

Antimicrobial Formulation Guide

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Preamble

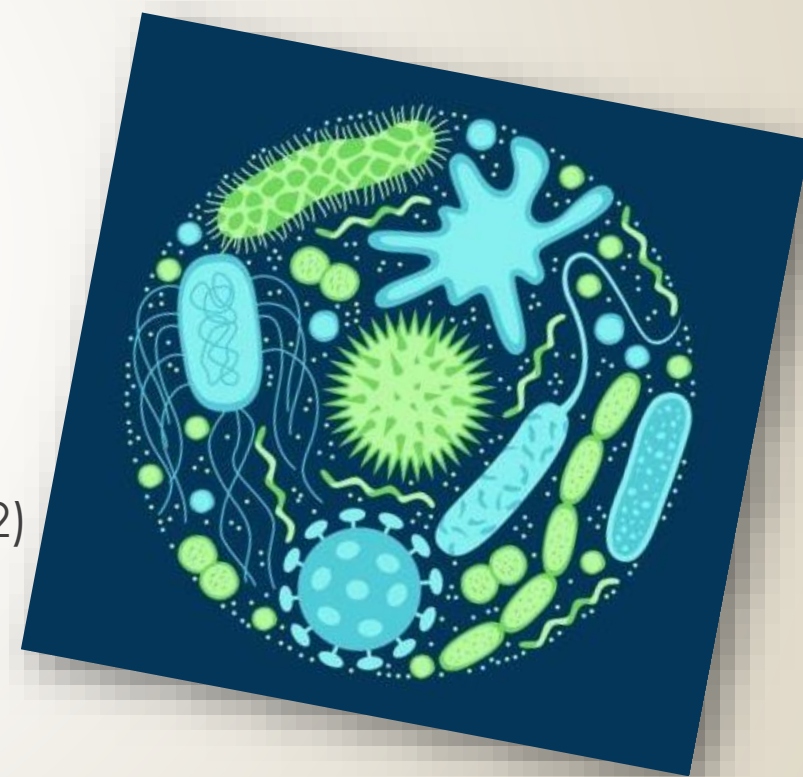
- The world of cosmetic preservation is changing. The market has been driven to alternative solutions for product preservation as a result of consumer pressure and regulatory environments. Formulator Sample Shop supplies a line of products based on naturally occurring compounds that provide active cosmetic properties, but are also capable of upholding product integrity.
- 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.

Preamble Cont.

- 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 Formulator Sample Shop's product as a means to ensure compatibility during formulation, while also providing sample formulations to allow our customers to continue leading the market with impressive formulations and innovative applications.

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AMTicide[®] Coconut (FSSM14003)

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AMTicide[®] Coconut (FSSM14003)

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

Quick Tips

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.

AMTicide® Coconut (FSSM14003)

Heat Stability

Results from testing has shown that **AMTicide® 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® 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.

AMTicide® Coconut (FSSM14003)

Recommended Techniques

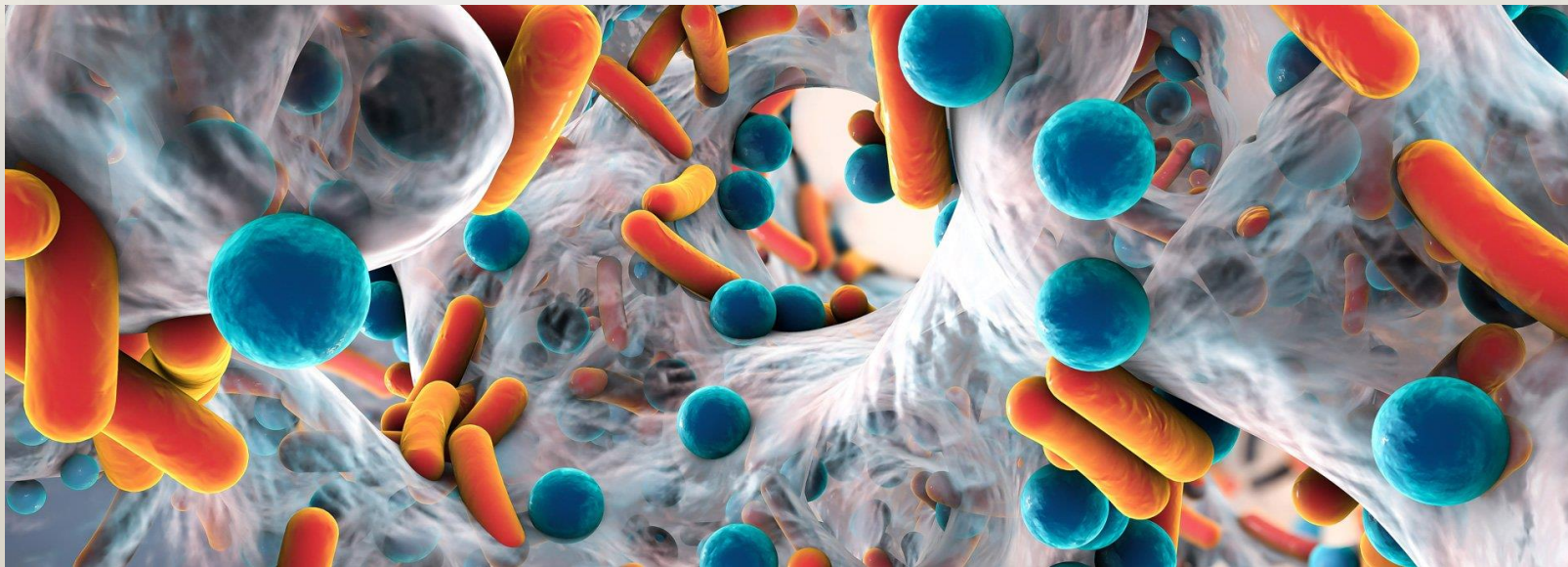
Add AMTicide® Coconut to the water phase: A successful recommendation is incorporating **AMTicide® Coconut** into the water phase of an emulsion or during cooling phase once the emulsion has been formed. Reference **FAQs** for techniques with anionic thickeners.

Additional Information

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

Leucidal[®] Liquid (FSSM15008)

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Leucidal[®] Liquid (FSSM15008)

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

Quick Tips

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.

Leucidal® Liquid (FSSM15008)

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.

Leucidal[®] Liquid (FSSM15008)

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.

Additional Information

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 Complete (FSSM15024)

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Leucidal[®] Liquid Complete (FSSM15024)

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

Quick Tips

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.

Leucidal[®] Liquid Complete (FSSM15024)



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.

Leucidal® Liquid Complete (FSSM15024)



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.

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 SF (FSSM15019)

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Leucidal[®] Liquid SF (FSSM15019)

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

Quick Tips

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.

Leucidal® Liquid SF (FSSM15019)

Heat Stability

Results from testing has shown that **Leucidal® 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® Liquid SF** makes the main formulating concern potential incompatibility with highly anionic ingredients, like Carbopol®, 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.



Figure 1: From left to right Keltrol® CG-SFT, Carbopol® Ultrez 10 and Carbopol® 940 with **Leucidal® Liquid SF**

Leucidal[®] Liquid SF (FSSM15019)

Compatibility (continued)

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**.

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.

Leucidal® Liquid SF (FSSM15019)

Recommended Techniques

Adding Leucidal® Liquid SF towards the end of the formulating process: A successful recommendation is adding **Leucidal® 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® Liquid SF** before neutralizing the anionic polymers (Novethix™ L-10 Polymer and Carbopol® Aqua SF-1 OS Polymer) resulted in the formation of precipitates. These precipitates were avoided by adding **Leucidal® Liquid SF** after the neutralization of the anionic polymers.

Leucidal[®] SF Complete (FSSM15025)

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Leucidal® SF Complete (FSSM15025)

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

Quick Tips

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.

Leucidal[®] SF Complete (FSSM15025)

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.

Leucidal® SF Complete (FSSM15025)

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.

Leucidal[®] Liquid PT (FSSM15021)

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Leucidal[®] Liquid PT (FSSM15021)

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

Quick Tips

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.

Leucidal[®] Liquid PT (FSSM15021)

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.

Leucidal® Liquid PT (FSSM15021)

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.

Additional Information

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.

PhytoCide Elderberry OS (FSSM16003)



PhytoCide Elderberry OS (FSSM16003)

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

Quick Tips

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.

PhytoCide Elderberry OS (FSSM16003)

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.

PhytoCide Elderberry OS (FSSM16003)

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.

PhytoCide Aspen Bark Extract Powder (FSSM16002)

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PhytoCide Aspen Bark Extract Powder

(FSSM16002)

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

Quick Tips

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.

PhytoCide Aspen Bark Extract Powder (FSSM16002)



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.

PhytoCide Aspen Bark Extract Powder (FSSM16002)



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.

PhytoCide Black Currant Powder (FSSM16001)

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PhytoCide Black Currant Powder

(FSSM16001)

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

Quick Tips

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.

PhytoCide Black Currant Powder (FSSM16001)

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.

PhytoCide Black Currant Powder (FSSM16001)

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.

SynerCide Asian Fusion (FSSM17001)

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SynerCide Asian Fusion (FSSM17001)

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

Quick Tips

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.

SynerCide Asian Fusion (FSSM17001)

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.

SynerCide Asian Fusion (FSSM17001)

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.

Arborcide® OC (FSSM15010)



Arborcide[®] OC (FSSM15010)

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

Quick Tips

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 (FSSM15010)

Heat Stability

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

Compatibility

We have not encountered formulating issues with **Arborcide[®] OC**.

Arborcide® OC (FSSM15010)

Recommended Techniques

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

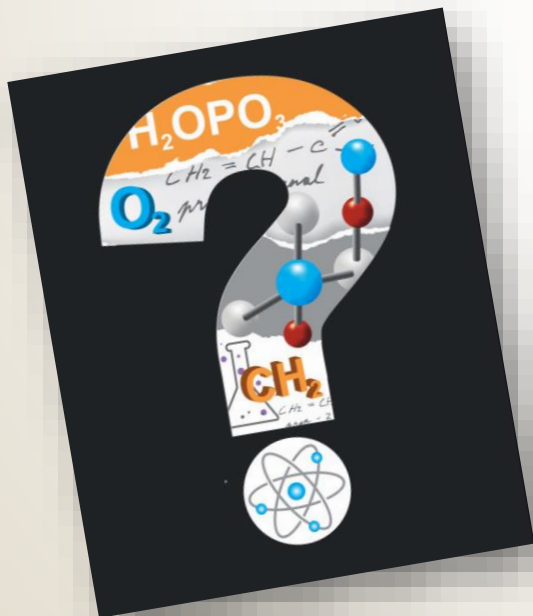
Additional Information

As with all biological materials, some attention must be paid to the conditions under which **Arborcide® 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® OC** remains active between a pH of 3 and 8.

FAQs

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 FSS product. As formulations are different, the use level can be adjusted down to best fit the specific needs of the formulation.



FAQs Cont.

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 (FSSM14003)
Water + Viscarin® SD 389 Carrageenan + FSSM14003
Water + Keltrol® CG-SFT + FSSM14003
Water + Sodium Hyaluronate/Hyaluronic Acid + FSSM14003
Water + FSSM14003 + Carbopol® Ultrez 10
Water + Carbopol® 940 + FSSM14003

FAQs Cont.

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

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 (FSSM15008)
Water + FSSM15008 + Viscarin® SD 389 Carrageenan
Water + FSSM15008 + Keltrol® CG-SFT
Water + FSSM15008 + Sodium Hyaluronate/Hyaluronic Acid
Water + FSSM15008 + Carbopol® Ultrez 10
Water + Carbopol® 940 + FSSM15008

FAQs Cont.

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 are displayed below.

4.0% Leucidal® Liquid Complete (FSSM15024)

Water + Keltrol® CG-SFT + FSSM15024

FAQs Cont.

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

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 (FSSM15019)
Water + FSSM15019 + Viscarin® SD 389 Carrageenan
Water + FSSM15019 + Keltrol® CG-SFT
Water + FSSM15019 + Sodium Hyaluronate/Hyaluronic Acid
Water + FSSM15019 + Carbopol® Ultrez 10
Water + FSSM15019 + Carbopol® 940

FAQs Cont.

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

2e. Leucidal® SF Complete and Anionic Thickeners

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

4.0% Leucidal® SF Complete (FSSM15025)
Water + FSSM15025 + Carbopol® Ultrez 10
Water + FSSM15025 + Carbopol® 940
Water + FSSM15025 + Keltrol® CG-SFT

FAQs Cont.

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® Coconut (FSSM14003)**, **Leucidal® Liquid (FSSM15008)**, or **Leucidal® Liquid SF (FSSM15019)** 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 $\leq 0.5\%$. If a solubilizing agent is employed, it should be incorporated after the addition of the FSS product.

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® Liquid SF (FSSM15019)**, 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 4 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.

FAQs Cont.

4. How compatible are FSS products with anionic ingredients?

Overall, **AMTicide® Coconut (FSSM14003)**, **Leucidal® Liquid (FSSM15008)**, or **Leucidal® Liquid SF (FSSM15019)** 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. (see next slide)

4a. Carbomers

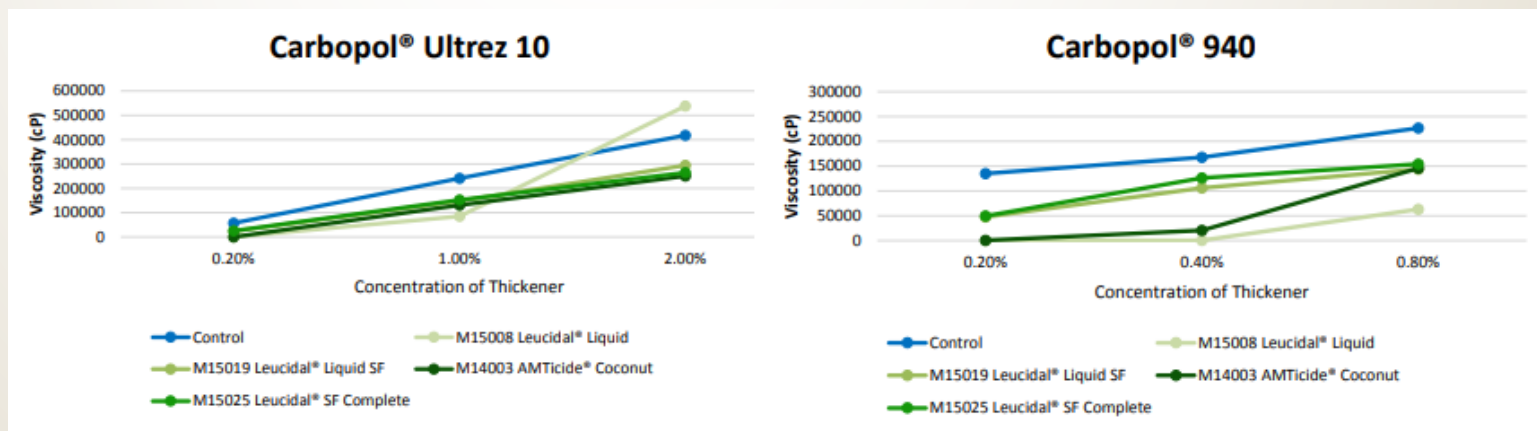


Figure 1: Viscosity Curve for Carbopol® Ultrez 10 and FSS products

Figure 2: Viscosity Curve for Carbopol® 940 and FSS products

FAQs Cont.

- ➡ The order of addition for each FSS product that proved most compatible with each of the carbomers are outlined in the tables below.

Carbopol® Ultrez 10
Water + FSSM14003 + Carbopol® Ultrez 10
Water + FSSM15008 + Carbopol® Ultrez 10
Water + FSSM15019 + Carbopol® Ultrez 10
Water + FSSM15025 + Carbopol® Ultrez 10

Carbopol® 940
Water + Carbopol® 940 + FSSM14003
Water + Carbopol® 940 + FSSM15008
Water + FSSM15019 + Carbopol® 940
Water + FSSM15025 + Carbopol® 940

FAQs Cont.

4. How compatible are FSS products with anionic ingredients?

4b. Xanthan Gum

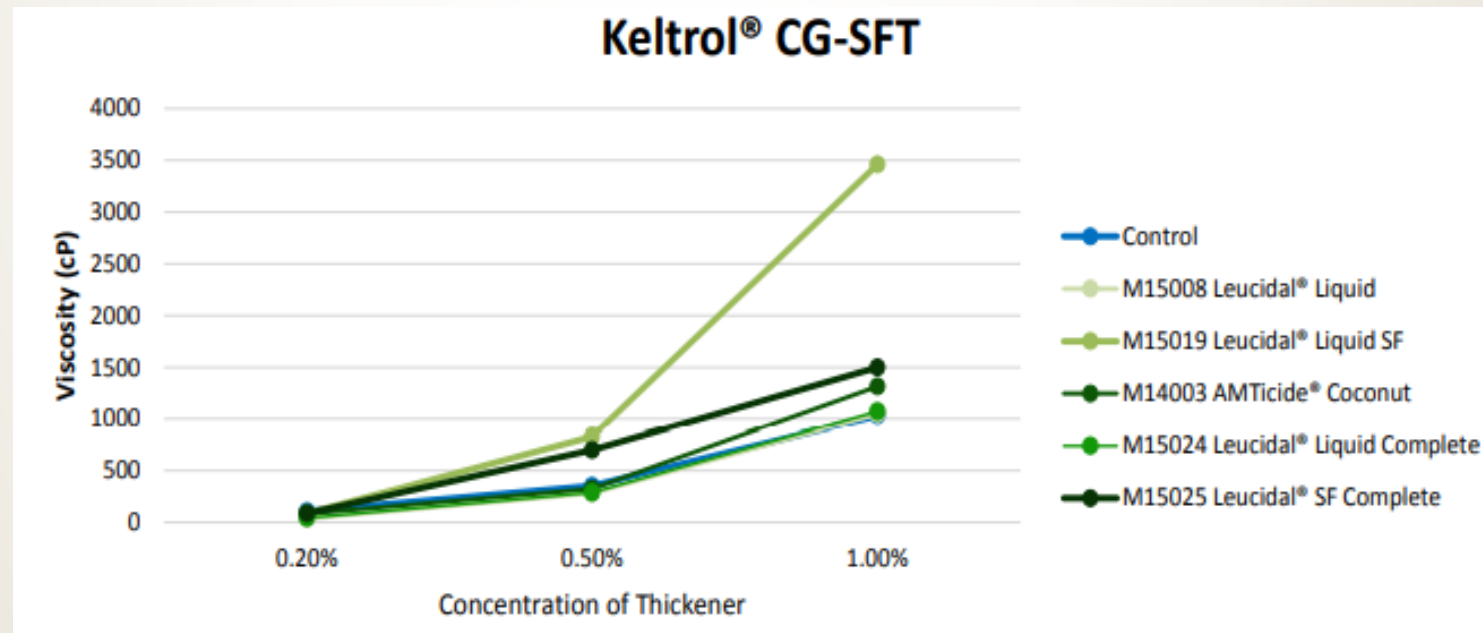


Figure 3: Viscosity Curve for Keltrol® CG-SFT and FSS products

FAQs Cont.

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

Keltrol® CG-SFT
Water + Keltrol® CG-SFT + FSSM14003
Water + FSSM15008 + Keltrol® CG-SFT
Water + FSSM15019 + Keltrol® CG-SFT*
Water + Keltrol® CG-SFT + FSSM15024
Water + FSSM15025 + Polysorbate 20 + Keltrol® CG-SFT

- *The best way to go about formulating **Leucidal® Liquid SF (FSSM15019)** with xanthan gum is to add **Leucidal® Liquid SF (FSSM15019)** to the water phase and then add xanthan gum. Haziness is likely to occur, but the addition of polysorbate 20 ($\leq 0.5\%$) will improve clarity. If the formulator would prefer to add **Leucidal® Liquid SF (FSSM15019)** into the solution of xanthan gum and water, salt can be used. White flocculation occurs when **Leucidal® Liquid SF (FSSM15019)** is added after the xanthan gum. The flocculation forms as **Leucidal® Liquid SF (FSSM15019)** is being introduced into the xanthan gum and water solution, suggesting that it is a result of the **Leucidal® Liquid SF (FSSM15019)** out of solution. The addition of salt ($\leq 2.0\%$ sodium chloride or sodium citrate) lowers the charge density, pulling **Leucidal® Liquid SF (FSSM15019)** into the solution and ultimately increases the viscosity of the solution.

FAQs Cont.

4. How compatible are FSS products with anionic ingredients?

4c. Sodium Hyaluronate/Hyaluronic Acid

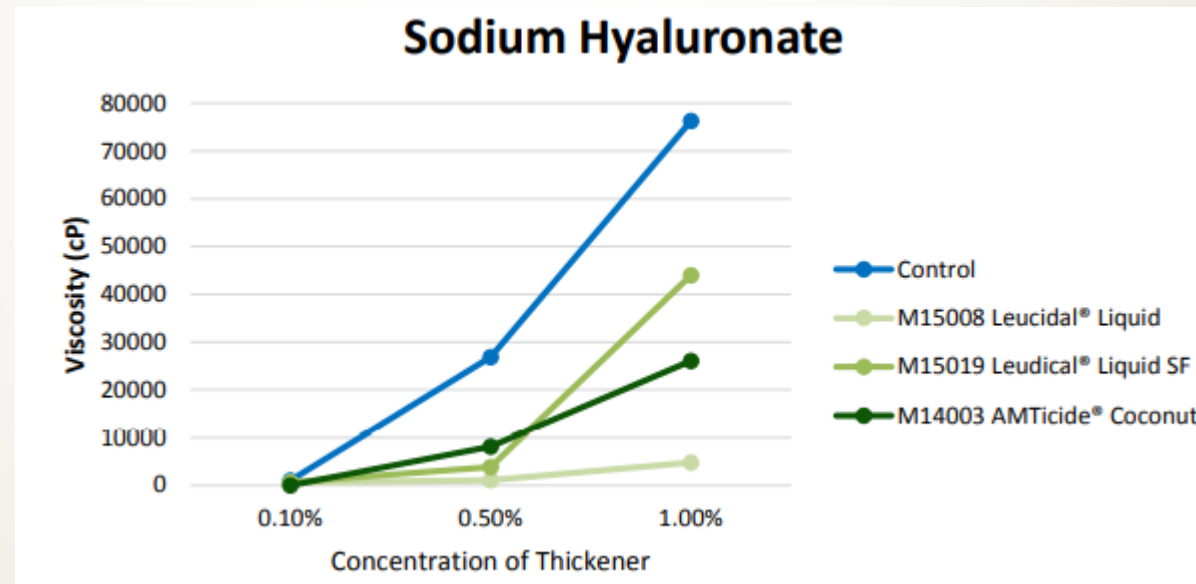


Figure 4: Viscosity Curve for Sodium Hyaluronate and FSS products

FAQs Cont.

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

Sodium Hyaluronate
Water + Sodium Hyaluronate + FSSM14003*
Water + FSSM15008 + Sodium Hyaluronate
Water + FSSM15019 + Sodium Hyaluronate

*When formulating **AMTicide® Coconut (FSSM14003)** with sodium hyaluronate, the addition of polysorbate 20 ($\leq 0.5\%$) may improve clarity, however the clarity achieved may not be ideal for clear formulations.

FAQs Cont.

4. How compatible are FSS products with anionic ingredients?

4d. Carrageenan

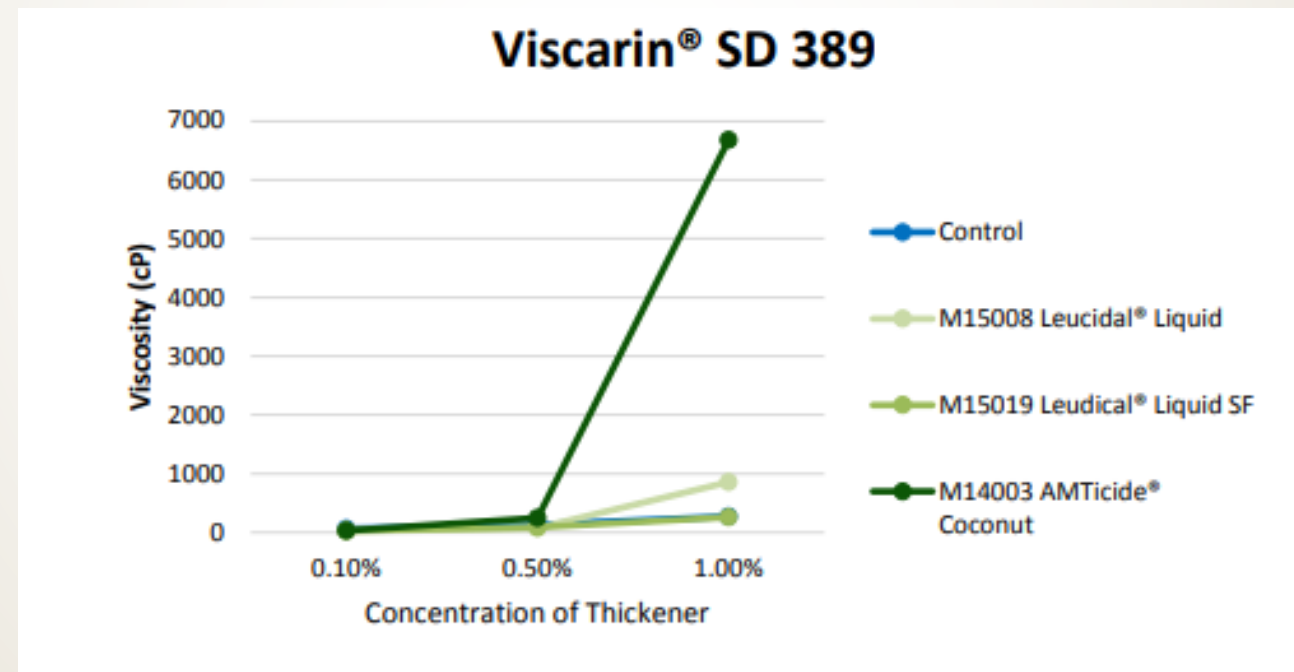


Figure 5: Viscosity Curve for Viscarin® SD 389 and FSS products

FAQs Cont.

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

Viscarin® SD 389
Water + Viscarin® SD 389 Carrageenan + FSSM14003*
Water + FSSM15008 + Viscarin® SD 389 Carrageenan
Water + FSSM15019 + Viscarin® SD 389 Carrageenan

*When formulating **AMTicide® Coconut (FSSM14003)** with Viscarin® SD 389, the addition of polysorbate 20 ($\leq 0.5\%$) may improve clarity, however the clarity achieved may not be ideal for clear formulations.

TESTING

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We always recommend Stability & Challenge Testing for every product you develop. We currently sell DIY Personal Care Product Testing Kits as a beginning point to see if your formulation will pass. We do not recommend that you solely rely on the DIY Kits, We always recommend lab testing once your product passes using the DIY Micro Kit. The Kits are available on our website under Testing.

**DIY PERSONAL CARE
PRODUCT TESTING**
Bacteria, Yeast & Mold

 **Formulator
Sample Shop**
make your mark!
www.FormulatorSampleShop.com

MICROBIAL TEST KIT

Microslides® contain a different test on each side of the paddle, for a 2-in-1 test. One side is selective for yeasts and moulds, while the other is selective for bacteria. This allows you to more easily identify contaminants.

- ✓ Microbiology training is not necessary
- ✓ For use on surfaces, liquids, & viscous materials, such as lotions or creams
- ✓ Economical price, simple application
- ✓ Available in kits of 4 or 10 Microslides®
- ✓ Shelf-life up to 9 months




**DIY PERSONAL CARE
PRODUCT TESTING**
Bacteria, Yeast & Mold


Quality Control
Check your cosmetic and personal care products for contamination using our Microslides®. It is fast, safe and easy!

Instructions
Carefully remove paddle from sterile vial and dip into a sample of a thin, aqueous solution, or apply creams and lotions to paddle with a sterile swab. Replace paddle in vial. Incubate or store at room temp.

Interpretation of Results
Check Microslide® after 24-48 hours of incubation or wait up to 5 days if stored at room temp. Includes evaluation chart for identifying level of contamination.

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Also Available:
**GNAT MX2
INCUBATOR**



MICROBIAL TEST KIT

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