# Minimally disruptive moisturising formulations

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One of the most apparent transformations that have occurred in the last 30 years in the personal care industry is the fact that the product development cycle has compressed tremendously. In the 1980s short time developments were 18 months. Today the market wants new products in what appears to be 18 days! This accelerated development takes place in an environment that has increased regulation and stability that needs to be addressed and must be done with fewer people. This change has forced personal care companies to re-think how they do research and development and to redefine the function of the R&D organisation.

Recently technology has been defined as either disruptive or sustaining in an attempt to better manage it. The concept of disruptive technology was coined by Clayton M. Christensen[1] in the book The Innovator's Dilemma. Disruptive technologies surprise the market by generating a substantial improvement over existing technology.[2] A disruptive technology is one that displaces an established technology and shakes up the industry or a groundbreaking product that creates a completely new industry.[3] While highly desirable, it is more expensive and risky to rely upon substantial market changing developments to keep a company growing. Sustaining technology is extremely important to a business and can well have a more direct effect upon a company's successful introduction of new products. Table 1 shows some differences between disruptive and sustaining technology.

We have begun using a concept we refer to as minimally disruptive formulation (MDF) as an effective approach to product development. This approach depends upon the ability of personal care formulators to provide products that have consumer perceptible differences that meet a market need. Since product aesthetics are a key attribute of personal care products, the ability to alter product aesthetics to provide a different consumer perception with minimal change to the formulation is a very cost-effective way to develop new products.


## Abstract

Silicone polymers have the unique ability to lower the surface tension of organic oils and thereby present a different aesthetic effect in cosmetic formulations. This allows silicone polymers to be added at less than 10% concentration and often less than 5% concentration and provide a different customer experience than achieved by standard silicones. Since the formulation is 90%+ identical to the starting formulation, the time and work needed to evaluate change is minimised. Likewise, the toxicology of the formulation, the need for many raw materials and the cost change is minimised. We have therefore called this approach Minimally Disruptive Formulation. This article will show the concept in a moisturising product.


The fact is a silicone polymer, properly chosen at a concentration of 10% or less, will provide to the formulation (1) a lowering of surface tension, (2) an alteration of feel, (3) an altering of cushion and playtime, (4) a change in gloss and (5) a perception to a customer the product is different from the formulation to which the additive has not been made. This makes silicone polymers quite valuable at low concentrations on formulations to make 'new products'. I have often said: "If a personal care product is compared to a gourmet meal, silicone additives will be the spice, not the meat or potatoes." This means that small amounts of silicone polymer added to great formulas will bring out desired properties to a consumer, that will amaze and delight. This approach will allow the formulator to make SMALL but MAJOR modifications to formulators in a very efficient way by modifying well known formulations to provide new products with different aesthetics.

Table 1[4]

| Disruptive | Sustaining |
|---|---|
| Newer markets | Current markets |
| Typically starts at the lower end of the customer segment | Primarily for milking the cash cows, so to speak! |
| Transformational business model | Sustaining current business model |

Additions of a properly chosen organo-functional silicones can be made to (1) the

| Formulation 1 | |
|---|---|
| Ingredient | %wt |
| DI Water | 67.50 |
| Propylene Glycol | 5.00 |
| Allantoin | 0.20 |
| Triethanolamine | 1.00 |
| Stearic Acid | 10.00 |
| PEG-2 Stearate | 2.00 |
| Isopropyl Myristate | 3.50 |
| Dimethicone | 6.00 |
| Mineral Oil | 3.00 |
| Lanolin Oil | 1.00 |
| Methylparaben | 0.15 |
| Propylparaben | 0.15 |
| Fragrance | 0.50 |
| Total | 100 |

**Procedure:**
In a clean and sanitized container, combine Part A and heat up to 90°C, mix well
In another clean and sanitized container equipped with a propeller mixer, combine Part B and heat up to 90°C, mix well.
Add Part B into part A at 90°C slowly.
Agitation around 650 rpm, in corporation time: 6 minutes for a batch of 200g. Then gently increase mixing rate with the batch becoming thicker and thicker.
Cool batch down to 65 °C, add fragrance under mixing, then continue to cool down to room temperature under mixing

oil phase (alkyl silicones), (2) water phase (PEG/PPG dimethicone) or (2) the silicone phase ( dimethicone), there are many possibilities. The reason for the addition needs to be evaluated. Adding a silicone to the oil phase can result in improved wetting and spreadbility, which in turn alters cushion and play time. The surface tension reduction can be reduced from 32 dynes/cm to 25 dynes/cm. This dramatic change will alter cushion, playtime and ultimate aesthetics.

Addition of a silicone that is soluble in the aqueous phase will reduce the surface tension of the water phase and also alter aesthetics. Finally, addition of a silicone soluble material other than dimethicone can provide water resistance, barrier properties and alter the skin-feel providing a dry powdery feel. All in all, there are many possibilities. This study presents an approach of looking at several different types of silicone in making a modified product which is subsequently evaluated using the control and noting differences.

## Case study

This case study is related to a greaseless, stainless water-based moisturiser with a light fresh fragrance. The product is commercially available.

Label Ingredients: Deionized water, stearic acid, PEG-2 Stearate, propylene glycol, isopropyl myristate, dimethicone, lanolin oil, mineral oil, triethanolamine, allantoin, methylparaben, propylparaben, fragrance

## Silicone types

We chose to evaluate several different types of silicone products. They include:

**Q Resins**
Silmer Q-25
Silmer Q-20
**Q Resin Elastomer Combination**
Silmer Q25/G162
**Alkyl Dimethicone**
Silwax J221M
Silwax J219M
**Ethyl Methicone**
Silwax D-02
Silube CR-1
Analysis

## Conclusions on rotational viscosity

Silmer Q25 Replaced all the dimethicone (6%) in control formula with Silmer Q25 give the best skin-feel such as soft, silky, slippery and powdery. The blue line in Figure 1 and shows the lowest rotational viscosities of all the samples tested.

Silmer Q25 (3%): Replaced only 3% of dimethicone in the control formula, the rotational viscosity data (green line) were still much lower than those of the control.

Silwax D02 (6%): The rotational line (brown line) is lower than that of the copy (see Figure 5), the brown line and the bright green line (with 3% Silmer Q25) are very close.

| Formulation 2 | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Ingredient | FC343 Control | FC343 A/A1 w/Q25 | FC34B w/Q20 | FC343C w/Q25 G162 | FC34D w/CR-1 | FC343E w/J219M | FC343F wJ221M | FC34G w/D02 |
| Part A | | | | | | | | |
| DI Water | 67.50 | 67.50 | 67.50 | 67.50 | 67.50 | 67.50 | 67.50 | 67.50 |
| Propylene Glycol | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 |
| Allantoin | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 | 0.20 |
| TEA | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Part B | | | | | | | | |
| Stearic Acid | 9.00 | 9.00 | 9.00 | 9.00 | 9.00 | 9.00 | 9.00 | 9.00 |
| PEG-2 Stearate | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 | 2.00 |
| Isopropyl Myristate | 3.50 | 3.50 | 3.50 | 3.50 | 3.50 | 3.50 | 3.50 | 3.50 |
| Mineral Oil | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 | 3.00 |
| Lanolin Oil | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 | 1.00 |
| Methylparaben | 0.15 | 0.15 | 0.15 | 0.15 | 0.15 | 0.15 | 0.15 | 0.15 |
| Propylparaben | 0.15 | 0.15 | 0.15 | 0.15 | 0.15 | 0.15 | 0.15 | 0.15 |
| Dimethicone | 6.00 | 0/3.00 | 3.00* | 3.00 | 0 | 3.00 | 3.00 | 0 |
| Silmer Q25 | 0 | 6.0/3.0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Silmer Q20 | 0 | 0 | 3.00 | 0 | 0 | 0 | 0 | 0 |
| Silmer Q25/G162 | 0 | 0 | 0 | 3.00 | 0 | 0 | 0 | 0 |
| Silube CR-1 | 0 | 0 | 0 | 0 | 6.00 | 0 | 0 | 0 |
| Silwax J219M | 0 | 0 | 0 | 0 | 0 | 3.00 | 0 | 0 |
| Silwax J221M | 0 | 0 | 0 | 0 | 0 | 0 | 3.00 | 0 |
| Silwax D02 | 0 | 0 | 0 | 0 | 0 | 0 | 0 | 6.00 |
| Part C | | | | | | | | |
| Fragrance | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 | 0.50 |
| Total | 100 | 100 | 100 | 100 | 100 | 100 | 100 | 100 |

*Only replace 3% of Dimethicone in the case of Silmer Q20, Silmer Q25/G162, Silwax J219M, and Silwax J221M

Table 3

| Specifications | Viscosity (cp)* | pH | Appearance | Stability @45°C | Feel (1-10, 10 the best) | Compatibility |
|---|---|---|---|---|---|---|
| FC343A w/Silmer Q25 (6%) | 1380 | 7.3 | White cream | Stable | 9.4 | Good |
| FC343A1 w/Silmer Q25 (3%) | 2005 | 7.3 | White cream | Stable | 9.2 | Good |
| FC343B w/Silmer Q20 (3%) | 3124 | 7.3 | White cream | Stable | 9.1 | Good |
| FC343C w/Silmer Q25/G162 (3%) | 3124 | 7.3 | White cream | Stable | 9.2 | Good |
| FC343D w/Silube CR-1 (6%) | 2543 | 7.3 | White cream | Stable | 9.3 | Good |
| FC343E w/Silwax J219M (3%) | 2196 | 7.3 | White cream | Stable | 9.2 | Good |
| FC343F w/Silwax J221M (3%) | 3601 | 7.3 | White cream | Stable | 9.2 | Good |
| FC343G w/Silwax D02 (6%) | 2091 | 7.3 | White cream | Stable | 9.3 | Good |

Roatational viscosity was tested by using Brookfield DV-III Rheometer V3.3, spindle CP51, 6 rpm

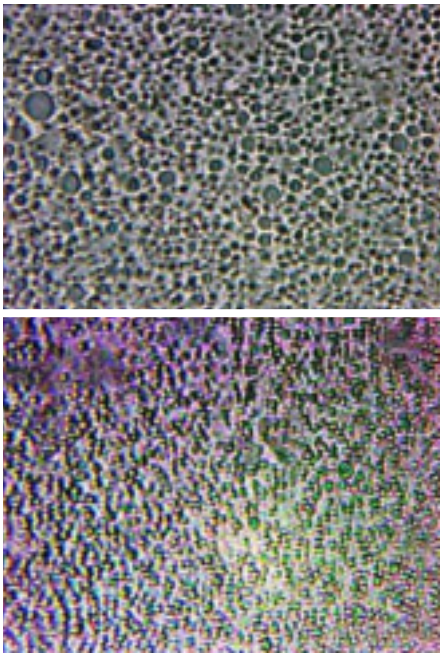

**Figure 2:** Microscopy of emulsions. Standard emulsion and emulsion with D-02.

## Aesthetic conclusions

The differences of the finished products can be felt on the skin. When all the dimethicone is replaced, many different effects based upon skin-feel were observed:

Silmer Q25, (a Q resin), gave the best skin-feel when evaluated against all other formulations. It was described by panellists as soft, silky, slippery and powdery.

Silwax D02 (ethyl methicone), provided a silky feel and easy spread, as well as making the skin look bright when dry.

With Silube CR-1 the cream can be applied easier and is slippery. The cream is more lubricant and soft.

The alkyl silicones (Silwax), provided a soft feel and high gloss on the skin and have more cushion and play time than the control.

## Microscopy of emulsion

Barska AY11374-Digital Microscope was used to take pictures of O/W emulstion drops. Pictures were processed (1X) by using Adobe Photoshop 7.0. Full scale of the image is 100 um.

Photo micrographs show that ethyl methicone provides a smaller, more uniform particle size. This provides easier spread (surface tension reduced from 32 dynes/cm to 25 dynes/cm) and renders a 'bright look' to the skin.

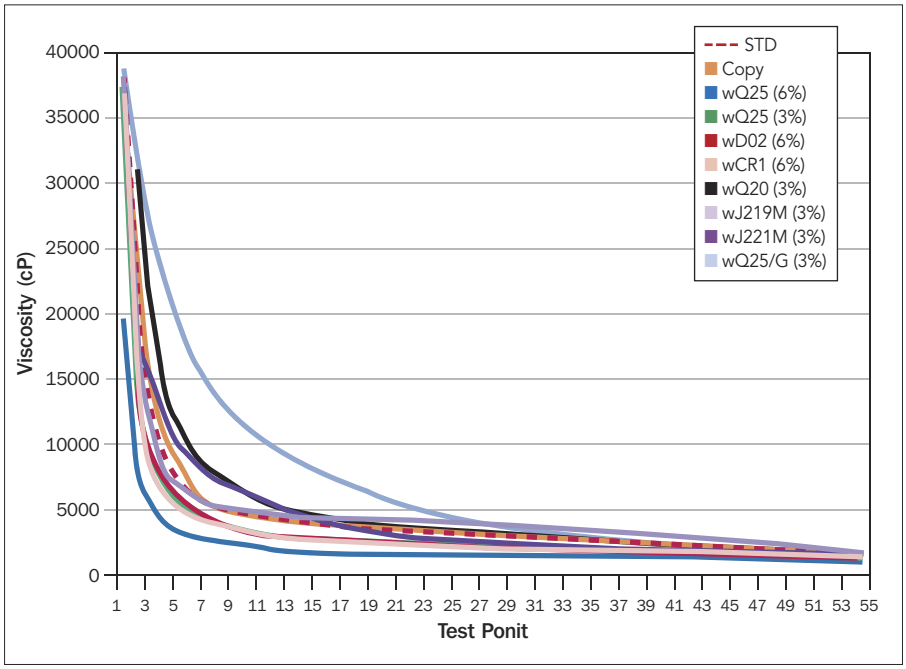


**Figure 1:** Rotational Viscosity (25C).

## Overall conclusions

Silmer Q25 (Q resin), Silwax D02 (ethylmethicone), are additives for alteration of the formulation. Silmer Q25 renders the skin soft, silky, slippery and provides a powdery feel.

Silwax D02 provides a silky feel and easy spread, and the skin looks bright when dry, spread is easier and the formulation is more lubricous and softer.

Silmer Q20 and Silmer G162 are not suitable for this kind of thick and heavy cream.

The use of minimally disruptive technology, an approach that makes incremental changes in an existing formulation using a variety of silicone polymers, is a very effective way to modify aesthetics, rheology and skin-feel in formulations. This approach allows for the keeping of successful platform formulations while looking to modify consumer perceptions, resulting in new products. PC

## References

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