COSMETIC PRESERVATIVE RESOURCE GUIDE

ELEMENT 44 INC.

CHEMISTSCORNER.COM

Introduction to preservatives

Why you need cosmetic preservatives:

1. To stop microbes from spoiling your products
2. To stop microbes from causing disease

The need for effective cosmetic preservation has been a challenge for centuries. It's even believed that the ancient Egyptians used copper sulfate to preserve their makeup. Today, preservatives are crucial to protect cosmetic products from microbial contamination, which can cause color changes, bad odors, texture variations and even pose health risks. The microbes that can infect formulas primarily include bacteria, mold, and yeast. In small quantities, they don't represent much of a problem but when they multiply, watch out. Bacteria like Pseudomonas can cause health problems including skin and eye infections, toxic shock, strep throat, and even food poisoning. Yeast like Candida albicans can cause thrush.

Why are cosmetic preservatives vilified?

More than any other ingredient, preservatives are most often called out as the worst ingredients you can use in a formula. Even the average consumer has likely heard about "evil" parabens and formaldehyde.

Preservatives are designed to kill cells. That's why they are effective. Unfortunately, that's also why they are potentially hazardous. They don't easily discriminate between good human cells and bad microbial cells. But ultimately, the risk from using preservatives is significantly lower than that of using unpreserved cosmetics. There are safe levels of "toxic" chemicals. All chemicals can be deadly if you're exposed to a high enough level. How many people die from water exposure (e.g. drowning)?

Remember, it's the dose that matters!

Cosmetic science research is ongoing in the field of preservatives since many things previously deemed safe have been reclassified as hazardous. Suppliers who can come up with even safer preservatives will likely make a lot of money.

The most important thing is that your formula MUST be adequately preserved. It's ok to try new alternatives but understand that you are taking a risk. The alternative preservative may not work as well, may break down over time and may have some unknown health risks.

This guide will cover:

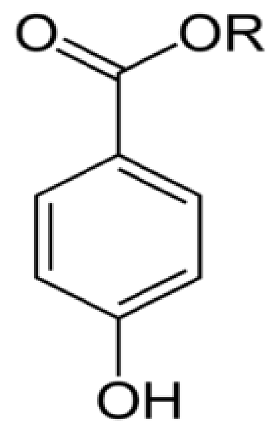
- Types of preservatives
- Factors to consider when selecting a preservative
- Important qualities when selecting a preservative
- Reference chart of commonly used preservatives and supplier blends

Types of preservatives

Parabens

Parabens are the most commonly used preservatives. They are derivatives of p-hydroxybenzoic acid and go by names like Methylparaben, Propylparaben, and Butylparaben. They are typically supplied as powders and can sometimes be difficult to incorporate into a system due to the water solubility limitations. They only function when dissolved in water so using more than its solubility profile is a waste of money. They are effective against a broad spectrum of bacteria and fungi. They do have pH limitations and are not effective against all microbes so you usually will need an additional preservative.

It's interesting to note that the safety of parabens was recently reviewed by the SCCS in the EU and determined to be safe when used at the levels found in cosmetics.



Formaldehyde donors

Formaldehyde derivatives are the next most common preservative. These compounds interfere with membrane proteins which kills microbes. They are effective against bacteria, fungi, and mold. Bad press and real safety concerns have led cosmetic chemists to stop using formaldehyde. Instead, ingredients that dissociate into formaldehyde when put in a water solution are used. These are compounds like DMDM Hydantoin and Imidazolidinyl Urea. They are most often used in surfactant systems.

Phenol derivatives

Phenol derivatives have been used in cosmetics for many years and can be effective against a range of microbes. Unfortunately, they are not as effective as the previous ingredients so their use is limited. The most common example is Phenoxyethanol. This is one of the most commonly used “natural” preservative ingredients.

Quats

Compounds that contain nitrogen and have a positive charge when placed in solution are called quaternary compounds (or quats). Many of them demonstrate an ability to kill microbes. This includes ingredients like Benzalkonium Chloride, Methene ammonium chloride, and Benzethonium chloride. Their cationic nature makes them less compatible with anionic surfactants which limits their application and use.

Alcohol

Ethanol is a great preservative but you need to use it in high levels and it faces significant environmental restrictions. Other compounds like benzyl alcohol, dichlorobenzyl alcohol, and even propylene glycol all have some anti-microbial effect. In lower levels, these compounds are less effective at preserving products.

Isothiazolones

Synthetic compounds like Methylchloro- Isothiazolinone and Methyl-Isothiazolinone are effective at incredibly low levels. They have been shown to work at a wide range of pHs and in many different formulas. There use has been stymied however, by at least one study that suggested it could cause skin sensitization.

Organic Acids and others

Various other compounds are used as preservatives but all face some limitations not experienced to the same extent as the previous ingredients discussed. Some of the most important include Sodium Benzoate, Chloracetamide, Triclosan, and Iodopropynyl Butylcarbamate. Pyridine derivatives like Sodium pyrithione and zinc pyrithione are used to kill the bacteria that causes dandruff.

Natural preservatives

Demand for “natural” or clean preservatives is rampant and has become a popular area of exploration. Unfortunately, the reality is, many of these options simply don’t work as well as traditional preservatives and have their own side effects or formulation challenges.

Nonetheless, here is a list of ingredients that “can” work. However, it should be noted that it will take a high level to get them many of these to work so they would be impractical for most cosmetics.

Natural preservatives	Alcohol	Benzoic acid and its salt Sodium Benzoate
	Boraxitrus seed extracts	Copper salts
	Fragrance oils	Glycerin
	Hinokitiol	Honey
	Japanese Honeysuckle extracts	Melaleucol (Tea Tree) oil
	Perillic acid	Salicylic acid
	Salt	Silver Chloride
	Sodium Gluconate	Sorbic acid
	Sugar	Usnic acid
	Wasabi extract	Zinc Salts

Selecting Preservatives

Preservatives are an integral part of the overall product development process, not just an additive. To minimize bioburden and reduce preservative use, factors such as product concept, formulation, manufacturing environment, packaging design, and GMP procedures should be evaluated. A thorough microbiology audit can also identify potential contaminants and necessary preservation methods to maintain product integrity.

The effectiveness of preservatives varies based on product type, complexity, emulsion types, water activity, and other factors like preservative concentration, contact time, pH, and interactions with other ingredients.

Formulation considerations

Amount of water

- Products that lack sufficient available water, such as talcum powder, mineral oil, and stick deodorants, typically do not require preservatives. However, microbial risk assessments should be conducted to consider the inadvertent addition of water by consumers, which can introduce microbial contamination.
- Aqueous products generally require preservatives unless they have low water activity, extreme pH levels, or contain antimicrobial components like alcohols, surfactants, or quaternary ammonium compounds. The effectiveness of preservatives is also influenced by the contact time between the preservative and the formulation; longer contact times result in more effective microbial kill rates.

Number of microorganisms

- A higher microbial load requires more time for the preservative system to reduce the count to an acceptable level, as too many organisms can overwhelm the system. Effective preservation is essential due to the susceptibility of natural extracts and raw materials to microbial contamination, with water being a common contaminant in the cosmetic industry.

pH and ingredient interactions

- Certain preservatives like benzoic acid or parabens are only active in their un-dissociated form. Additionally, interactions between preservatives and other ingredients can either inactivate or enhance preservative efficacy. For example, anionic surfactants can inactivate cationic preservatives, while proteins can inactivate quats, parabens, and phenolics. Conversely, raw materials like antioxidants, alcohols, aldehydes, and acids can enhance preservative effectiveness due to their own antimicrobial properties.

Manufacturing considerations

When scaling up formulas for manufacturing it's important to consider processing factors that can affect the preservation efficacy of a formulation. These include the amount of product reworking, excessive or additional heating and the storage time between manufacture and filling. The challenges faced during the filling process and final consumer use also play a role. Excessive heat during manufacturing can negatively impact heat-sensitive ingredients. When adding preservatives, ensure they are fully dissolved, especially if added as solids.

In oil-in-water systems, preservation depends on the antimicrobial agent remaining in the aqueous phase after partitioning equilibrium between water and oil. Remixing these systems can disrupt this balance, leading to inadequate preservation. Additionally, certain cleaning agents can neutralize or counteract preservatives, and some preservatives may adsorb onto equipment surfaces like plastics, PTFE, and rubber.

It's important to validate and follow manufacturing and filling procedures to ensure they are standardized and repeatable for consistent preservation efficacy.

Product packaging

Packaging influences both the preservative system and dosage. Sterile products in multi-dose containers need preservatives capable of self-sterilizing if contamination occurs. Non-sterile water-based products also require preservatives to reduce microbial bioburden quickly. Larger packs are more susceptible to contamination after opening. Therefore, packaging should prevent contaminant access, with options like pumps, collapsible tubes, and smaller packs being preferable due to lower contamination risks.

Additionally, preservatives must not be inactivated by packaging materials, such as low-density polyethylene, which can absorb parabens. Good Manufacturing Practices (GMP) are essential, as well-maintained facilities with clear procedures require lower preservative levels than those with higher microbial loads.

Preservative Factors

Selecting an effective preservative system requires a balance between using as little preservative as possible while ensuring sufficient protection. The ideal preservative system needs to have several properties, and rarely does one single raw material meet all these requirements. Therefore, multiple preservative systems are often employed to leverage the synergistic effects of different preservatives.

Broad spectrum	•The preservative should be effective against a wide range of microorgamisms, including bacteria, yeast and mold.
Stability	•Should remain stable and effective throughout the product shelf life, even under varying storage conditions.
Concentration level	•The lower the preservative concentration, the less risk of irritation and toxicity, and the lower the cost.
Solubility	•Microorganisms grow in the water phase or at the water-oil interface, so preservatives must be available in the water phase to be effective. The active ingredient's delivery system is crucial for reaching the interface where microbial growth occurs. The more water-soluble and less oil-soluble the preservative is, the better it functions. Adding a preservative to the oil phase defeats its purpose.
Compability	•It should be compatible with other ingredients in the formula and not cause adverse reactions or instability.
Aesthetics	•It should have minimal odor and color to avoid altering product aesthetics.
Shelf-life	•It should maintain activity throughout the shelf-life of the product, including varying storage conditions.
Safety	•The preservative should be safe for use as directed, causing no irritancy, allergies, sensitivities, or other serious reactions. Additionally, it should be environmentally safe.
Convenience	•The preservative should be easy to incorporate and safe to handle in its raw form.

Formulating strategies

Preservative enhancers

Chelating agents and their salts are commonly used in cosmetics for a variety of reasons including enhancing product stability and product performance, water softening, preventing product discoloration and reducing skin irritation. They also are capable of product preservation.

Chelating agents, such as EDTA (ethylenediaminetetraacetic acid), are commonly used in cosmetics as preservation potentiators or boosters. They work by binding to metal ions, which microorganisms need to grow, thus enhancing the effectiveness of preservatives. By depriving microbes of essential nutrients, chelating agents help to maintain the stability and safety of cosmetic products. Additionally, they can prevent preservatives from being deactivated by interactions with metal ions, ensuring that the antimicrobial agents remain effective throughout the product's shelf life. This dual function makes chelating agents a valuable component in cosmetic formulations, contributing to both product longevity, efficacy and safety.

Propylene glycol (PG) can also enhance preservative activity. PG increases the solubility of preservatives in the formulation, ensuring that they are evenly distributed and effective throughout the product. It can also enhance the antimicrobial activity of preservatives through synergistic effects. When used in combination with other preservatives (primarily parabens), it can improve their overall efficacy in preventing microbial growth.

Reactions and interactions

It's also important to recognize that some preservatives can react or be incompatible with certain preservative systems. While not comprehensive, the following table highlights some of the more common unwanted reactions.

Preservative	Formulation notes
DMDM Hydantoin	Reacts with Avobenzone
Imidazolidinyl Urea	Reacts with Avobenzone
Diazolidinyl Urea	Reacts with Avobenzone
Iodopropynyl Butylcarbamate	Can be inactivated by strong acids and bases
Benzethonium Chloride	Inactivated by anionics, polysorbate, and lecithin
Polyaminopropyl Biguanide	Inactivated in an alkaline environment
Chlorhexidine Digluconate	Incompatible with anionics
Phenethyl Alcohol	Inactivated by non-ionics
Sorbic Acid	Slight incompatibility with non-ionics

Commonly Used Preservatives

Type	Preservative	Spectrum	Max use level	Approvals	pH range
Acid	Dehydroacetic Acid	Yeast & Mold	Japan 0.5%, US 0.6%, EU 0.6%	Eccocert approved, NaTrue	2.0 – 7.0
Acid	Sodium Dehydroacetate	Yeast & Mold	Japan 0.5%, US 0.6%, EU 0.68%	Eccocert approved, NaTrue	2.0 – 7.0
Acid	Sodium Benzoate	Fungi	Japan 0.2%	Eccocert approved	Below 5.0
Acid	Salicylic Acid	Fungi	Japan 0.2%	Eccocert approved	Below 5.0
Acid	Benzoic Acid	Fungi	Japan 0.2%	Eccocert approved	Below 5.0
Acid	Sorbic Acid	Fungi	Japan 0.5%	Eccocert approved	Below 5.0
Acid	Potassium Sorbate	Fungi	Japan 0.5%	Eccocert approved	Below 5.0
Booster	Caprylyl Glycol	Preservative booster – Bacteria	1 – 5% use level	No restrictions	4.0-8.0
Booster	1,2 Hexanediol	Preservative booster – Bacteria	1 – 5% use level	No restrictions	2.0 – 10.0
Booster	Pentylene Glycol	Preservative booster – Bacteria	1 – 5% use level	No restrictions	2.0 – 10.0
Booster	Ethylhexylglycerin	Bacteria, Yeast, Mold	0.1 – 1% use level	No restrictions	2 – 12.0
FD	DMDM Hydantoin	Bacteria	EU 0.6%, Japan 0.3%	Requires warning label for EU & Japan	2.0 – 10.0
FD	Imidazolidinyl Urea	Bacteria	EU 0.6%, Japan 0.3%	Requires warning label for EU & Japan	3.0 – 9.0
FD	Diazolidinyl Urea	Bacteria	EU 0.6%, Japan 0.3%	Requires warning label for EU & Japan	3.0 – 9.0
FD	Quaternium 15	Bacteria	Not allowed in Japan		2.0 – 10.0
FD	Sodium Hydroxymethylglycinate	Bacteria, Yeast, Mold		Requires warning label for EU & Japan	3.5 – 12.0

Iso	Methylchloroisothiazolinone	Bacteria	Japan rinse off only		2.0 – 9.0
Iso	Methylisothiazolinone	Bacteria	Japan rinse off only		2.0 – 9.0
Misc	Iodopropynyl Butylcarbamate	Yeast & Mold	Japan 0.2%, US 1%. EU 0.2% rinse off	Japan, US, EU	2.0 – 10.0
Misc	Benzyl Alcohol	Bacteria			Below 5.0
Misc	Gluconolactone	Bacteria		Eccocert approved, NaTrue	Below 5.0
Misc	Benzethonium Chloride	Bacteria, Fungi			6.0-9.0
Misc	Polyaminopropyl Biguanide	Bacteria			5.0-7.0
Misc	Chlorhexidine Digluconate	Bacteria	Japan 0.25% leave-on, no limit rinse-off, EU 1.5%, US 1%		6.0-8.0
Misc	Phenoxyethanol	Bacteria, yeast	Japan 1.0%, EU 1.0%		3.0 – 10.0
Misc	Phenethyl Alcohol	Bacteria	1% use level	Not listed as preservative in Japan or EU	Below 7.0
Misc	Chlorphenesin	Fungi	Japan 0.3%, EU 0.3%		Below 5.0
Paraben	Methylparaben	Fungi	Japan 1.0%, EU 0.8%		3.5 – 8.0
Paraben	Propylparaben	Fungi	Japan 1.0%, EU 0.8%		3.5 – 8.0
Paraben	Butylparaben	Fungi	Japan 1.0%, EU 0.8%		3.5 – 8.0
Paraben	Ethylparaben	Fungi	Japan 1.0%, EU 0.8%		3.5 – 8.0
Paraben	Isopropylparaben	Fungi	Japan 1.0%, EU 0.8%		3.5 – 8.0
Paraben	Isobutylparaben	Fungi	Japan 1.0%, EU 0.8%		3.5 – 8.0
Paraben	Sodium Methylparaben	Fungi	Japan 1.0%, EU 0.8%		3.5 – 8.0
Paraben	Sodium Propylparaben	Fungi	Japan 1.0%, EU 0.8%		3.5 – 8.0
Paraben	Sodium Butylparaben	Fungi	Japan 1.0%, EU 0.8%		3.5 – 8.0
Paraben	Sodium Ethylparaben	Fungi	Japan 1.0%, EU 0.8%		3.5 – 8.0

NOTE: FD=FORMALDEHYDE DONOR

Preservative Blends by Supplier*

Company	Trade name	INCI name	Effectiveness	Use level	pH
Ashland	Optiphen, 200, 300	Phenoxyethanol (and) Caprylyl Glycol	B, Y, M	0.75 – 1.5%	4 – 8
Ashland	Optiphen Plus	Phenoxyethanol (and) Caprylyl Glycol (and) Sorbic Acid	B, Y, M	0.75 – 1.5%	4 – 6
Ashland	Optiphen BSP	Phenoxyethanol (and) Propylene Glycol (and) Sorbic Acid (and) Benzoic acid	B, Y, M	0.3 – 1%	up to 5.4
Ashland	Optiphen ND	Phenoxyethanol (and) Benzoic acid (and) Dehydroacetic acid	B, Y, M	0.3 – 1%	up to 6.4
Ashland	Optiphen PO	Phenoxyethanol	B, Y, M	up to 1%	3 – 10
Ashland	Optiphen DP	Propylene Carbonate (and) Benzoic Acid (and) Dehydroacetic Acid (and) Propanediol	B, Y, M	0.3 – 2%	up to 6.0
Ashland	Optiphen DLP	Propylene Carbonate (and) Dehydroacetic Acid	Y, M	0.3 – 2%	up to 6.4
Ashland	Optiphen BD	Benzyl Alcohol (and) Benzoic acid (and) Dehydroacetic acid	B, Y, M	0.3 – 1%	up to 6.4
Ashland	Optiphen BSB-W	Benzyl Alcohol (and) Sodium Benzoate (and) Potassium Sorbate	B, Y, M	0.3 – 1%	up to 5.4
Ashland	Optiphen BS	Sodium Benzoate (and) Potassium Sorbate	B, Y, M	0.3 – 1%	up to 5.4
Ashland	Optiphen BSB-N	Benzyl Alcohol (and) Glycerin (and) Benzoic acid (and) Sorbic acid	B, Y, M	0.3 – 1%	up to 5.4
Ashland	Conarom P aromatic	Phenethyl Alcohol (and) Caprylyl Glycol (and) Trideceth-8	B, Y, M	0.3 – 2%	4 – 8
Ashland	Conarom P2 aromatic	Phenethyl Alcohol (and) Caprylyl Glycol (and) Propanediol (and)	B, Y, M	0.3 – 2%	4 – 8
		Polyglyceryl-4 Laurate/Sebacate (and) Polyglyceryl-6 Caprylate/Caprate			
Ashland	Germaben II	Propylene Glycol (and) Diazolidinyl Urea (and) Methylparaben (and) Propylparaben	B, Y, M	0.5 – 1.0%	3 – 7.5
Ashland	Germall 115	Imidazolidinyl Urea	B	0.2 – 0.6%	3 – 9
Ashland	Germall II	Diazolidinyl Urea	B	0.1 – 0.3%	3 – 9
Ashland	Germall Plus	Diazolidinyl Urea (and) Iodopropynyl Butylcarbamate	B, Y, M	0.05 – 0.2%	3 – 8
Ashland	Liquid Germall Plus	Propylene Glycol (and) Diazolidinyl Urea (and) Iodopropynyl Butylcarbamate	B, Y, M	0.1 – 0.5%	3 – 8
Ashland	Liquigard	Butylene Glycol (and) Iodopropynyl Butylcarbamate	Y, M	0.1 – 0.2%	4 – 9
Ashland	Optiphen MIT	Methylisothiazolinone	B	0.05 – 0.1%	2 – 10
Ashland	Optiphen MIT Plus	Methylisothiazolinone (and) Phenethyl Alcohol (and) PPG-2 Methyl Ether	B, Y, M	0.05 – 0.2%	2 – 10
Ashland	Optiphen MIT Ultra	Methylisothiazolinone (and) Phenylpropanol (and) Propylene Glycol	B, Y, M	0.05 – 0.3%	2 – 10
Ashland	Liquapar Oil	Isoropylparaben & Isobutylparaben & Butylparaben	B, Y, M	0.3 – 1%	3 – 7.5
Ashland	Liquapar Optima	Phenoxyethanol & Methyparaben & Isoropylparaben & Isobutylparaben & Butylparaben	B, Y, M	0.4 – 0.8%	3 – 7.5

Ashland	Liquapar PE	Phenoxyethanol & Isoropylparaben & Isobutylparaben & Butylparaben	B, Y, M	0.5 – 1.0%	3 – 7.5
Ashland	Liquapar MEP	Methylparaben & Ethylparaben (and) Propylparaben	B, Y, M	0.5 – 1.0%	3 – 7.5
Ashland	Liquapar PN	Phenoxyethanol & Methylparaben & Ethylparaben & Propylparaben & Butylparaben	B, Y, M	0.3 – 1%	3 – 7.5
Ashland	Liquaguard S-1	Methylchloroisothiazolinone (and) Methylisothiazolinone	B, Y, M	0.03 – 0.1%	3 – 8
Ashland	Suttocide A	Sodium Hydroxymethylglycinate	B, Y, M	0.5 – 1.0%	3.5 – 12
Lonza	Biovert Enzyme and Substrate	Glucose (and) Lactoperoxidase (and) Glucose Oxidase	B, Y, M	1.00%	4 – 6
Lonza	Cosmocil CQ	Polyaminopropyl Biguanide	B	0.2– 1.5%	3 – 10
Lonza	Geogard 111A	Dehydroacetic Acid	Y, M	0.1– 0.6%	2 – 6.5
Lonza	Geogard 111S	Sodium Dehydroacetate	Y, M	0.1– 0.6%	2 – 6.5
Lonza	Geogard 221	Dehydroacetic Acid (and) Benzyl Alcohol (and) Water	B, Y, M	0.2– 1.1%	2 – 7
Lonza	Geogard ECT	Benzyl Alcohol (and) Salicylic Acid (and) Glycerin (and) Sorbic Acid	B, Y, M	0.6– 1.0%	3 – 8
Lonza	Geogard Ultra	Gluconolactone (and) Sodium Benzoate	B, Y, M	0.75– 2.0%	3 – 6.5
Lonza	Glycacil 2000	Iodopropynyl Butylcarbamate	Y, M	0.15– 0.5%	2 – 10
Lonza	Glycacil L	Iodopropynyl Butylcarbamate	Y, M	0.1 – 0.3%	2 – 10
Lonza	Glydant	DMDM Hydantoin	B	0.1 – 0.6%	2 – 10
Lonza	Glydant LTD	DMDM Hydantoin	B	0.1 – 0.6%	2 – 10
Lonza	Glydant 2000	DMDM Hydantoin	B	0.1 – 0.6%	2 – 10
Lonza	Glydant Plus	DMDM Hydantoin (and) Iodopropynyl Butylcarbamate	B, Y, M	0.075– 0.18%	2 – 10
Lonza	Glydant Plus Liquid	DMDM Hydantoin (and) Iodopropynyl Butylcarbamate	B, Y, M	0.15– 0.36%	2 – 10
Lonza	Isocil PC	Methylchloroisothiazolinone (and) Methylisothiazolinone	B	0.05– 0.1%	3 – 9
Lonza	Lonzagard	Benzethonium Chloride	B	0.1– 0.5%	6 – 9
Lonza	Lonzaserve PC	DMDM Hydantoin(and) Methylchloroisothiazolinone (and) Methylisothiazolinone	B, Y, M	0.25– 0.6%	3 – 9
Lonza	Mikrokill COS	Phenoxyethanol (and) Caprylyl Glycol (and) Chlorphenesin	B, Y, M	0.75– 1.5%	3 – 8
Lonza	Spectradyne™	Chlorhexidine Digluconate	B	0.25– 1.5%	6 – 8
Inolex	Aromastat	Caprylhydroxamic Acid (and) Phenethyl Alcohol (and) Glycerin	B, Y, M		up to 5.5
Inolex	Benzostat	Caprylhydroxamic acid (and) Benzyl alcohol (and) Glycerin	B, Y, M		up to 5.5
Inolex	Phenostat	Caprylhydroxamic Acid (and) Phenethyl Alcohol (and) Glycerin	B, Y, M		up to 5.5
Inolex	Zeastat	Caprylhydroxamic Acid (and) Propanediol	B, Y, M		up to 5.5
Inolex	Spectrastat	Caprylhydroxamic Acid (and) Caprylyl Glycol (and) Glycerin	B, Y, M		up to 5.5

Inolex	Spectrastat G	Caprylhydroxamic Acid (and) Glyceryl Caprylate (and) Methylpropanediol	B, Y, M		up to 5.5
Inolex	Spectrastat G2	Caprylhydroxamic Acid (and) Glyceryl Caprylate (and) Glycerin	B, Y, M		up to 5.5
Inolex	Spectrastat G2-N	Caprylhydroxamic Acid (and) Glyceryl Caprylate (and) Glycerin	B, Y, M		up to 5.5
Inolex	Spectrastat E	Caprylhydroxamic Acid (and) Ethylhexylglycerin (and) Methylpropanediol	B, Y, M		up to 5.5
Inolex	Spectrastat OEL	Caprylhydroxamic Acid (and) Caprylyl Glycol (and) Ethylhexylglycerin (and) Propanediol	B, Y, M		up to 5.5
Inolex	Spectrastat OL	Caprylhydroxamic Acid (and) Caprylyl Glycol (and) Propanediol	B, Y, M		up to 5.5
Inolex	Spectrastat BHL	Caprylhydroxamic Acid (and) 1,2-Hexanediol (and) Butylene Glycol	B, Y, M		up to 5.5
Inolex	Spectrastat PHL	Caprylhydroxamic Acid (and) 1,2-Hexanediol (and) Propanediol	B, Y, M		up to 5.5
Inolex	Lexgard Natural	Glyceryl Caprylate (and) Glyceryl Undecylenate	B, Y, M		up to 8
Inolex	Lexgard GCP	Glyceryl Caprylate (and) Phenethyl Alcohol	B, Y, M		up to 8
Inolex	Lexgard HPO	Caprylyl Glycol (and) Phenoxyethanol (and) Hexylene Glycol	B, Y, M		up to 8
Inolex	Lexgard OE 90	Caprylyl Glycol (and) Ethylhexylglycerin	Y, M		up to 8
Inolex	Lexgard NAP	Caprylyl Glycol (and) Phenethyl Alcohol	B, Y, M		up to 8
Inolex	Lexgard PE 9010	Phenoxyethanol (and) Ethylhexylglycerin	B, Y, M		4 – 8
Ele	PEL-STAT G221	Benzyl Alcohol (and) Dehydroacetic Acid	B, Y, M		up to 5.0
3V	3CC	Triclocarban	B	0.2 – 2%	up to 8
Schulke	Euxyl PE 9010	Phenoxyethanol (and) Ethylhexylglycerin	B, Y, M	0.5 – 1.0%	4 – 8
Schulke	Euxyl K 100	Benzyl Alcohol & Methylchloroisothiazolinone (and) Methylisothiazolinone	B, Y, M	0.05 – 0.15%	up to 8
Schulke	Euxyl K 220	Methylisothiazolinone (and) Ethylhexylglycerin	B, Y, M	0.03 – 0.1%	up to 10
Schulke	Euxyl K 300	Phenoxyethanol & Methylparaben & Ethylparaben & Propylparaben & Butylparaben & Isobutylparaben	B, Y, M	0.5 – 1.0%	up to 8
Schulke	Euxyl K 320	Phenoxyethanol & Methylparaben & Ethylparaben & Propylene Glycol	B, Y, M	0.5 – 1.4%	up to 8
Schulke	Euxyl K 350	Phenoxyethanol & Methylparaben & Ethylparaben & Propylene Glycol & Ethylhexylglycerin	B, Y, M	0.5 – 1.4%	up to 8
Schulke	Euxyl K 500	Diazolidinyl Urea & Sodium Benzoate & Potassium Sorbate	B, Y, M	0.2 – 1.5%	4 – 7
Schulke	Euxyl K 510	DMDM Hydantoin & Methychloroisothiazolinone & Methylisothiazolinone	B, Y, M	0.05 – 0.15%	up to 8
Schulke	Euxyl K 700	Phenoxyethanol & Benzyl Alcohol & Potassium Sorbate and Tocopherol	B, Y, M	0.5 – 1.5%	3 – 5.5
Schulke	Euxyl K 701	Phenoxyethanol & Benzoic Acid & Dehydroacetic Acid & Ethylhexylglycerin	B, Y, M	0.4 – 1.2%	up to 6.0
Schulke	Euxyl K 702	Phenoxyethanol & Benzoic Acid & Dehydroacetic Acid & Ethylhexylglycerin & Polyaminopropyl Biguanide	B, Y, M	0.2 – 1.0%	up to 6.0
Schulke	Euxyl K 703	Phenoxyethanol & Benzoic Acid & Dehydroacetic Acid	B, Y, M	0.4 – 1.2%	up to 6.0

Schulke	Euxyl K 712	Sodium Benzoate (and) Potassium Sorbate	B, Y, M	0.5 – 1.5%	up to 5.5
Schulke	Euxyl K 900	Benzyl Alcohol & Ethylhexylglycerin & Tocopherol	B, Y, M	0.5 – 1.0%	up to 12
Schulke	Euxyl K 903	Benzyl Alcohol & Benzoic Acid & Dehydroacetic Acid & Tocopherol	B, Y, M	0.4 – 1.2%	up to 6.0
Schulke	Euxyl K 940	Phenoxyethanol & Benzyl Alcohol & Ethylhexylglycerin and Tocopherol	B, Y, M	0.5 – 1.5%	up to 12
Clariant	Nipaguard SCP	Phenoxyethanol & Sorbitan Caprylate	B, Y, M		4 – 8
Clariant	Nipaguard PO 5	Phenoxyethanol & Piroctone Olamine & Water	B, Y, M		up to 6.0
Clariant	Nipaguard POB	Phenoxyethanol & Benzoic Acid & Piroctone Olamine	B, Y, M		up to 6.0
Solvay	Phenagon PBD	Phenoxyethanol & Benzoic Acid & Dehydroacetic Acid	B, Y, M	0.5 – 1.25%	
Solvay	Mackstat GCM	Glyceryl Caprylate & Methylisothiazolinone	B, Y, M	0.5 – 1.0%	
Solvay	Mackaderm GCP	Phenethyl Alcohol & Glyceryl Caprylate	B, Y, M	0.5 – 1.66%	
Solvay	Paragon IB-PG	Propylene Glycol & Iodopropynyl & Butylcarbamate	B, Y, M	0.8 – 1.2%	
Solvay	Paragon	Propylene Glycol & DMDM Hydantoin & Methylparaben	B, Y, M		
Solvay	Paragon II	Propylene Glycol & DMDM Hydantoin & Methylparaben & Propylparaben	B, Y, M		
Solvay	Paragon III	Phenoxyethanol & DMDM Hydantoin & Methylparaben & Propylparaben	B, Y, M		
Solvay	Paragon G2	Propylene Glycol & Diazolidinyl Urea & Methylparaben & Propylparaben	B, Y, M		
Solvay	Paragon PPM	Phenoxyethanol & Methylparaben & Propylparaben & Ethylparaben & Butylparaben & Isobutylparaben	B, Y, M		
Solvay	Paragon MEPB	Phenoxyethanol & Methylparaben & Propylparaben & Ethylparaben & Butylparaben	B, Y, M		

NOTE: B=BACTERIA, M=MOLD, Y=YEAST

**always confirm use levels, availability and regulatory compliance with supplier before using as specifications may have changed*