homogenise briefly afterwards.

4.2. Procedure Warm Process

This way of working can be used in any case.

Procedure:

- 1) Heat up the oil phase until all the solids are melted.
- 2) Add Inutec SP1 to the hot oil phase. Do this just before emulsification. Inutec SP1 can be heated together with oil, but there's a risk to overheat Inutec SP1. This can lead to browning of the Inutec SP1 and the formation of non soluble lumps.
- 3) Disperse the colloids into the water phase and add other water soluble ingredients.
- 4) Heat the water phase to the same temperature (+/- 5°C)
- 5) Add the oil phase to the water phase
- 6) Homogenise. Avoid entrapping air.
- 7) The emulsion becomes very white. The homogenisation can be stop when the area around the homogeniser has the same white colour as the area further away from the homogeniser
- 8) Allow to cool down, while mixing gently.
- 9) It can be beneficial to homogenise briefly at 45°C in case fatty alcohols are used.
- 10) Add the heat sensitive ingredients at 30°C or lower. It can be beneficial to homogenise briefly
- 11) The emulsion can be conditioned.

Discussion

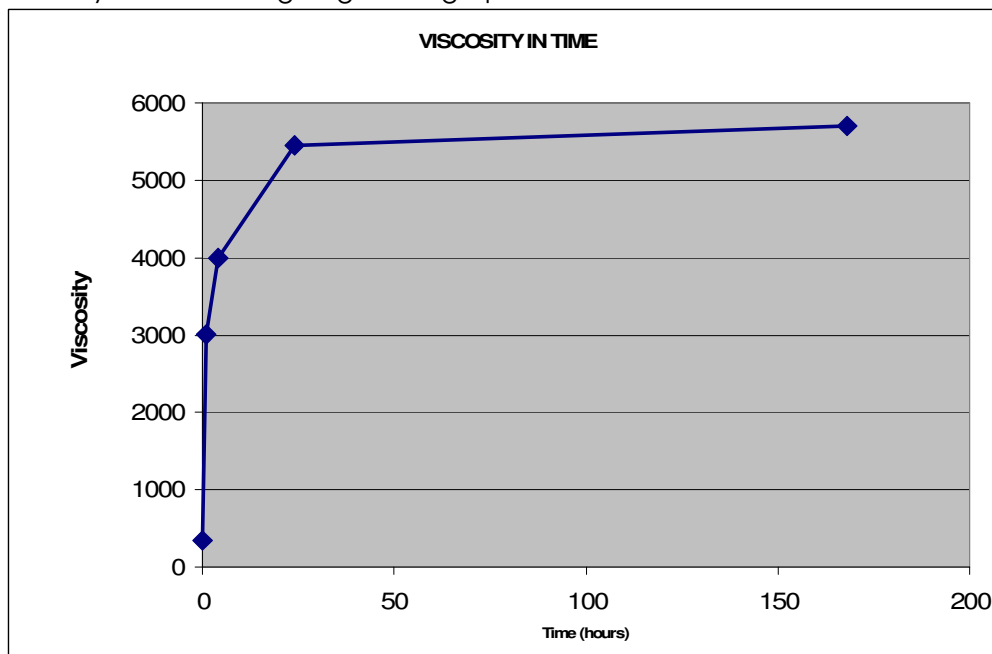
The skins feel is determined by the choice of co emulsifier

The skins feel is determined by the choice of fatty alcohol

The skins feel is determined by the amount of fatty alcohol

The viscosity is not build up immediately. During mixing the emulsion can stay liquid.

After the mixing is stopped the emulsion starts to build up it's viscosity. A typical viscosity behaviour is giving in the graph below:



4.3. Special Procedures

4.3.1. Indirect Process

With Inutec SP1 it is perfectly possible to add the water phase into the oil phase.

4.3.2. Sprayable emulsions

The procedure to produce a spray able emulsion is in fact the same as the general procedure. However creaming can occur at 40°C. In that case following actions can help:

- Use of Gellan Gum
- Use of the combination Xanthan Gum + Veegum HS
- Use of the combination Xanthan Gum + Laracare
- Use of the combination of Veegum HS + Laracare
- Use of the combination of Veegum HS + Xanthan Gum + Laracare
- The addition of Cetearyl Alcohol in a concentration <1,8%
- The addition of Glyceryl stearate in a concentration < 0,5%

4.3.3. Working with DHA (Sunless tan)

The procedure to produce a spray able emulsion is in fact the same as the general procedure. However DHA requires a pH of 4,5. This is possible with Inutec SP1, but this pH is on the borderline for Inutec SP1. It is recommended to use a buffer that assures a stable pH for a longer time.

4.3.4. Working with Alcohol

Alcohol can cause oil separation. The amount of alcohol can not be higher than 8% to the water phase. The allowed amount of alcohol decreases with increasing amount of oil phase.

% Oil phase	Max% Alcohol
5	8
10	7
15	7
20	6,5
25	6
30	5,5
40	5
50	4,5
60	4

Tabel5: Maximum amount of Alcohol in function of the % oil phase

4.3.5. Working with disturbing ingredients

Disturbing ingredients are:

- Ethylhexyl Glycerin (Sensiva SC50)
- Polyglyceryl-3 Caprylate.

They can disturb the emulsifier film. In this case they have to be added at the very end and below 30°C. After they have been added, the mixing has to be gentle and short

4.3.6. Working with sunscreens

Sunscreens are mainly oil soluble, but have a different chemical structure. This can cause oil separation. The following can be done to avoid oil separation:

- 1) Always add 2% Inutec SP1 to the oil phase
- 2) Addition of a coupling agent (such as PPG-15 Stearyl Ether)
- 3) Addition of a second co emulsifier with different HLB. Following combinations are recommended:

Steareth-2 (0,2-0,5%) +	Sucroselaurate HLB 16 (0,2-0,5%) +	Ceteareth-2 (0,1-0,3%) +
Steareth-21 (0,5-0,2%)	Sucrose Laurate HLB 6 (0,5-0,2%)	Ceteareth-20 (0,3-0,1%)

- 4) Always add minimum 1% fatty alcohol
- 5) Do not use Ethylhexylglycerine nor alcohol

4.3.7. Working with surfactants (foaming emulsions, shower creams,...)

In order to make foaming emulsions, surfactants need to be added to the emulsion. All surfactants (Amphoteric, Anionic, Cationic or Non ionic) can be used with Inutec SP1. For foaming emulsions the following can be applied:

- 1) No co emulsifier is needed
- 2) The amount of inutec SP1 is 1 to 2% to the oil phase
- 3) All oils even silicones, butters, waxes can be emulsified without affecting the foam quality.
- 4) Inutec SP1 has a foam boosting effect when following surfactants are use:
 - SLS
 - Sodium Lauroyl Sarcosinate
 - Sodium Cocoyl Glutamate
- 5) A classification of foam quantity in combination with Inutec SP1 is as follow (from highest foam quality to lowest):
 - Primary Surfactants:
 - 1° Sodium Lauroyl Sarcosinate
 - 2° Sodium Lauryl Sulfate
 - 3° Ammonium Lauryl Sulfate
 - 4° Sodium C14-16 Olefin Sulfonate
 - 4° SLES
 - Secondary Surfactants
 - 1°Cocamidopropyl hydroxysultaine
 - 2°CAPB
- 6) The best combination to avoid creaming is
 - 1° Xanthan Gum(>0,3%) + Carbopol ETD2020 (>0,4%)
 - 2° Xathan Gum(>0,3%) + Ultrez-20 (>0,4%)
 - 3° HEC (>0,7%) + Jaguar HP105(>0,7%)
- 7) Good foamboosters are:
 - 1° Kiosmetine S1000 at pH 6-6,5
 - 2° PEG-12 Dimethicone
 - 3° Hydroxypropylmethyl cellulose
 - 4° Cocamide MEA

General procedure

- 1° Mix inutec SP1 with the oils+ perfume
- 2° Add colloids (xanthan Gum, etc..) to the water phase
- 3° When the colloids are fully dispersed add the remaining ingredients
- 3° Add Oil+Inutec SP1 to the waterphase and homogenise
- 4° Add the surfactants
- 6°Adjust the pH
- 7° Do not add salt to thicken the showergel or shampoo. This might affect the colloids. Creaming will occur.