



Case Study

# Cleaner Beauty: Replacing petrochemicals with naturally-derived ingredients in skincare

*Improved consumer responsiveness*



## Executive Summary

A large CPG company used the Citrine Platform to reformulate 3 well-loved skin care products using completely new, naturally-derived ingredients **in 2.5 months**. The normal timeline for a similar project was estimated to be between 12 and 18 months, depending on the product family complexity.

## Background

A large consumer product goods (CPG) customer of Citrine produces iconic skin care brands used and loved all over the world. Their customers rely on these products day-to-day, to protect their skin and make them feel good. This customer is constantly surveying consumer sentiment and knows that in order to grow their large market share, it is important to give customers products that utilise naturally-derived ingredients. The customer accepted the challenge to develop replacement products that maintained the feel that their loyal customers expected, while using naturally-derived thickeners and emulsifiers.



## Business Project Aim

The goal of this project was to respond to consumer feedback and get to market quickly with improved, naturally-derived products that maintain the feel consumers know and love.

## Technical Project Aim

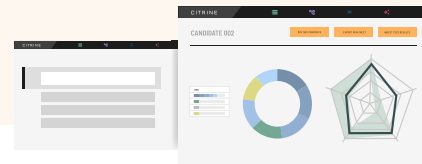
The aim was to formulate a trio of distinctive skin care products which met two rheological properties of the three existing products but used naturally-derived ingredients in place of those currently derived from petrochemicals.

## Starting Point

The customer started with approximately 50 data points that measured the two properties of interest based on tests carried out on formulations containing naturally-derived ingredients. The challenge was that none of these samples had the desired combination of rheological properties to be considered acceptable for the second and third targets.



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## Using Expertise

The team at the CPG customer had decades of experience in formulating skin care products and it was important to leverage this knowledge to drive project success. The team were able to label the ingredients, e.g. Emollient, Emulsifier, thickeners etc., and use their knowledge of the fractions of these ingredient types used in successful products, to guide the AI model. They also provided information on the relevant properties of the ingredients used and how they would impact the desired results.

## Sequential Learning

A sequential learning approach was taken. This involves doing small rounds of experiments and feeding the resulting data back into the Citrine Platform to improve the AI model and choose the experiments to try next. With each round of experiments, 10 candidate formulations were chosen by the customer's experts to test. Initial rounds can be focused on data gathering, testing unusual formulations that help the AI model to understand the formulating landscape better. Later rounds can be focussed on hitting the target properties as soon as possible.

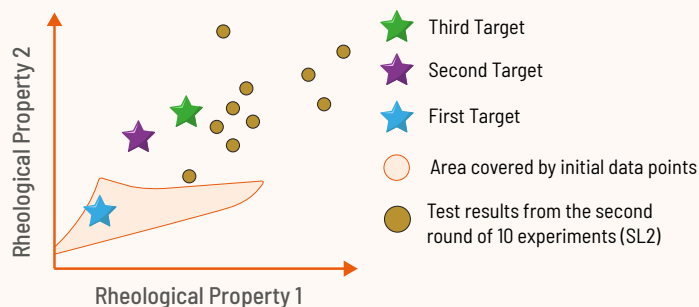
### Experiment Batch 1 – Test the model

As the initial data points were already very close to the properties needed for target 1, it was not a surprise that a formulation in the first round of 10 experiments hit the first target.



### Experiment Batch 2 - Explore

This round of experiments was used to really explore the formulation landscape. High values that had not been achieved before were achieved for both target properties.



### Experiment Batch 3 – Home in on targets

In this round the model used the data from the previous exploratory round to really home in on target properties.

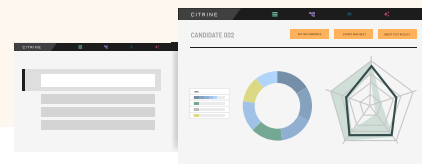


### Experiment Batch 4 – Final Round

The final round of experiments were deemed close enough to the target properties. This round also included never-before-used ingredients in the design process, highlighting the Citrine Platform's capability to accelerate development of novel formulations.



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## Summary

Previously, hitting the three targets would have taken around a year. In this case, the project took just 2.5 months and approximately 40 experiments to complete. The wider team at the CPG company were reassured that the new way of working would get products to market faster and enable the team to be more productive, using their extra time to either launch more projects or hit more ambitious target properties.

The beauty and personal care market in general has in recent years been in flux with more consumers happy to buy products online from foreign countries. (20% of Millennials and Gen Z are purchasing cosmetics, fragrance and skin care products from outside their own country, according to ESW Global Voices Pre-Peak Pulse Survey.) This has resulted in a loss of market share by established brands. Part of this loss is attributed to direct-to-consumer brands selling “clean” cosmetics. The Citrine Platform gives our CPG customers the chance to rapidly respond to consumer sentiment and maintain their pole position.



At Citrine, we envision a world with clean products and materials, used well. Our company mission is to enable a greener, more efficient world by accelerating the development and deployment of next-generation materials, chemicals and products.

