

TX-85

SCCS\* TiO<sub>2</sub>



\*SCCS: Scientific Committee on Consumer Safety,  
Opinion on Titanium Dioxide(nano form) COLIPA n° S75

# SCCS\* conformity summary for TiO<sub>2</sub>

- Purity >99%, Anatase <5%
- Median primary particle size 30~100nm by number based size distribution
- Aspect ratio <4.5
- Volume specific surface area <460m<sup>2</sup>/cm<sup>3</sup>
- Photo-stable
- Approved coating ingredients\*\*

Inorganic	Organic
Silica	Aluminium stearate
Alumina	Stearate
Hydrated silica	Trimethoxycaprylylsilane
Aluminium hydroxide	Glycerin
	Stearic acid
	Dimethicone
	Dimethicone/methicone copolymer
	Simethicone

\* [http://ec.europa.eu/health/scientific\\_committees/consumer\\_safety/docs/sccs\\_o\\_136.pdf](http://ec.europa.eu/health/scientific_committees/consumer_safety/docs/sccs_o_136.pdf)

\*\* page 8, Table 1

# TX-85 series

## SCCS TiO<sub>2</sub>

### **TX-85**

#### Composition

TiO <sub>2</sub>	85%
SiO <sub>2</sub>	10%
Dimethicone	5%

Particle Size: 30nm  
Aspect Ratio: 1.4

### **TX-85AQ**

#### Composition

TiO <sub>2</sub>	90%
SiO <sub>2</sub>	10%

Particle Size: 30nm  
Aspect Ratio: 1.4

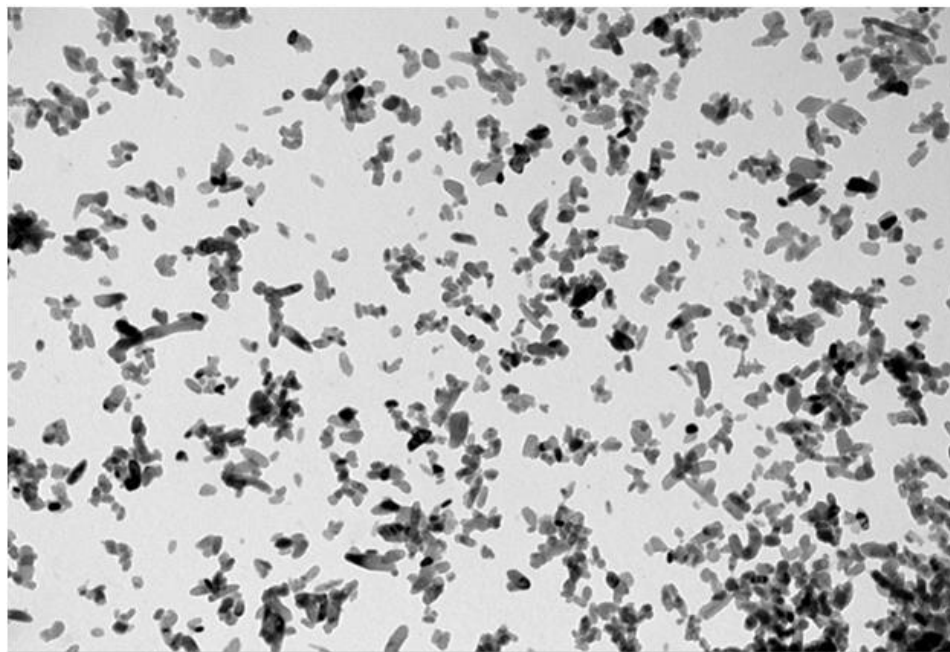
## ECOCERT TiO<sub>2</sub>

### **TX-85SA**

#### Composition

TiO <sub>2</sub>	80%
SiO <sub>2</sub>	10%
Stearic Acid	10%

Particle Size: 30nm  
Aspect Ratio: 1.4



500 nm

# Benefit #1



- 1. High SPF**
- 2. Can provide Low Viscosity & Good re-dispersibility especially when to make High SPF Sun Spray**
- 3. In combination with Avobenzone (BMDBM) i.e. Alumina Free**

# SPF test(in vitro)

## Tested TiO<sub>2</sub>

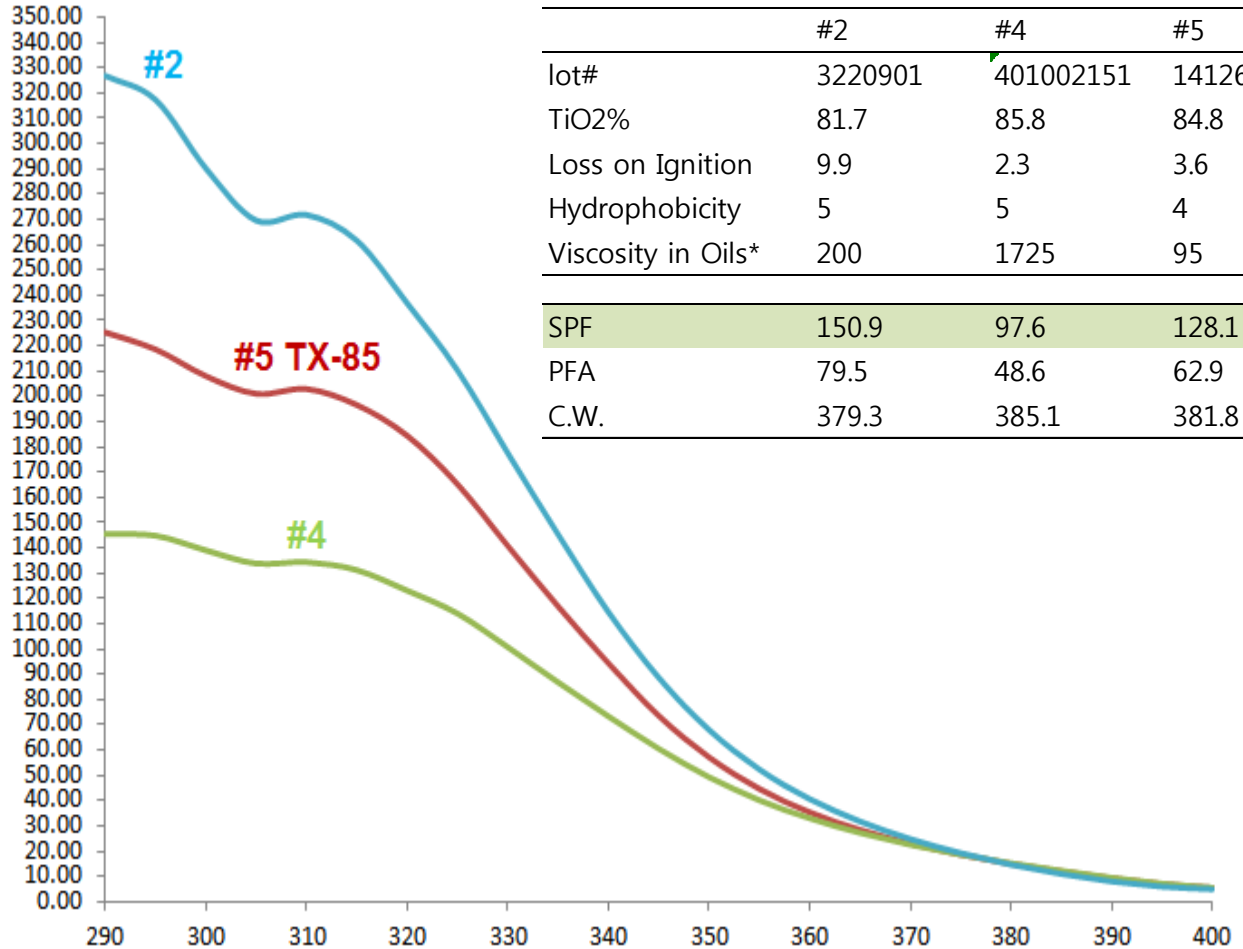
#1:  
Company "I"  
Product "M"  
TiO<sub>2</sub>, Alumina, Stearic Acid,  
Dimethicone

#2  
Company "T"  
Product "M"  
TiO<sub>2</sub>, Alumina, Stearic Acid

#3  
Company "S"  
Product "M"  
TiO<sub>2</sub>, Silica, Methicone

#4  
Company "D"  
Product "P"  
TiO<sub>2</sub>, Silica, Dimethicone

#5  
Company: **SUNJIN**  
Product: **TiO<sub>2</sub>, Silica,**  
**Dimethicone**



	#2	#4	#5
lot#	3220901	401002151	14126002
TiO <sub>2</sub> %	81.7	85.8	84.8
Loss on Ignition	9.9	2.3	3.6
Hydrophobicity	5	5	4
Viscosity in Oils*	200	1725	95
SPF	150.9	97.6	128.1
PFA	79.5	48.6	62.9
C.W.	379.3	385.1	381.8

\*Oils = Cetiol 1.5: D5 1.5 : TiO<sub>2</sub> 1

## Benefit #2



1. High SPF
2. Can provide **Low Viscosity & Good re-dispersibility** especially when to make High SPF Sun Spray
3. In combination with Avobenzone (BMDBM) i.e. Alumina Free

# Dispersibility Test of 5 different kinds of $\text{TiO}_2$ in Oils

## Tested $\text{TiO}_2$


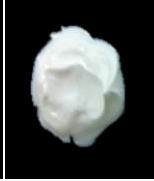
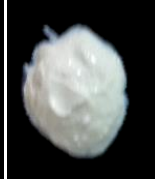





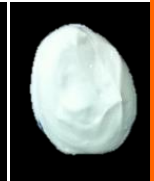

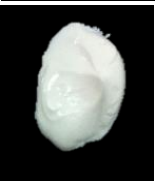

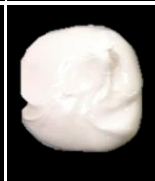



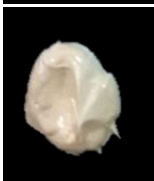

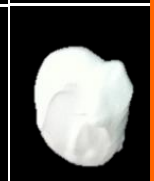


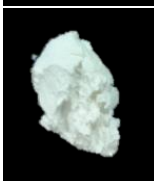




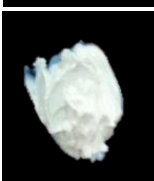

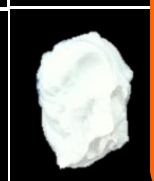

#1:  
Company "I"  
Product "M"  
 $\text{TiO}_2$ , Alumina, Stearic Acid,  
Dimethicone

#2  
Company "T"  
Product "M"  
 $\text{TiO}_2$ , Alumina, Stearic Acid

#3  
Company "S"  
Product "M"  
 $\text{TiO}_2$ , Silica, Methicone

#4  
Company "D"  
Product "P"  
 $\text{TiO}_2$ , Silica, Dimethicone

**#5**  
**Company: SUNJIN**  
**Product:  $\text{TiO}_2$ , Silica,**  
**Dimethicone**

	<u>#1</u>	<u>#2</u>	<u>#3</u>	<u>#4</u>	<u>#5</u> TX-85	
						C12-15 Alkyl Benzoate
						Dicaprylyl Carbonate
						Caprylic/Capric Triglyceride
						Sun Flower Oil
						Cyclomethicone
						Liquid Paraffin



# Re-Dispersibility Test

## Tested TiO<sub>2</sub>

#1:

Company "I"  
Product "M"  
TiO<sub>2</sub>, Alumina, Stearic Acid,  
Dimethicone

#2

Company "T"  
Product "M"  
TiO<sub>2</sub>, Alumina, Stearic Acid

#3

Company "S"  
Product "M"  
TiO<sub>2</sub>, Silica, Methicone

#4

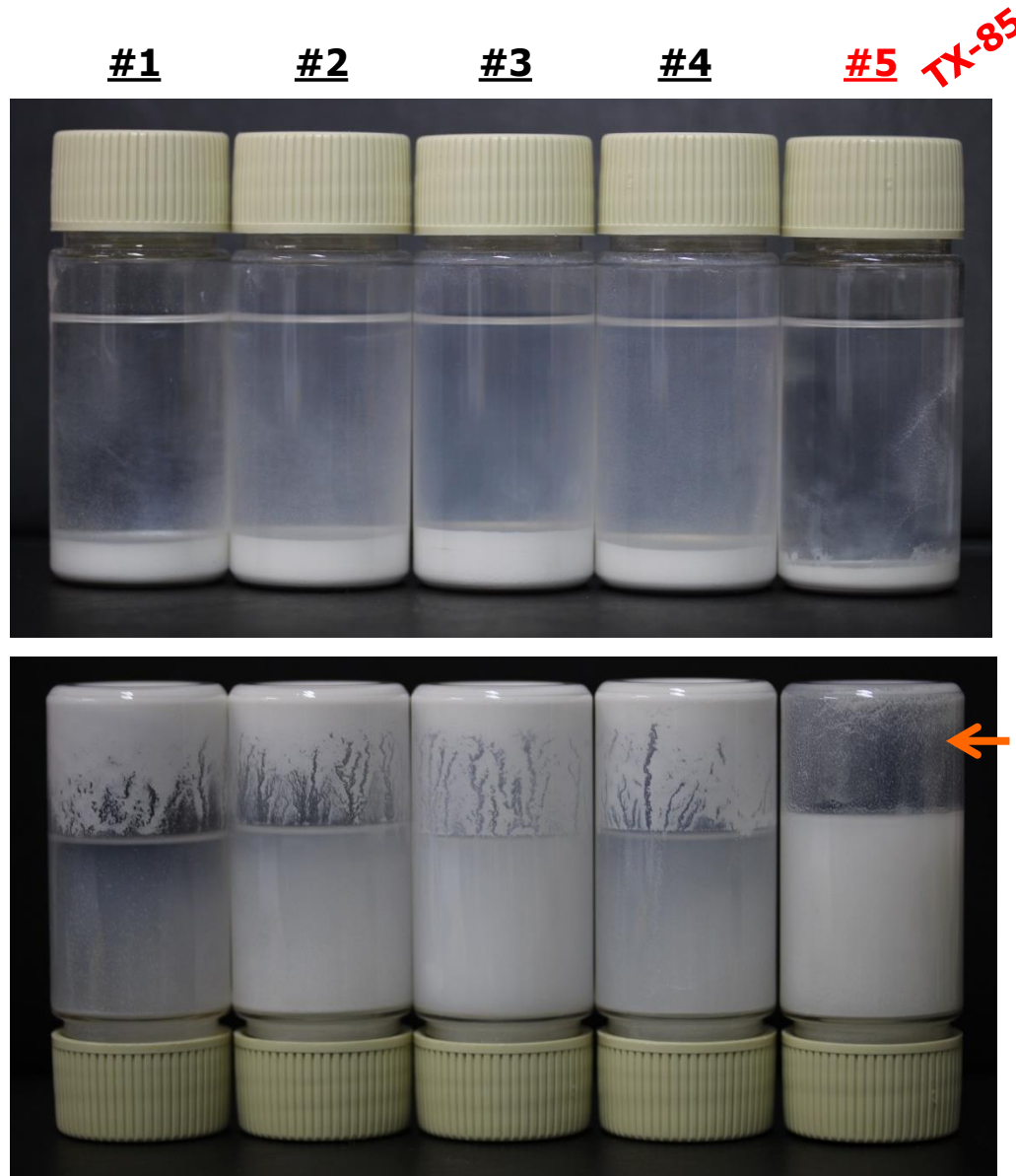
Company "D"  
Product "P"  
TiO<sub>2</sub>, Silica, Dimethicone

**#5**

**Company: SUNJIN**  
**Product: TiO<sub>2</sub>, Silica,**  
**Dimethicone**

### Test condition

*Powder 1g , Cyclomethicone (D5) 30g  
2 Days Later, Upside down test*





# Key Challenges to make SPF 50 Sun Spray

## SPF50 Sun Spray



## Key Challenges

- It's easy to make SPF30 sun spray only with chemical UV filters
- But to make SPF50 sun spray,  $\text{TiO}_2$  & Zinc Oxide should be used
- However, when it comes to use  $\text{TiO}_2$  in sun spray, there are usually some concerns about the possible clogging of spray nozzle caused by aggregation or settlement of  $\text{TiO}_2$
- Also the low viscosity of sun spray formula should be maintained over storage to spray well
- **The media dispersibility of  $\text{TiO}_2$  matters a lot.**

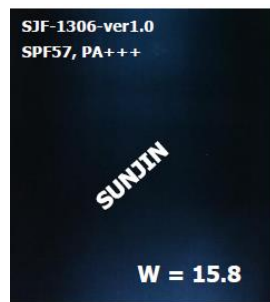
# TX 85, ideal micronized TiO<sub>2</sub> for Sun Spray SPF50 PA+++

## SJF-1306-W/S Sun Spray SPF50+, PA+++-ver1.0

New in 2014

Evaluation	
SPF	57
PA	+++ (8.7)
SPF/UVA	n.a.
Critical Wavelength	n.a.
White Index	<b>15.8</b>
Sensory Index	n.a.

Extremely transparent formula for SPF50 PA+++



Part	Product Name	ICID Name	%
A	DC200/0.65cs	Disiloxane	25.00
	SUNCLEAR Z60-CO	ZnO & Hydrogen Dimethicone & PEG-9 polydimethyl siloxyethyl dimethicone	15.00
	TX-85	TiO <sub>2</sub> & Silica & Dimethicone	4.00
	KF 6017	PEG-10 Dimethicone	2.00
	KF 995	Cyclomethicone	5.00
B	PARSOL MCX	Ethylhexyl Methoxycinnamate	7.50
	Parsol EHS	Ethylhexyl Salicylate	5.00
	Neoheliopan E 1000	Isoamyl p-Methoxycinnamate	5.00
	Tinosorb S	Bis-Ethylhexyloxyphenol Methoxyphenyl Triazine	1.50
C	D.I. Water	Water	23.50
	1,3-BG	Butylene Glycol	5.00
	NaCl	Sodium Chloride	1.00
	Phenoxyethanol	Phenoxyethanol	0.50



# TX 85, ideal micronized TiO<sub>2</sub> for Shaking Sun Milk SPF50 PA+++

## SJF-1306-W/S Shaking Sun Milk SPF50+, PA+++-ver1.0

New in 2015

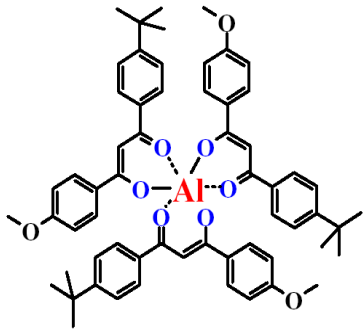
Evaluation	
SPF	57
PA	+++ (8.7)
SPF/UVA	n.a.
Critical Wavelength	n.a.
White Index	<b>15.8</b>
Sensory Index	n.a.

Extremely transparent formula for SPF50 PA+++

Part	Product Name	ICID Name	%
A	KF995	cyclomethicone	30.00
	SUNCLEAR Z60-CO	ZnO & Hydrogen Dimethicone & PEG-9 polydimethyl siloxyethyl dimethicone	15.00
	TX-85	TiO <sub>2</sub> & Silica & Dimethicone	4.00
	KF 6017	PEG-10 Dimethicone	2.00
B	PARSOL MCX	Ethylhexyl Methoxycinnamate	7.50
	Parsol EHS	Ethylhexyl Salicylate	5.00
	Neoheliopan E 1000	Isoamyl p-Methoxycinnamate	5.00
	Tinosorb S	Bis-Ethylhexyloxyphenol Methoxyphenyl Triazine	1.50
C	D.I. Water	Water	23.50
	1,3-BG	Butylene Glycol	5.00
	NaCl	Sodium Chloride	1.00
	Phenoxyethanol	Phenoxyethanol	0.50

# Benefit #3

**BMDBM forms a complex**  
with  $\text{Al}_3^+$  salts from  $\text{TiO}_2$   
coatings



Aluminum oxide is one of  
the most common coating  
material for  $\text{TiO}_2$ .

→ The amount of BMDBM  
decreases

→ weakening of the UVA  
protection



1. Can provide Low Viscosity & Good re-dispersibility especially when to make High SPF Sun Spray
2. High SPF
3. In combination with **Avobenzone (BMDBM) i.e. Alumina Free**

# Avobenzone compatibility test

## Tested TiO<sub>2</sub>

#1:  
Company "I"  
Product "M"  
TiO<sub>2</sub>, Alumina, Stearic Acid,  
Dimethicone

#2  
Company "T"  
Product "M"  
TiO<sub>2</sub>, Alumina, Stearic Acid

#3  
Company "S"  
Product "M"  
TiO<sub>2</sub>, Silica, Methicone

#4  
Company "D"  
Product "P"  
TiO<sub>2</sub>, Silica, Dimethicone

**#5**  
**Company: SUNJIN**  
**Product: TX-85**  
**TiO<sub>2</sub>, Silica, Dimethicone**

## Tested Formula: W/O SUN CREAM

Part	Trade Name	%
A	<b>5 kinds of TiO<sub>2</sub> tested</b>	<b>8.00</b>
	Parsol 1789	3.00
	OMC	7.50
	OS	5.00
	OC	2.40
	ABIL EM90	2.00
	ABIL WE09	3.00
	Finsolv TN	6.00
	Salacos 99	3.00
	Cetiol CC	3.00
B	D.I-Water	49.60
	NaCl	1.00
	1,3-BG	6.00
	Phenoxyethanol	0.50

60 °C, 4weeks  
25 °C, 4weeks  
→



Analyzed by  
Liquid Chromatography



### **Analysis Condition**

1. Model : Agilent 1200 HPLC
2. Column : ZORBAX Eclipse XDS-C18  
250×4.6mm I.D., 5µm
3. Guard Column : ZORBAX Eclipse XDS-C18 12.5×4.6mm I.D., 5µm
4. Mobile Phase : 0.1% TFA in water :  
MeOH = 10 : 90
5. Detector : UV 358nm
6. Column over Temp. : 35 °C
7. Flow rate : 0.6ml/min
8. Injection volume : 1µl

# Combination Test Result

## Tested TiO<sub>2</sub>

#1:  
Company "I"  
Product "M"  
TiO<sub>2</sub>, Alumina, Stearic Acid,  
Dimethicone

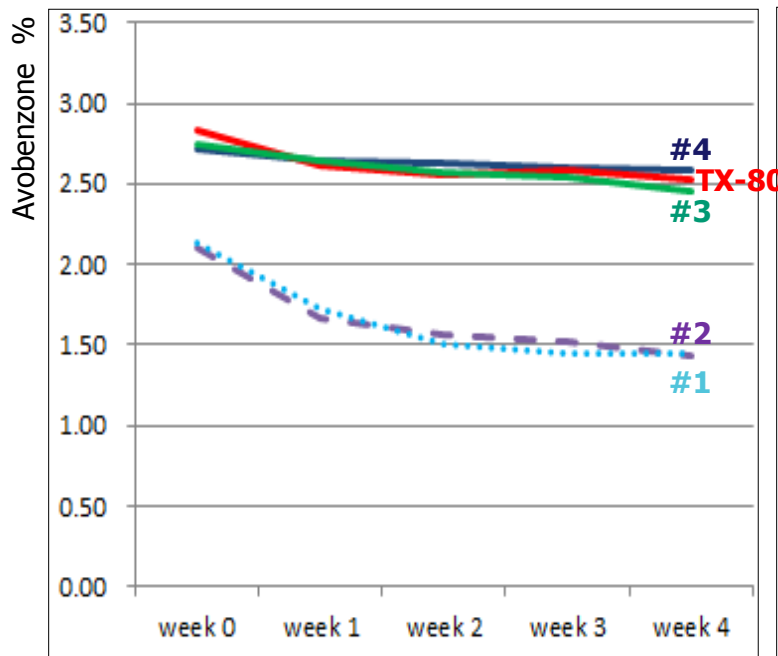
#2  
Company "T"  
Product "M"  
TiO<sub>2</sub>, Alumina, Stearic Acid

#3  
Company "S"  
Product "M"  
TiO<sub>2</sub>, Silica, Methicone

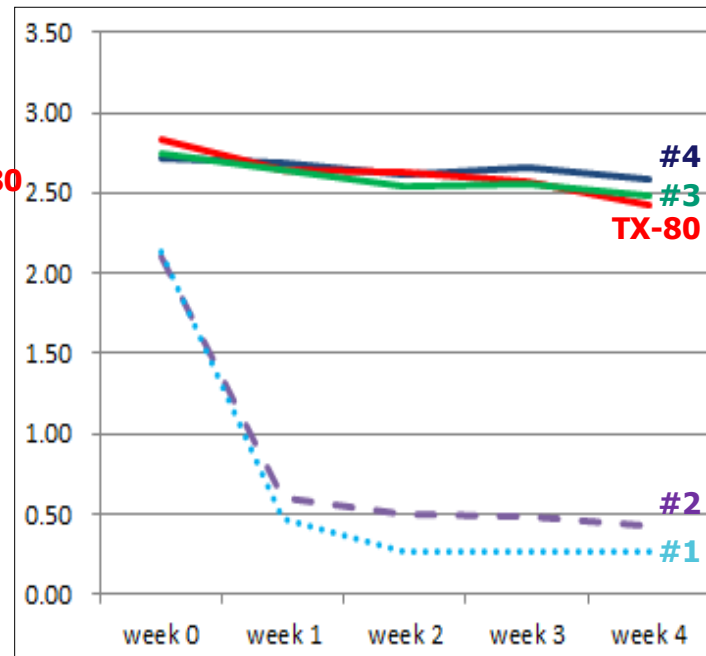
#4  
Company "D"  
Product "P"  
TiO<sub>2</sub>, Silica, Dimethicone

#5  
Company: SUNJIN  
Product: TX-85  
TiO<sub>2</sub>, Silica, Dimethicone

### Test Results at 20°C



### Test Results at 60°C



week	#1	#2	#3	#4	#5
week 0	2.13	2.11	2.75	2.71	2.84
week 1	1.72	1.67	2.64	2.65	2.61
week 2	1.51	1.56	2.57	2.63	2.55
week 3	1.44	1.52	2.54	2.60	2.58
week 4	1.44	1.43	2.46	2.58	2.53

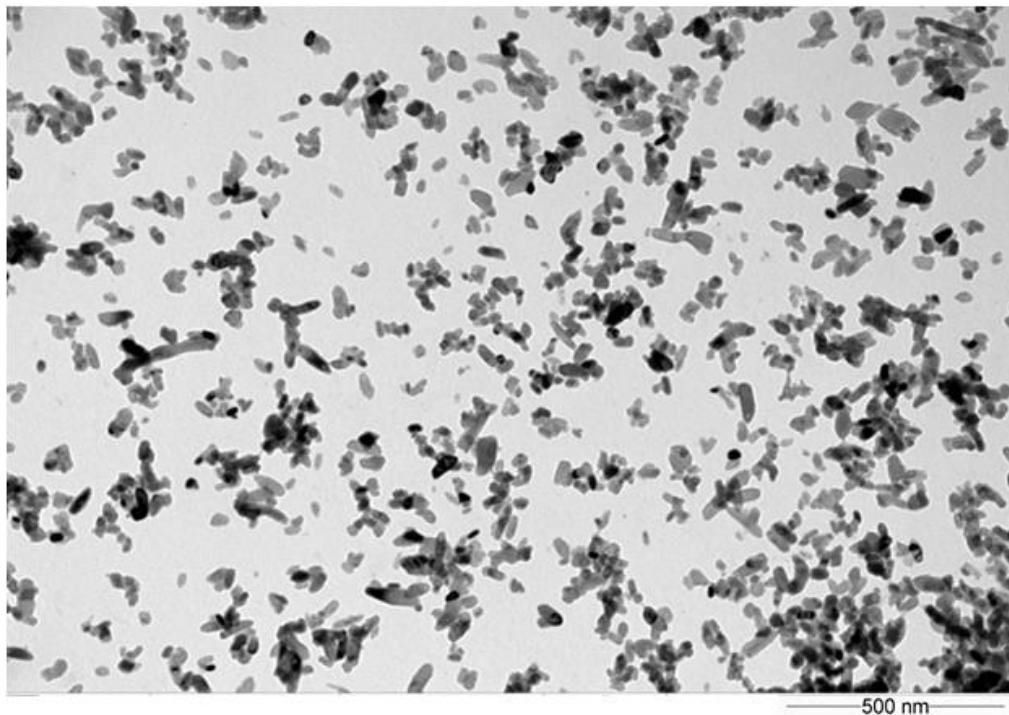
week	#1	#2	#3	#4	#5
week 0	2.13	2.11	2.75	2.71	2.84
week 1	0.47	0.6	2.65	2.68	2.64
week 2	0.27	0.5	2.54	2.62	2.63
week 3	0.26	0.48	2.56	2.66	2.57
week 4	0.26	0.42	2.49	2.59	2.43

TX-85AQ

TiO<sub>2</sub> in  
Water Dispersion



# TX-85 series



## TX-85

### Composition

TiO <sub>2</sub>	85%
SiO <sub>2</sub>	10%
Dimethicone	5%

Particle Size: 30nm  
Aspect Ratio: 1.4

## TX-85AQ

### Composition

TiO <sub>2</sub>	90%
SiO <sub>2</sub>	10%

Particle Size: 30nm  
Aspect Ratio: 1.4



# Key Challenges to make SPF 50 O/W Sun Care

## SPF50 O/W



## Key Challenges

- High SPF O/W gets more and more popular
- It's easy to achieve SPF30 only with commonly used oil soluble chemical UV filters
- But to make SPF50, using chemical filter only is not enough
- So you need to use  $\text{TiO}_2$  & Zinc Oxide
- Easy bet is putting  $\text{TiO}_2$  in internal oil phase
- But that's OK up to 3%
- Now you have to add  $\text{TiO}_2$  in water phase by 5~7% more to reach SPF50
- However, thickener compatible  $\text{TiO}_2$  to be able to put in water phase is very rare

Do you have  $\text{TiO}_2$  to be incorporated into Water phase?

# Thickener compatibility test

SUNSIL Tin50

TX-85AQ

**#1**

**#2**

**#3**

**#4**

## Tested TiO<sub>2</sub>

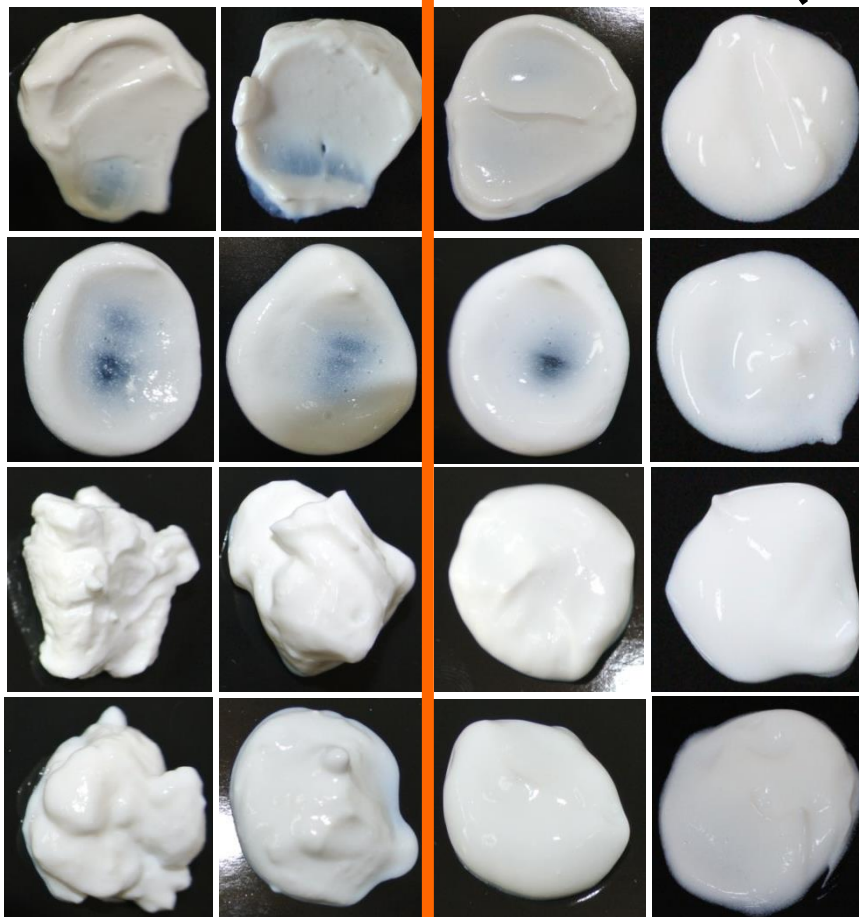
#1:  
Company "T"  
Product "WP"  
TiO<sub>2</sub>, Hydrated Silica

#2  
Company "T"  
Product "AQ"  
TiO<sub>2</sub>, Hydrated Silica,  
Aluminum Hydroxide,  
Alginic acid

#3  
Company: SUNJIN  
Product: SUNSIL Tin50  
TiO<sub>2</sub>, Silica

#4  
Company: SUNJIN  
Product: TX-85AQ  
TiO<sub>2</sub>, Silica

Test condition  
Powder 10% ,  
Different Thickeners solution 90%



## Tested Thickeners

Bentone EW (1.0%)  
Bentonite

Sepiplus 400 (1.0%)  
Polyacrylamide/ C13-14  
Isoparaffin/ Laureth-7

Aristoflex AVC (0.4%)  
Ammonium Acryloyldimethyl  
taurate/VP Copolymer

Carbopol 940 (0.2%)  
Carbomer

Good compatibility