Background

Ingredient substitutions at cosmetic brands and contract manufacturers may occur in cosmetic and personal care products for a variety of reasons, including supply chain interruptions brought on by natural disasters. Cost considerations also play a significant role, since changes in the price of alternative materials force the usage of less expensive alternatives without sacrificing product quality. Additionally, product reformulations often involve swapping ingredients to align with changing consumer preferences, sustainability goals, or technological advancements. Concerns over allergies or sensitivities drive the substitution of irritants with gentler alternatives, while labeling claims such as organic or cruelty-free necessitate ingredient adjustments to meet certification standards.

Objective

To goals of this study were to substitute guar gum in a hand cream with xanthan gum, hydropropyl methyl cellulose, ceratonia siliqua (carob) gum (and) sclerotium gum, carbomer, cellulose gum, gellan gum formulate the different versions of the hand cream. Second goal, evaluating the changes that occurred via visual and instrumental techniques. The third goal was to finetune the best hand cream containing one of the alternative thickeners to closely match the original hand cream.

Methods

The hand creams were evaluated visually for physical stability and shine. Instrumental evaluation included testing color with a colorimeter (Konika Minolta CM5), consistency with a texture analyzer (TA.XTPlus), and pH with a pH meter (HANNA Instruments).

**Hand Cream Formulation**

|  |  |  |
| --- | --- | --- |
| **Hand Cream Formulation** | **INCI Name** | **Weight %** |
| **Phase A** |  |  |
| Water | Water | qs |
| Guar Gum | Guar Hydroxypropyltrimonium Chloride | 0.5% |
| Aloe Vera | Helianthus Annuus (Sunflower) Seed Oil (and) AloeBarbadensis Leaf Extract (and) Rosmarinus Officinalis (Rosemary) Leaf Extract | 4% |
| EDTA | EDTA Tetrasodium | 0.2% |
| **Phase B** |  |  |
| Polysorbate 60 | Polysorbate 60 | 2% |
| Ceteareth-20 | Ceteareth-20 | 2% |
| Cetyl Alcohol | Cetyl Alcohol | 3% |
| Triglyceride | Caprylic/Capric Triglyceride | 5% |
| Almond Oil | Prunus Amygdalus Dulcis (Sweet Almond) Oil | 9% |
| Vaseline | Petrolatum | 4% |
| Dimethicone | Dimethicone | 2% |
| Shea Butter | Butyrospermum Parkii (Shea) Butter | 2% |
| **Phase C** |  |  |
| Provitamin B5 | Panthenol | 2% |
| Vitamin E | Tocopheryl Acetate | 1.5% |
| Paraben-DU | Propylparaben (and) Methylparaben (and) Diazolidinyl Urea (and) Propylene Glycol | 1% |
| Eucalyptus oil | Eucalyptus Globulus Leaf oil | 0.3% |
| **Thickeners Alternative** | **Lable** |  |
| Xanthan Gum | **C1** | 0.5% |
| Xanthan Gum | **C2** | 0.2%, |
| Hydropropyl Methyl Cellulose | **C3** | 0.2% |
| Ceratonia Siliqua (Carob) Gum (and) Sclerotium | **C4** | 1.5 % |
| Carbomer | **C5** | 0.2% |
| Cullose Gum | **C6** | 0.4 % |
| Gellan Gum | **C7** | 0.2% |

A group of white round shapes on a gray surface

Description automatically generated

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Table: L\*a\*b\* data by colorimeter | | | | | |
| **Thickeners** | **L\*** | **a\*** | **b\*** | **ΔE** |
| **CO** | 70.29 | -1.57 | -1.50 | 0.00 |
| **C1** | 72.95 | -1.49 | -1.24 | 2.67 |
| **C2** | 72.28 | -1.36 | -1.38 | 2.00 |
| **C3** | 72.77 | -1.37 | -1.41 | 2.49 |
| **C4** | 66.13 | -1.33 | -1.90 | 4.19 |
| **C5** | 64.75 | -1.41 | -2.45 | 5.62 |
| **C6** | 75.77 | -1.29 | -1.15 | 5.50 |
| **C7** | 71.37 | -1.56 | -1.30 | 1.10 |

Starting with the most similar, it turns out that Gellan Gum 2% has the closest data with Guar Gum 0.5% followed by Xanthan Gum with variant of 0.2% and 0.5%.

On the other hand, Carbomer 0.2%, Natirheo 1.5%, and Cellulose Gum 0.4% stand at the lowest rank regards to the similarity.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Thickener** | **L\*** | **a\*** | **b\*** | **∆** |
| **CO** | **70.29** | **-1.57** | **-1.50** | **0.00** |
| **C1** | **72.95** | **-1.49** | **-1.24** | **2.67** |
| **C2** | **72.28** | **-1.36** | **-1.38** | **2.00** |
| **C3** | **72.77** | **-1.37** | **-1.41** | **2.49** |
| **C4** | **66.13** | **-1.33** | **-1.90** | **4.19** |
| **C5** | **64.75** | **-1.41** | **-2.45** | **5.62** |
| **C6** | **75.77** | **-1.29** | **-1.15** | **5.50** |
| **C7** | **71.37** | **-1.56** | **-1.30** | **1.10** |

A screenshot of a graph

Description automatically generated

A screenshot of a computer

Description automatically generated

A graph of different colored lines

Description automatically generatedA screenshot of a computer

Description automatically generated

Results

The research is still ongoing. Based on our current results, we expect the hand creams to exhibit promising results. Visual evaluation suggests improved physical stability and shine compared to the original formulation containing guar gum. Instrumental measurements indicate that the hand creams formulated with alternative thickeners are likely to show favorable color, consistency, and pH values. Further analysis will be conducted to confirm these initial observations and assess the overall performance of the hand creams.

Conclusions

Full conclusions will be presented at the symposium.

Guar Gum 0.5% vs Xanthan Gum 0.2%:

A group of white containers with labels

Description automatically generated

Color:

* Guar Gum: off white
* Xanthan Gum: true white

Shininess:

* Guar Gum: not very shine
* Xanthan Gum: shinier

After feel:

* Guar Gum: heavier when gliding on skin
* Xanthan Gum: smoother, little tacky

Texture:

* Guar Gum: thicker, feel more consistent
* Xanthan Gum: more liquid

Hydropropyl Methylcellulose 0.25% vs Guar Gum 0.5%

A group of jars of white cream

Description automatically generated

Color:

* Guar Gum: off white
* Hydropropyl: whiter

Shininess:

* Guar Gum: not much of a difference
* Hydropropyl: not much of a difference

After feel:

* Guar Gum: not much of a difference
* Hydropropyl: not much of a difference

Texture:

* Guar Gum: not much of a difference
* Hydropropyl: not much of a difference

Natirheo 1.5% vs Guar Gum 0.5%

A group of jars of cream

Description automatically generated

Color:

* Guar Gum: off white
* Natirheo: whiter

Shininess:

* Guar Gum: not much of a difference
* Natirheo: not much of a difference

After feel:

* Guar Gum: not much of a difference
* Natirheo: not much of a difference

Texture:

* Guar Gum: thicker
* Natirheo: little bit more liquid

Natirheo 1.5% vs Guar Gum 0.5%

Color:

* Guar Gum: off white
* Natirheo: whiter

Shininess:

* Guar Gum: not much of a difference
* Natirheo: not much of a difference

After feel:

* Guar Gum: not much of a difference
* Natirheo: not much of a difference

Texture:

* Guar Gum: thicker
* Natirheo: little bit more liquid

A group of containers of cream

Description automatically generatedCarbomer 0.2% vs Guar Gum 0.5%

Color:

* Guar Gum: off white
* Carbomer: whiter

Shininess:

* Guar Gum: shinier
* Carbomer: not very shine

After feel:

* Guar Gum: smoother
* Carbomer: tackier

Texture:

* Guar Gum: thicker
* Carbomer: more liquid

Cellulose Gum 0.4% vs Guar Gum 0.5%

A group of white containers with white liquid in them

Description automatically generated

Color:

* Guar Gum: off white
* Cellulose Gum: whitest ever

Shininess:

* Guar Gum: not as shine
* Cellulose: shiniest

After feel:

* Guar Gum: smooth
* Cellulose: tackier

Texture:

* Guar Gum: normal
* Cellulose: prettier

Gellan Gum 2% vs Guar Gum 0.5%

A group of white containers with white liquid in them

Description automatically generated

Color:

* Guar Gum:
* Gellan: whiter

Shininess:

* Guar Gum: shinier
* Gellan: not as shiny

After feel:

* Guar Gum: absorb slower
* Gellan: adopt better, dry much quicker

Texture:

* Guar Gum: better form
* Gellan: don’t have uniformity

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | **CO vs C2** | **CO vs C3** | **CO vs C4** | **CO vs C5** | **CO vs C6** | **CO vs C7** |
| **Color** | CO: Off white  C1: True white | CO: Off white  C3: Whiter | CO: Off white  C4: Whiter | CO: Off white  C5: Whiter | CO: Off white  C6: Whitest ever | CO: Off white  C7: Whiter |
| **Shininess** | CO: Not very shine  C2: shinier | Not much of a difference | Not much of a difference | CO: Shinier  C5: Not very shine | CO: Not as shine  C6: Shiniest | CO: Shinier  C7: Not as shiny |
| **After feel** | CO: Heavier when gliding on skin  C2: Smoother | Not much of a difference | Not much of a difference | CO: Smoother  C5: Tackier | CO: Smooth  C6: Tackier | CO Absorb slower.  C7: Adopt better, dry much quicker |
| **Texture/ Consistency** | CO: Thicker, feel more consistent  C2: More liquid | Not much of a difference | CO: Thicker, feel more consistent  C2: More liquid | CO: Thicker  C5: More liquid | CO: good  C6: Prettier | CO: Better form  C7: Does not have uniformity. |