



# Antimicrobial Formulating Guidelines



We always recommend that every formula undergo stability and microbial testing to ensure adequate preservation.

# Preamble

This document was created to address the challenges and concerns regarding our antimicrobials in the formulating process.

Formulators are often challenged with natural antimicrobials, as they are newer and do not necessarily behave like synthetic preservatives. Likewise, incorporating a natural antimicrobial into a formulation is not a matter of simply removing the synthetic preservative and adding the natural antimicrobial – formulation techniques need to be tailored to each natural antimicrobial to ensure the product is properly preserved.

Continued 

We always recommend that every formula undergo stability and microbial testing to ensure adequate preservation.

# Preamble

Preservatives may have a broader effect on the finished product, altering aesthetics such as color, odor, and viscosity. When formulating with new antimicrobials, it is important to monitor the antimicrobial closely to control undesired aesthetic changes in the finished product. An important factor to consider when formulating using most natural antimicrobials is broad-spectrum protection. It is not likely that a natural antimicrobial will exhibit the same level of broad-spectrum protection as a synthetic preservative. For this reason, natural antimicrobials often need to be used in conjunction with one another to synergistically produce a broad-spectrum self-preserving system.

This document outlines several properties of each antimicrobial as a means to ensure compatibility during formulation to allow our customers to continue leading the market with impressive formulations and innovative applications.

Continued 

## Leucidal Liquid



**Leucidal® Liquid** has been in use for almost a decade now and has been proven to be a very compatible ingredient for formulating.

### Leucidal® Liquid

Temperature Stability	<70°C
pH Stability	3 - 8
Suggested Use Levels	2.0 - 4.0%
Solubility	Water Soluble

1. We recommend starting with 4.0% **Leucidal® Liquid**.
2. Monitor the interaction of **Leucidal® Liquid** with other ingredients for compatibility.
3. Incorporate **Leucidal® Liquid** into formulations at a pH between 3 and 8, during the cooling phase of the process at temperatures lower than 70°C.

Continued 

We always recommend that every formula undergo stability and microbial testing to ensure adequate preservation.

# Leucidal Liquid

## Recommended Techniques

**Incorporating Leucidal® Liquid towards the end of the formulating process:** A successful recommendation is adding **Leucidal® Liquid** near the end of the formulating process and after the formulation has cooled to below 70°C. Reference [FAQs](#) for recommended techniques regarding specific anionic thickeners.

## Heat Stability

Results from testing has shown that **Leucidal® Liquid** can tolerate temperatures of up to 70°C for a period of 8 hours without having any impact on MIC performance.

## Compatibility

The cationic nature of **Leucidal® Liquid** makes the main formulating concern potential incompatibility with highly anionic ingredients, such as thickeners. Reference [FAQs](#) for more information regarding specific anionic thickeners. The use of solubilizing agents may help improve clarity in cases where haziness is observed.

*We always recommend that every formula undergo stability and microbial testing to ensure adequate preservation.*

# Leucidal Liquid Complete



## Leucidal® Liquid Complete

Temperature Stability	<70°C
pH Stability	3 - 8
Suggested Use Levels	2.0 - 4.0%
Solubility	Water Soluble

1. We recommend starting with 4.0% **Leucidal® Liquid Complete**.
2. Monitor the interaction of **Leucidal® Liquid Complete** with other ingredients.
3. Incorporate **Leucidal® Liquid Complete** into formulations at a pH between 3 and 8, during the cooling phase of the process at temperatures lower than 70°C.

Continued 

We always recommend that every formula undergo stability and microbial testing to ensure adequate preservation.

# Leucidal Liquid Complete



## Heat Stability

Results from testing has shown that **Leucidal® Liquid Complete** can tolerate temperatures of up to 70°C for a period of 8 hours without having any impact on MIC performance.

## Compatibility

The cationic nature of **Leucidal® Liquid Complete** makes the main formulating concern potential incompatibility with highly anionic ingredients, such as thickeners. Reference [FAQs](#) for more information regarding specific anionic thickeners.

The use of solubilizing agents may help improve clarity in cases where haziness is observed.

## Recommended Techniques

### **Incorporating Leucidal® Liquid Complete towards the end of the formulating process:**

A successful recommendation is adding **Leucidal® Liquid Complete** near the end of the formulating process and after the formulation has cooled to below 70°C. Reference [FAQs](#) for recommended techniques regarding specific anionic thickeners.

Continued 

We always recommend that every formula undergo stability and microbial testing to ensure adequate preservation.

# Leucidal Liquid Complete



## Additional Information

As with all biological materials, attention must be paid to the conditions under which **Leucidal® Liquid Complete** is used. Based on bench-scale evaluations, as well as actual product applications, **Leucidal® Liquid Complete** has been found to be effective over a wide range of typical cosmetic and personal care product manufacturing conditions.

**Leucidal® Liquid Complete** can be hazy at cooler temperatures, therefore it is recommended to warm the full container of product to 35-40°C and mix until clear prior to use.

Continued 

We always recommend that every formula undergo stability and microbial testing to ensure adequate preservation.



## Leucidal Liquid SF

Leucidal® Liquid SF	
Temperature Stability	<70°C
pH Stability	3 - 8
Suggested Use Levels	2.0 - 4.0%
Solubility	Water Soluble

1. We recommend starting with 4.0% **Leucidal® Liquid SF**.
2. Monitor the interaction of **Leucidal® Liquid SF** with other ingredients for compatibility.
3. Incorporate **Leucidal® Liquid SF** into formulations at a pH between 3 and 8, during the cooling phase of the process at temperatures lower than 70°C.
4. With viscosity modifiers, it is best to add **Leucidal® Liquid SF** prior to the thickener.

Continued 

## Leucidal Liquid SF

### Heat Stability

Results from testing has shown that **Leucidal**<sup>®</sup> **Liquid SF** can tolerate temperatures of up to 85°C for a period of 8 hours without having any impact on MIC performance.

**Compatibility Anionic Ingredients:** The cationic nature of **Leucidal**<sup>®</sup> **Liquid SF** makes the main formulating concern potential incompatibility with highly anionic ingredients like Carbopol<sup>®</sup>, Xanthan gums, Carrageenan, and Hyaluronic Acid. The haze and the presence of white particles suspended along with bubbles through the thickener solutions in **Figure 1** illustrate this incompatibility. The use of solubilizing agents, such as polysorbate 20, may help improve clarity when haziness is observed. The addition of sodium chloride or sodium citrate may help prevent a loss of viscosity when formulating with anionic ingredients. For compatibility issues regarding specific anionic thickeners, reference [FAQs](#).

**Figure 1:** From left to right Keltrol<sup>®</sup> CGSFT, Carbopol<sup>®</sup> Ultrez 10 and Carbopol<sup>®</sup> 940 with **Leucidal**<sup>®</sup> **Liquid SF**



Continued 

## Leucidal Liquid SF

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### Compatibility (continued)

**High salt concentration:** We have had customers report that **Leucidal® Liquid SF** did not perform well in a formulation containing 10% magnesium chloride. This is an unusually high concentration of this salt for a typical cosmetic formulation. We believe the excessive amount of electrolytes in the formulation due to the 10% concentration of magnesium chloride causes saturation of the cationic antimicrobial peptides, essentially neutralizing their efficacy

**High alcohol content:** Incorporating **Leucidal® Liquid SF** in a formulation with high alcohol content can cause haziness. Results from testing has shown **Leucidal® Liquid SF** to be stable and compatible in up to 20% ethanol.

Continued 

## Leucidal Liquid SF

### Recommended Techniques

**Adding Leucidal<sup>®</sup> Liquid SF towards the end of the formulating process:** A successful recommendation is adding **Leucidal<sup>®</sup> Liquid SF** near the end of the formulating process and after the formulation has cooled to below 70°C. Reference [FAQs](#) for recommended techniques regarding specific anionic thickeners.

### Additional Information

We have had customers report that the addition of **Leucidal<sup>®</sup> Liquid SF** before neutralizing the anionic polymers (Novethix<sup>™</sup> L-10 Polymer and Carbopol<sup>®</sup> Aqua SF-1 OS Polymer) resulted in the formation of precipitates. These precipitates were avoided by adding **Leucidal<sup>®</sup> Liquid SF** after the neutralization of the anionic polymers.

Continued 

# Leucidal SF Complete



## Leucidal® SF Complete

Temperature Stability	<70°C
pH Stability	3 - 8
Suggested Use Levels	2.0 - 4.0%
Solubility	Water Soluble

1. We recommend starting with 4.0% **Leucidal® SF Complete**.
2. Monitor the interaction of **Leucidal® SF Complete** with other ingredients.
3. Incorporate **Leucidal® SF Complete** into formulations at a pH between 3 and 8, during the cooling phase of the process at temperatures lower than 70°C

Continued 

We always recommend that every formula undergo stability and microbial testing to ensure adequate preservation.

# Leucidal SF Complete



## Heat Stability

Results from testing has shown that **Leucidal® SF Complete** can tolerate temperatures of up to 70°C for a period of 8 hours without having any impact on MIC performance.

## Compatibility

The cationic nature of **Leucidal® SF Complete** makes the main formulating concern potential incompatibility with highly anionic ingredients, such as thickeners. Reference [FAQs](#) for more information regarding specific anionic thickeners.

The use of solubilizing agents may help improve clarity in cases where haziness is observed

Continued 

We always recommend that every formula undergo stability and microbial testing to ensure adequate preservation.

# Leucidal SF Complete



## Recommended Techniques

### **Incorporating Leucidal® SF Complete towards the end of the formulating process:**

A successful recommendation is adding **Leucidal® SF Complete** near the end of the formulating process and after the formulation has cooled to below 70°C. Reference [FAQs](#) for recommended techniques regarding specific anionic thickeners.

## Additional Information

As with all biological materials, attention must be paid to the conditions under which **Leucidal® SF Complete** is used. Based on bench-scale evaluations, as well as actual product applications, **Leucidal® SF Complete** has been found to be effective over a wide range of typical cosmetic and personal care product manufacturing conditions.

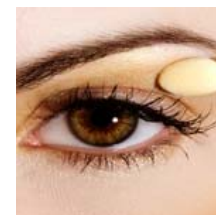
Continued 

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# Leucidal Liquid PT

Leucidal Liquid PT is perfect option for Powdered or Spray Treatments

Leucidal® Liquid PT	
Temperature Stability	<70°C
pH Stability	3 - 8
Suggested Use Levels	2.0%
Solubility	Water Soluble



1. We recommend starting with 2.0% **Leucidal® Liquid PT**.
2. Monitor the interaction of **Leucidal® Liquid PT** with other ingredients for compatibility.
3. We recommend incorporating **Leucidal® Liquid PT** at temperatures lower than 70°C and a pH between 3 and 8.

Continued 

We always recommend that every formula undergo stability and microbial testing to ensure adequate preservation.



# Leucidal Liquid PT

## Heat Stability

With regard to the potential negative effects of high temperatures, we have done testing to show that **Leucidal® Liquid PT** can tolerate temperatures of up to 70°C.



## Compatibility

We are unaware of any adverse reactions between **Leucidal® Liquid PT** and any thickeners.

## Recommended Techniques

**Add Leucidal® Liquid PT to the water phase:** **Leucidal® Liquid PT** is water soluble and may therefore be added to aqueous systems, as well as the aqueous phase of emulsions.

**Leucidal® Liquid PT** can also be easily incorporated into emulsion systems and water based applications. For color applications, we recommend spraying the product on the pigments along with other ingredients such as binders.

Continued 

We always recommend that every formula undergo stability and microbial testing to ensure adequate preservation.

# PhytoCide Elderberry OS



## PhytoCide Elderberry OS

Temperature Stability	<75°C
pH Stability	3 - 8
Suggested Use Levels	1.0 - 5.0%
Solubility	Oil Soluble

1. We recommend starting with 5.0% **PhytoCide Elderberry OS**.
2. Monitor the interaction of **PhytoCide Elderberry OS** with other ingredients.
3. We recommend incorporating **PhytoCide Elderberry OS** at temperatures lower than 75°C and a pH between 3 and 8.

Continued 

We always recommend that every formula undergo stability and microbial testing to ensure adequate preservation.

# PhytoCide Elderberry OS



## Heat Stability

With regard to the potential negative effects of high temperatures, we have done testing to show that **PhytoCide Elderberry OS** can tolerate temperatures of up to 75°C for a period of 8 hours without having any impact on the MIC performance.

## Compatibility

**PhytoCide Elderberry OS** does not interact with anionic materials and, because of this, we are not aware of any adverse reactions between **PhytoCide Elderberry OS** and thickeners.

## Recommended Techniques

**Add PhytoCide Elderberry OS to the oil phase:** **PhytoCide Elderberry OS** is oil soluble and may therefore be added to the oil phase of emulsions.

## Additional Information

**PhytoCide Elderberry OS** is temperature stable up to 75°C and its antimicrobial properties are most effective between a pH of 3 and 8

Continued 

We always recommend that every formula undergo stability and microbial testing to ensure adequate preservation.



## AMTicide Coconut

### AMTicide® Coconut

Temperature Stability	<70°C
pH Stability	3 - 8
Suggested Use Levels	2.0 - 4.0%
Solubility	Water Soluble

1. We recommend coupling **AMTicide® Coconut** with one of our broad-spectrum antimicrobials, such as Leucidal® Liquid, at 4.0% each.
2. Monitor the interaction of **AMTicide® Coconut** with other ingredients for compatibility.
3. Incorporate **AMTicide® Coconut** into formulations at a pH between 3 and 8, during the cooling phase of the process at temperatures lower than 70°C

Continued 

We always recommend that every formula undergo stability and microbial testing to ensure adequate preservation.

# AMTicide Coconut



## Heat Stability

Results from testing has shown that **AMTicide**<sup>®</sup> **Coconut** can tolerate temperatures of up to 70°C for a period of 8 hours without having any impact on MIC performance.

## Compatibility

The cationic nature of **AMTicide**<sup>®</sup> **Coconut** makes the main formulating concern potential incompatibility with highly anionic ingredients, such as thickeners. Reference [FAQs](#) for more information regarding specific anionic thickeners.

The use of solubilizing agents may help improve clarity in cases where haziness is observed.

## Recommended Techniques

**Add AMTicide**<sup>®</sup> **Coconut to the water phase:** A successful recommendation is incorporating **AMTicide**<sup>®</sup> **Coconut** into the water phase of an emulsion or during cooling phase once the emulsion has been formed. Reference [FAQs](#) for techniques with anionic thickeners.

## Additional Information

**AMTicide**<sup>®</sup> **Coconut** typically works well when added toward the end of the manufacturing process when the formulation temperature is below 70°C.

Continued 

# PhytoCide Aspen Bark Extract Powder



## PhytoCide Aspen Bark Extract Powder

Temperature Stability	<70°C
pH Stability	3 - 8
Suggested Use Levels	0.2 - 3.0%
Solubility	Water Soluble

1. We recommend starting with 3.0% **PhytoCide Aspen Bark Extract Powder**.
2. Monitor the interaction of **PhytoCide Aspen Bark Extract Powder** with other ingredients.
3. We recommend incorporating **PhytoCide Aspen Bark Extract Powder** at temperatures lower than 70°C and a pH between 3 and 8.

Continued 

We always recommend that every formula undergo stability and microbial testing to ensure adequate preservation.

# PhytoCide Aspen Bark Extract Powder

## Heat Stability

With regard to the potential negative effects of high temperatures, we have done testing to show that **PhytoCide Aspen Bark Extract Powder** can tolerate temperatures of up to 70°C.

## Compatibility

**PhytoCide Aspen Bark Extract Powder** does not interact with anionic materials and, because of this, we are not aware of any incompatibility between the product and thickeners.

## Recommended Techniques

**Add PhytoCide Aspen Bark Extract Powder to the water phase: PhytoCide Aspen Bark Extract Powder** is water soluble and may therefore be added to aqueous systems, as well as the aqueous phase of emulsions.

## Additional Information

When using **PhytoCide Aspen Bark Extract Powder** it is recommended to maintain the formulation pH between 3 and 8 and incorporate the product at temperatures below 60°C

Continued 

# PhytoCide Black Currant Powder



## PhytoCide Black Currant Powder

Temperature Stability	<75°C
pH Stability	3 - 8
Suggested Use Levels	1.0 - 3.0%
Solubility	Water Soluble

1. We recommend starting with 3.0% **PhytoCide Black Currant Powder**.
2. Monitor the interaction of **PhytoCide Black Currant Powder** with other ingredients.
3. We recommend incorporating **PhytoCide Black Currant Powder** at temperatures lower than 75°C and a pH between 3 and 8.

Continued 

We always recommend that every formula undergo stability and microbial testing to ensure adequate preservation.





# PhytoCide Black Currant Powder

## Heat Stability

With regard to the potential negative effects of high temperatures, we have done testing to show that **PhytoCide Black Currant Powder** can tolerate temperatures of up to 75°C.

## Compatibility

**PhytoCide Black Currant Powder** does not interact with anionic materials and, because of this, we are not aware of any adverse reactions between anionic thickeners.

## Recommended Techniques

**Adding PhytoCide Black Currant Powder to the water phase: PhytoCide Black Currant Powder** may be added to aqueous systems, as well as the aqueous phase of emulsions.

## Additional Information

When using **PhytoCide Black Currant Powder** it is recommended to maintain the formulation pH between 3 and 8 and incorporating the product at temperatures below 75°C

Continued 

# SynerCide Asian Fusion

## SynerCide Asian Fusion

Temperature Stability	<70°C
pH Stability	3 - 8
Suggested Use Levels	1.0 - 2.0%
Solubility	Water Soluble



1. We recommend starting with 2.0% **SynerCide Asian Fusion**.
2. Monitor the interaction of **SynerCide Asian Fusion** with other ingredients.
3. We recommend incorporating **SynerCide Asian Fusion** at temperatures lower than 70°C and a pH between 3 and 8.

Continued 

We always recommend that every formula undergo stability and microbial testing to ensure adequate preservation.

# SynerCide Asian Fusion



## Heat Stability

We have done testing to show that **SynerCide Asian Fusion** can tolerate temperatures of up to 70°C for a period of 8 hours without having any impact on MIC performance.

## Compatibility

**SynerCide Asian Fusion** does not interact with anionic materials and, because of this, we are not aware of any adverse reactions between **SynerCide Asian Fusion** and thickeners.

## Recommended Techniques

**Add SynerCide Asian Fusion to the water phase:** **SynerCide Asian Fusion** is water soluble and may therefore be added to aqueous systems, as well as the aqueous phase of emulsions.

## Additional Information

Optimal conditions for formulating with **SynerCide Asian Fusion** include maintaining a pH between 3 and 8 and temperatures below 70°C. If formulating at temperatures higher than 70°C it is recommended to add the ingredient on cooling after an emulsion has formed.

Continued 

# PhytoCide Herbal Fusion

## SynerCide Herbal Fusion (M17002)

Temperature Stability	<70°C
pH Stability	3 - 8
Suggested Use Levels	1.0 - 2.0%
Solubility	Water Soluble



1. We recommend starting with 2.0% **SynerCide Herbal Fusion**.
2. Monitor the interaction of **SynerCide Herbal Fusion** with other ingredients.
3. We recommend incorporating **SynerCide Herbal Fusion** at temperatures lower than 70°C and a pH between 3 and 8.

Continued 

We always recommend that every formula undergo stability and microbial testing to ensure adequate preservation.

# PhytoCide Herbal Fusion



## Heat Stability

We have done testing to show that **SynerCide Herbal Fusion** can tolerate temperatures of up to 70°C for a period of 8 hours without having any impact on MIC performance.

## Compatibility

**SynerCide Herbal Fusion** does not interact with anionic materials and, because of this, we are not aware of any adverse reactions between **SynerCide Herbal Fusion** and thickeners.

## Recommended Techniques

**Add SynerCide Herbal Fusion to the water phase:** **SynerCide Herbal Fusion** is water soluble and may therefore be added to aqueous systems, as well as the aqueous phase of emulsions.

## Additional Information

Optimal conditions for formulating with **SynerCide Herbal Fusion** include maintaining a pH between 3 and 8 and temperatures below 70°C. If formulating at temperatures higher than 70°C, it is recommended to add the ingredient on cooling after an emulsion has formed.

Continued 

We always recommend that every formula undergo stability and microbial testing to ensure adequate preservation.

## ArborCide OC



### Arborcide® OC

Temperature Stability	<70°C
pH Stability	3 - 8
Suggested Use Levels	2.0 - 4.0%
Solubility	Water Soluble

1. We recommend starting with 4.0% **Arborcide® OC**.
2. Monitor the interaction of **Arborcide® OC** with other ingredients for compatibility.
3. Incorporate **Arborcide® OC** into formulations at a pH between 3 and 8, during the cooling phase of the process at temperatures lower than 70°C.

**Arborcide®OC** is not Certified Organic by the USDA National Organic Program. However, it is allowed for use in Certified Organic products according to section 205.605 of the Code of Federal Regulations.

**Arborcide®OC** must be reviewed and approved for use by each customer's individual certifying agency if it is to be used in an organic finished formula.

Each agency interprets the Code of Federal Regulations in their own way. Because of this, we recommend consulting with the organic certifying agent of choice prior to submitting the finished formula for certification

Continued 

We always recommend that every formula undergo stability and microbial testing to ensure adequate preservation.

# ArborCide OC



## Heat Stability

With regard to the potential negative effects of high temperatures, we have done testing to show that **Arborcide**<sup>®</sup>**OC** can tolerate temperatures of up to 70°C.

## Compatibility

We have not encountered formulating issues with **Arborcide**<sup>®</sup> **OC**.

## Recommended Techniques

**Add Arborcide**<sup>®</sup> **OC to the water phase:** A successful recommendation is adding **Arborcide**<sup>®</sup> **OC** in the water phase of an emulsion or cooling phase once the emulsion has been formed.

## Additional Information

As with all biological materials some attention must be paid to the conditions under which **Arborcide**<sup>®</sup> **OC** is used. Applications to date have shown that the material is stable up to a temperature of 70°C. Additionally, our testing has shown that **Arborcide**<sup>®</sup> **OC** remains active between a pH of 3 and 8.

Continued 

We always recommend that every formula undergo stability and microbial testing to ensure adequate preservation.

## FAQ's

### 1. What use level is best compatible for my formulation?

When formulating with our products we recommend starting with the highest suggested use level of each AMT product. As formulations are different, the use level can be adjusted down to best fit the specific needs of the formulation.

### 2. How do I formulate with AMT products and anionic ingredients?

#### 2a. AMTicide®Coconut and Anionic Thickeners

Overall, 4.0% **AMTicide®Coconut** is compatible with the following thickeners: Carbomers (Carbopol® Ultrez 10; Carbopol® 940), Hyaluronic Acid, Carrageenan, and Xanthan Gum. Compatibility tests with these thickeners and **AMTicide®Coconut** were performed and the order of addition that provided the best clarity and viscosity are displayed below

#### 4.0% AMTicide® Coconut (M14003)

Water + Viscarin® SD 389 Carrageenan + M14003

Water + Keltrol® CG-SFT + M14003

Water + Sodium Hyaluronate/Hyaluronic Acid + M14003

Water + M14003 + Carbopol® Ultrez 10

Water + Carbopol® 940 + M14003

Continued 

We always recommend that every formula undergo stability and microbial testing to ensure adequate preservation.



## FAQ's

### 2b. Leucidal® Liquid and Anionic Thickeners

Overall, 4.0% **Leucidal® Liquid** is compatible with the following thickeners: Carbomers (Carbopol® Ultrez 10; Carbopol® 940), Hyaluronic Acid, Carrageenan, and Xanthan Gum.

Compatibility tests with these thickeners and **Leucidal® Liquid** were performed and the order of addition that provided the best clarity and viscosity are displayed below.

#### 4.0% Leucidal® Liquid (M15008)

Water + M15008 + Viscarin® SD 389 Carrageenan

Water + M15008 + Keltrol® CG-SFT

Water + M15008 + Sodium Hyaluronate/Hyaluronic Acid

Water + M15008 + Carbopol® Ultrez 10

Water + Carbopol® 940 + M15008

Continued 

We always recommend that every formula undergo stability and microbial testing to ensure adequate preservation.

## FAQ's

### 2. How do I formulate with AMT products and anionic ingredients?

#### 2c. Leucidal® Liquid Complete and Anionic Thickeners

4.0% **Leucidal® Liquid Complete** has been tested for compatibility with Carbomers (Carbopol® Ultrez 10; Carbopol® 940) and Xanthan Gum. Compatibility tests with various orders of addition deemed **Leucidal® Liquid Complete** incompatible with Carbomers. The order of addition that provided the best clarity and viscosity for Xanthan Gum is displayed below

##### 4.0% Leucidal® Liquid Complete (M15024)

Water + Keltrol® CG-SFT + M15024

#### 2d. Leucidal® Liquid SF and Anionic Thickeners

Overall, 4.0% **Leucidal® Liquid SF** is compatible with the following thickeners: Carbomers (Carbopol® Ultrez 10; Carbopol® 940), Hyaluronic Acid, Carrageenan, and Xanthan Gum. Compatibility tests with these thickeners and **Leucidal® Liquid SF** were performed and the order of addition that provided the best clarity and viscosity are displayed below.

##### 4.0% Leucidal® Liquid SF (M15019)

Water + M15019 + Viscarin® SD 389 Carrageenan

Water + M15019 + Keltrol® CG-SFT

Water + M15019 + Sodium Hyaluronate/Hyaluronic Acid

Water + M15019 + Carbopol® Ultrez 10

Water + M15019 + Carbopol® 940

Continued 

## FAQ's

### 2. How do I formulate with antimicrobials and anionic ingredients?

#### 2e. Leucidal<sup>®</sup> SF Complete and Anionic Thickeners

4.0% **Leucidal<sup>®</sup> SF Complete** has been tested for compatibility with Carbomers (Carbopol<sup>®</sup> Ultrez 10; Carbopol<sup>®</sup> 940) and Xanthan Gum. The order of addition that provided the best clarity and viscosity for these thickeners is below.

#### **4.0% Leucidal<sup>®</sup> SF Complete (M15025)**

Water + M15019 + Viscarin<sup>®</sup> SD 389 Carrageenan

Water + M15019 + Keltrol<sup>®</sup> CG-SFT

Continued 

We always recommend that every formula undergo stability and microbial testing to ensure adequate preservation.

## FAQ's

### 3. What can be used to improve the clarity or viscosity of the solution?

**Add a solubilizing agent to improve clarity:** When a lipophilic peptide such as **AMTicide**<sup>®</sup> **Coconut**, **Leucidal**<sup>®</sup> **Liquid**, or **Leucidal**<sup>®</sup> **Liquid SF** interacts

with an anionic material, haze may be observed. The haze is the result of the lipophilic portion going from fully soluble to partially soluble. A solubilizing agent, such as polysorbate 20, can be used to drag the lipophilic portion back into solution and, consequently, improve clarity. Therefore if it is possible, the addition of polysorbate is recommended at a use level of < 0.5%. If a solubilizing agent is employed, it should be incorporated after the addition of the antimicrobial.

**Add salt to improve viscosity:** In cases where this recommended procedure does not produce the desired viscosity, such as with xanthan gum, the addition of sodium chloride or sodium citrate has been shown to increase viscosity. After thorough mixing of water, salt, and **Leucidal**<sup>®</sup> **Liquid SF**, the anionic ingredient is then added to the solution and agitation is continued. In the case of xanthan gum, we have found that the salt to xanthan gum ratio should be around four parts salt to each part of xanthan gum (e.g., 2.0% sodium citrate or sodium chloride to 0.5% xanthan gum). Again, care should be taken to determine the amount and duration of agitation required to produce the desired solution.

Continued 

## FAQ's

### 4. How compatible are antimicrobials with anionic ingredients?

Overall, **AMTicide® Coconut Leucidal® Liquid** or **Leucidal® Liquid SF** is compatible with the following thickeners: Carbomers (Carbopol® Ultrez 10; Carbopol® 940), Hyaluronic Acid, Carrageenan, and Xanthan Gum. Compatibility testing was performed and viscosity curves were created for each anionic thickener.

#### 4a. Carbomers

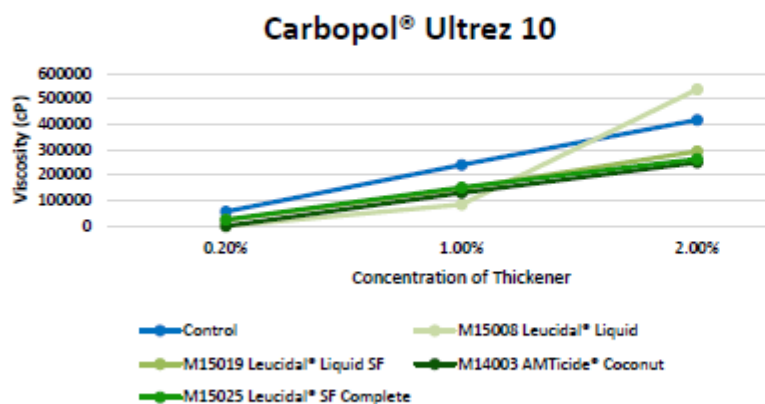


Figure 2: Viscosity Curve for Carbopol® Ultrez 10 and AMT products

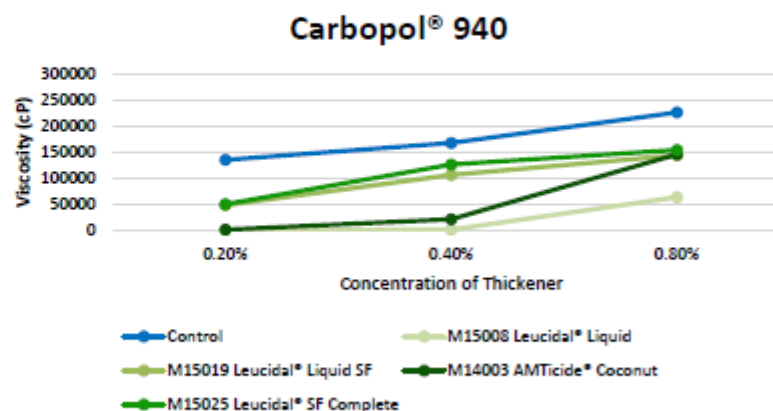


Figure 3: Viscosity Curve for Carbopol® 940 and AMT products

Continued 

We always recommend that every formula undergo stability and microbial testing to ensure adequate preservation.

## FAQ's

The order of addition for each antimicrobial that proved most compatible with each of the carbomers are outlined in the tables below.

### **Carbopol® Ultrez 10**

Water + M14003 + Carbopol® Ultrez 10

Water + M15008 + Carbopol® Ultrez 10

Water + M15019 + Carbopol® Ultrez 10

Water + M15025 + Carbopol® Ultrez 10

### **Carbopol® 940**

Water + Carbopol® 940 + M14003

Water + Carbopol® 940 + M15008

Water + M15019 + Carbopol® 940

Water + M15025 + Carbopol® 940

Continued 

We always recommend that every formula undergo stability and microbial testing to ensure adequate preservation.

# FAQ's

## 4. How compatible are the Antimicrobials with anionic ingredients?

### 4b. Xanthan Gum

#### Keltrol® CG-SFT

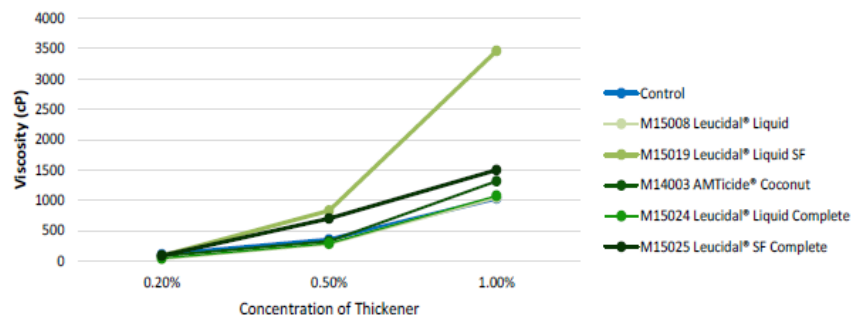


Figure 4: Viscosity Curve for Keltrol® CG-SFT and AMT products

The order of addition for each AMT product that proved most compatible with xanthan gum is outlined in the table below.

#### Keltrol® CG-SFT

Water + Keltrol® CG-SFT + M14003
Water + M15008 + Keltrol® CG-SFT
Water + M15019 + Keltrol® CG-SFT*
Water + Keltrol® CG-SFT + M15024
Water + M15025 + Polysorbate 20 + Keltrol® CG-SFT

Continued 

We always recommend that every formula undergo stability and microbial testing to ensure adequate preservation.

## FAQ's

\*The best way to go about formulating **Leucidal® Liquid SF** with xanthan gum is to add **Leucidal® Liquid SF** to the water phase and then add xanthan gum. Haziness is likely to occur, but the addition of polysorbate 20 (<0.5%) will improve clarity. If the formulator would prefer to add **Leucidal® Liquid SF** into the solution of xanthan gum and water, salt can be used. White flocculation occurs when **Leucidal® Liquid SF** is added after the xanthan gum. The flocculation forms as Leucidal Liquid SF is being introduced into the xanthan gum and water solution, suggesting that it is a result of the **Leucidal® Liquid SF** out of solution. The addition of salt (<2.0% sodium chloride or sodium citrate) lowers the charge density, pulling **Leucidal® Liquid SF** into the solution and ultimately increases the viscosity of the solution.

Continued 



## FAQ's

### 4. How compatible are the Antimicrobials products with anionic ingredients?

#### 4c. Sodium Hyaluronate/Hyaluronic Acid

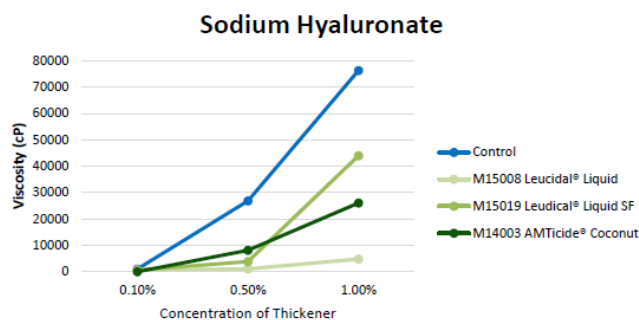


Figure 5: Viscosity Curve for Sodium Hyaluronate and AMT products

The order of addition for each AMT product that proved most compatible with sodium hyaluronate is outlined in the table below.

#### Sodium Hyaluronate

Water + Sodium Hyaluronate + M14003*
Water + M15008 + Sodium Hyaluronate
Water + M15019 + Sodium Hyaluronate

\*When formulating **AMTicide® Coconut** with sodium hyaluronate, the addition of polysorbate 20 (<0.5%) may improve clarity, however the clarity achieved may not be ideal for clear formulations

Continued 

We always recommend that every formula undergo stability and microbial testing to ensure adequate preservation.

## FAQ's

### 4. How compatible are the Antimicrobials products with the following anionic ingredients?

#### 4d. Carrageenan

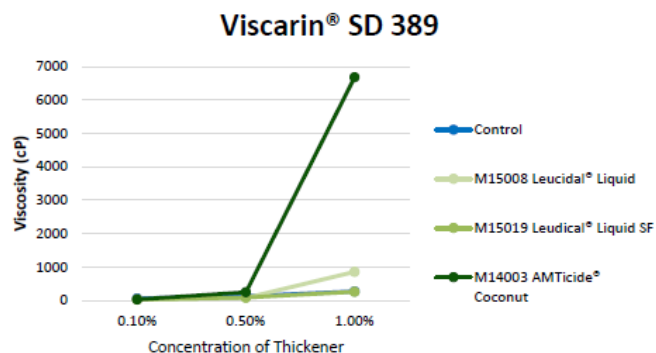


Figure 6: Viscosity Curve for Viscarin® SD 389 and AMT products

\*When formulating **AMTicide® Coconut** with Viscarin® SD 389, the addition of polysorbate 20 (<0.5%) may improve clarity, however the clarity achieved may not be ideal for clear formulations.

The order of addition for each AMT product that proved most compatible with carrageenan is outlined in the table below.

#### Viscarin® SD 389

Water + Viscarin® SD 389 Carrageenan + M14003*
Water + M15008 + Viscarin® SD 389 Carrageenan
Water + M15019 + Viscarin® SD 389 Carrageenan

Continued 

We always recommend that every formula undergo stability and microbial testing to ensure adequate preservation.

## Additional Questions?

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