Cosmetic Preservation Training

FORMULATING PRODUCTS THAT ARE SAFE, EFFICACIOUS AND COMPLIANT

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November 2025

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Get your Free Bonuses!

- Preservative handbook
- List of over 100 preservative & blends

- Comprehensive slide deck with additional information

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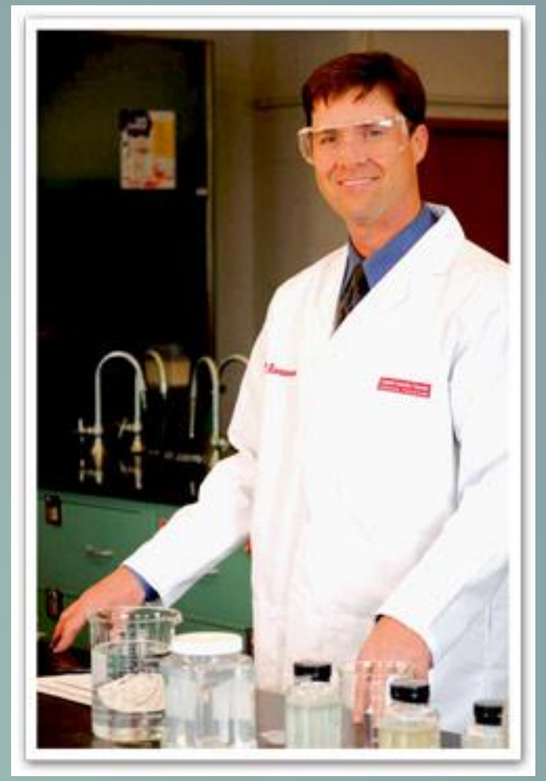
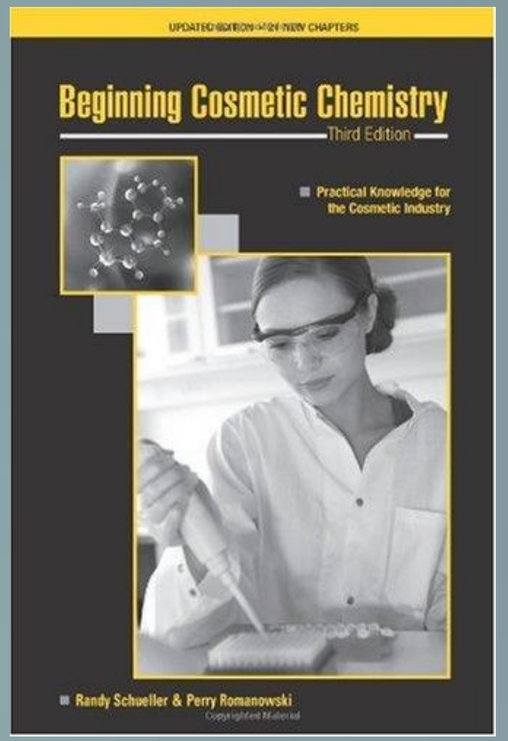
About Me

- Chemistry degree DePaul University
  - Biochemistry
- 30+ years Cosmetic Scientist - Formulator
- Alberto Culver
- Vice President SCC - 2026
- Past Education Chair of the IFSCC
- Founder Element 44 Inc





Scope of this Training

- Introduction to preservatives
- Types of preservatives
- Factors to consider when choosing preservatives
- Formulation tips and using AI
- Preservative testing
- Q&A

Why are preservatives important?

Types of microbes to worry about

- Microbes
- Single-celled organisms
- Bacteria
  - Gram Positive
  - Gram Negative
- Fungi – Yeasts / Molds
- Protists

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Microbe Effects on Formulas

- Break down emulsions
- Visible growth
- Create bad odors
- Make clear formulas hazy
- Change colors
- Reduce viscosity / thickness
- Reduce pH
- Make products less effective

How your product gets contaminated

- *Things you can control*
  - Production conditions
  - Raw material quality
  - Production / filling equipment cleanliness
  - Packaging / shipping conditions

- *You can’t control*
  - Consumer contamination

Why you need a preservative system

You ***always need*** a way to stop microbes from growing in your formulas to ensure product safety and efficacy

- It is ***illegal*** to sell unsafe cosmetic products
- Written into the FDA regulations & the EU regulations

Microbes need 2 things to grow…

- Food source
- Water

Water activity

Minimum water activities at which active growth can occur	
Group of micro-organism	Minimum aw
Most Gram-negative bacteria	0.97
Most Gram-positive bacteria	0.90
Most yeasts	0.88
Most filamentous fungi	0.80
Halophilic bacteria	0.75
Xerophilic fungi	0.61
Osmophilic yeasts	0.60

What about Honey?

Formula Preservation

- ***Process*** of protecting cosmetic products from microbial contamination

- Main parts of this process are:
  - Good (hygienic) Manufacturing Procedures
  - Preservative System

Don’t contaminate your product while making it!

Hygienic Manufacturing

- Clean environment
- Equipment clean
- High quality raw materials

Components of a Preservative system

- Preservatives
- Preservative boosters
- Component raw materials
- Formula pH level
- Water activity level
- Packaging

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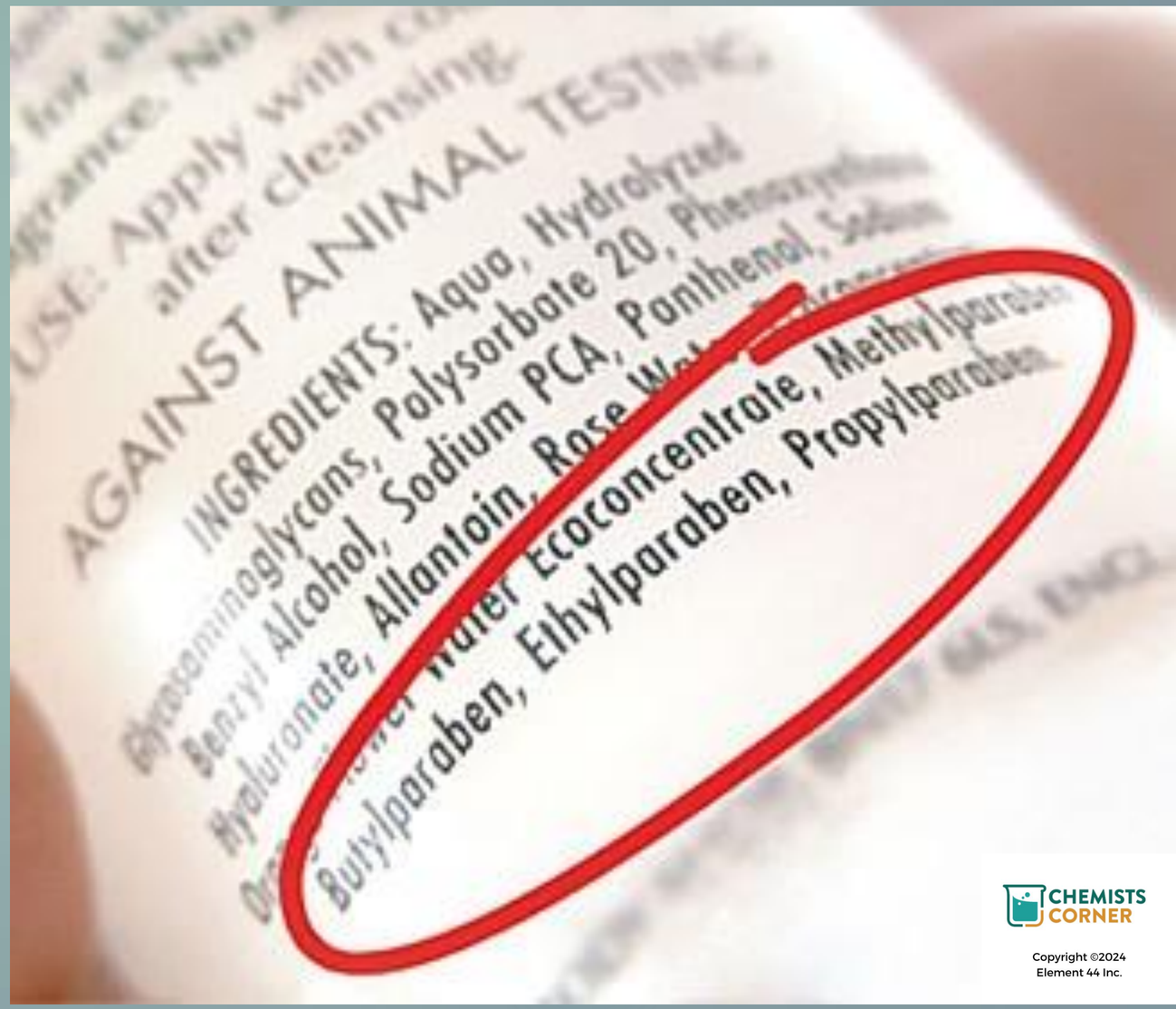
What is a Preservative?

- Any compound used to kill or prevent the growth of microbes in a formulation
- Ingredients listed in Annex V (EU)



Characteristics of an Ideal Preservative

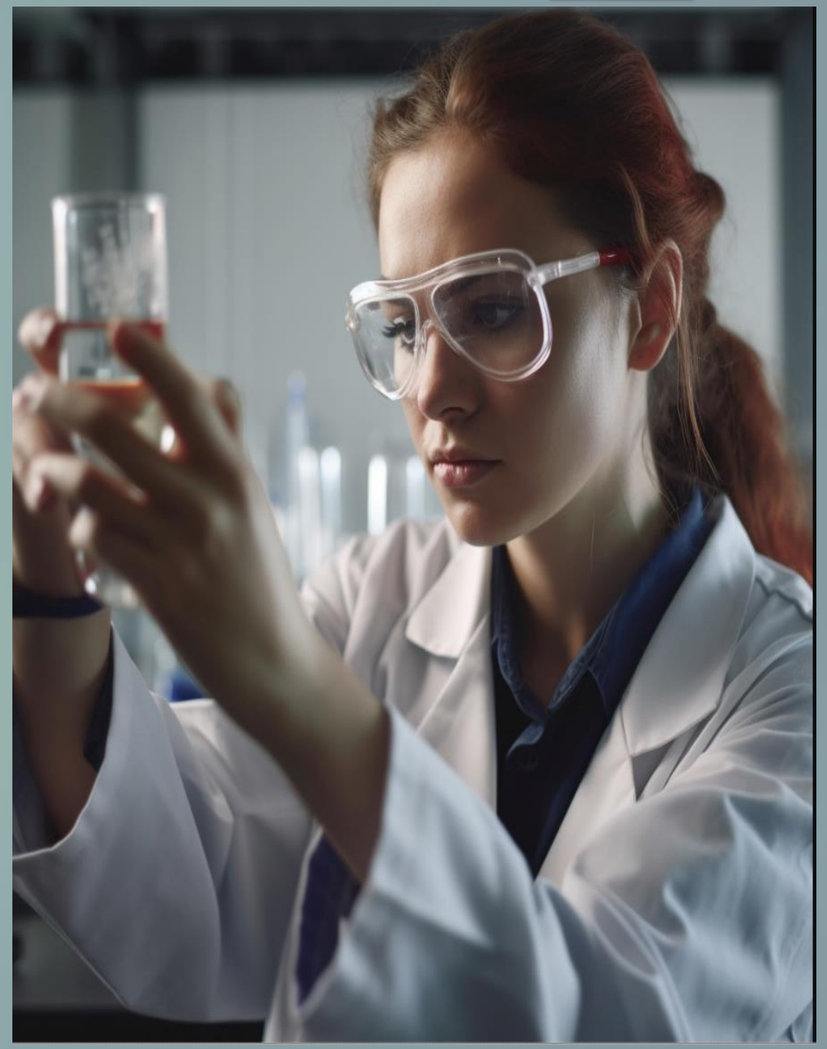
- Effective against all microbes (Broad spectrum activity)
- Kills quickly
- Stable and effective for over a year
- Safe at use concentrations
- Easy and safe to handle in concentrated form (pref. liquid)
- Effective at wide pH range
- Compatible
- Odorless and colorless
- Water soluble
- Heat stable to at least 80°C
- Approved worldwide
- Cost effective
- Acceptable to consumers and retailers

Natural vs Synthetic

Synthetic is dangerous and natural is safe

Not true!

Origin is not related to ingredient safety!



Preservatives in Formulating

- Traditional Preservatives
- Natural-ish / Green preservatives
- Non-standard Preservatives

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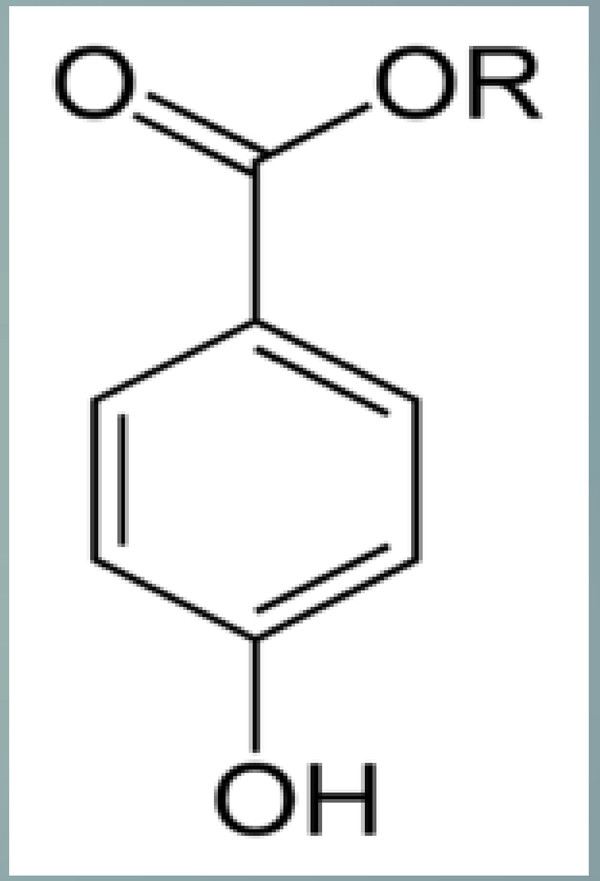
Traditional Preservatives

- Parabens
- Formaldehyde donors
- Isothiazolinones

Parabens

- Esters of parahydroxybenzoic acid
- Methyparaben
- Ethylparaben
- Propylparaben
- Butylparaben
- **Isopropylparaben - banned in EU*
- **Isobutylparaben - banned in EU*
- Plus…their sodium salts
  - (e.g. sodium methylparaben)



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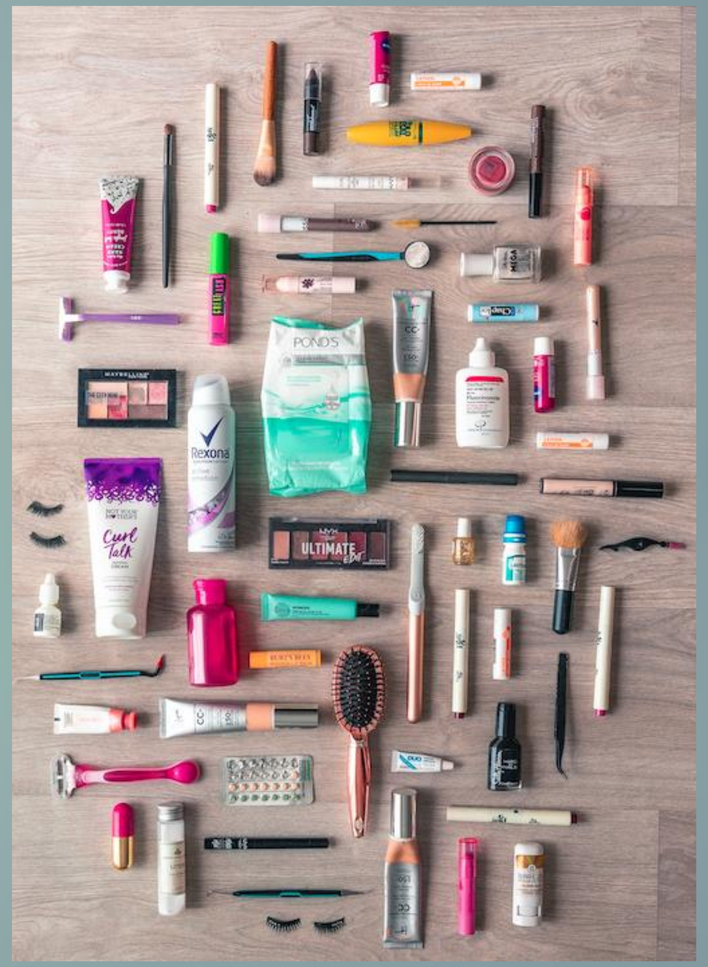
Parabens

- Many benefits
- Effectiveness - Kill Fungi (mold & yeast)
- Formulating
- Compatibility

- Formulating tips
  - Not compatible with polysorbates / Lecithin
  - Incompatible with some proteins
  - Heat stable
    - pH range: 3.5 – 8.0
    - Use range: 0.1 – 0.4%

Parabens

- Poor public perception due to misinformation
- Thought to be a weak hormone disrupter
- Implied concern between paraben use and breast cancer
- SCCS validated safety
- Still widely used but many brands claim “paraben free”



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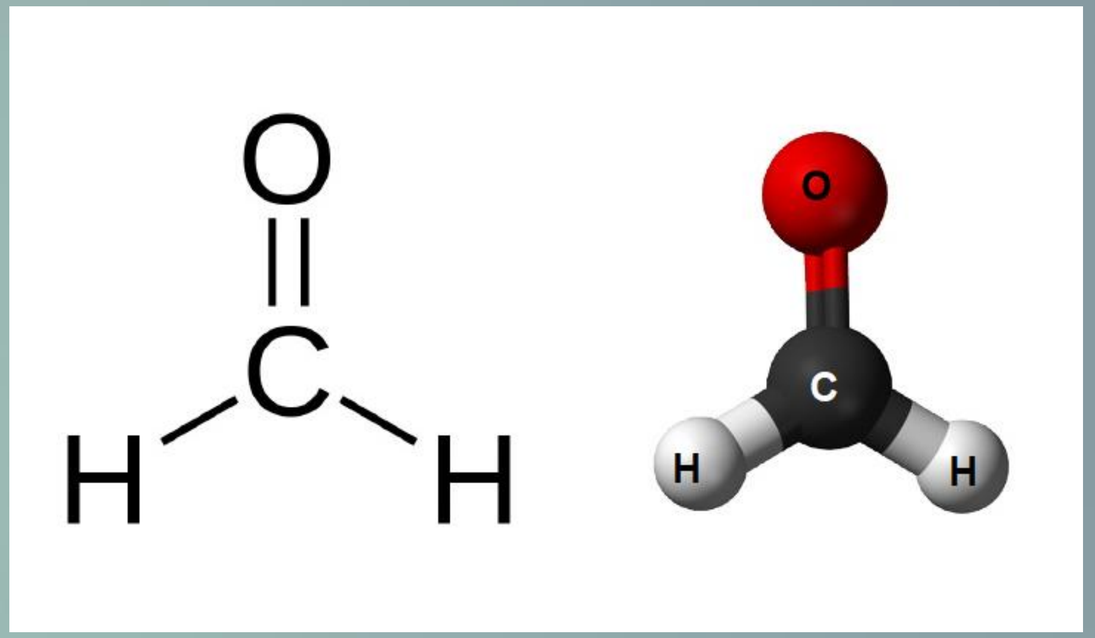
Formaldehyde Donors (FD)

- Formalin (37% solution)
  - Sometimes called Methylene Glycol
- DMDM Hydantoin
- Quaternium 15
- Diazolidinyl Urea
- Imidazolidinyl Urea
- Sodium Hydroxymethyl Glycinate

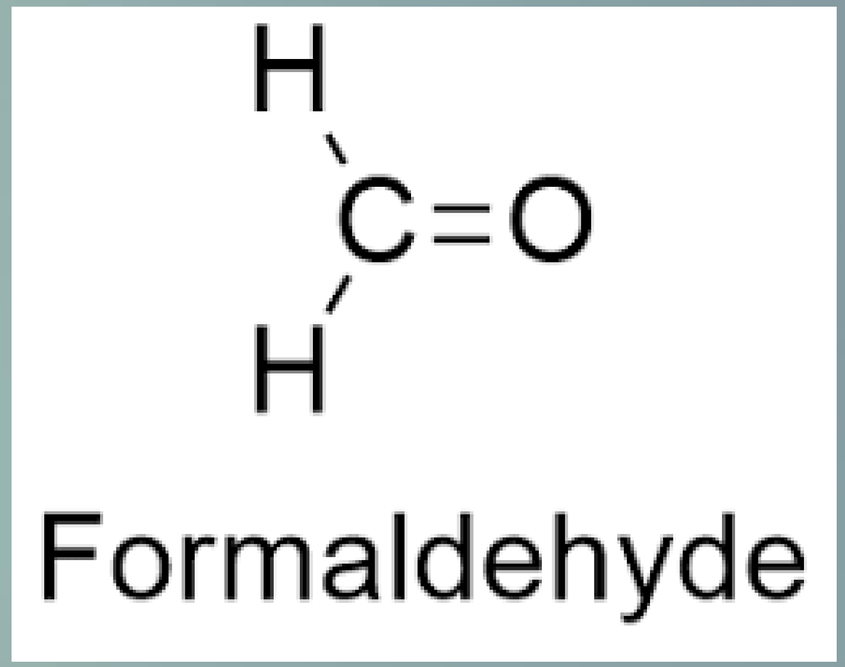


Formaldehyde Donors (FD)

- Pros
  - Broad spectrum activity
  - Most effective against bacteria
  - Good antifungal effect
  - Relatively inexpensive
  - Active at low levels
- Cons
  - Poor public perception
  - Cancer warning sometimes required
  - Skin allergen
  - Known sensitizer / irritant
  - Hazardous to handle
  - Suspected carcinogen in gaseous form

Formaldehyde Donors (FD)

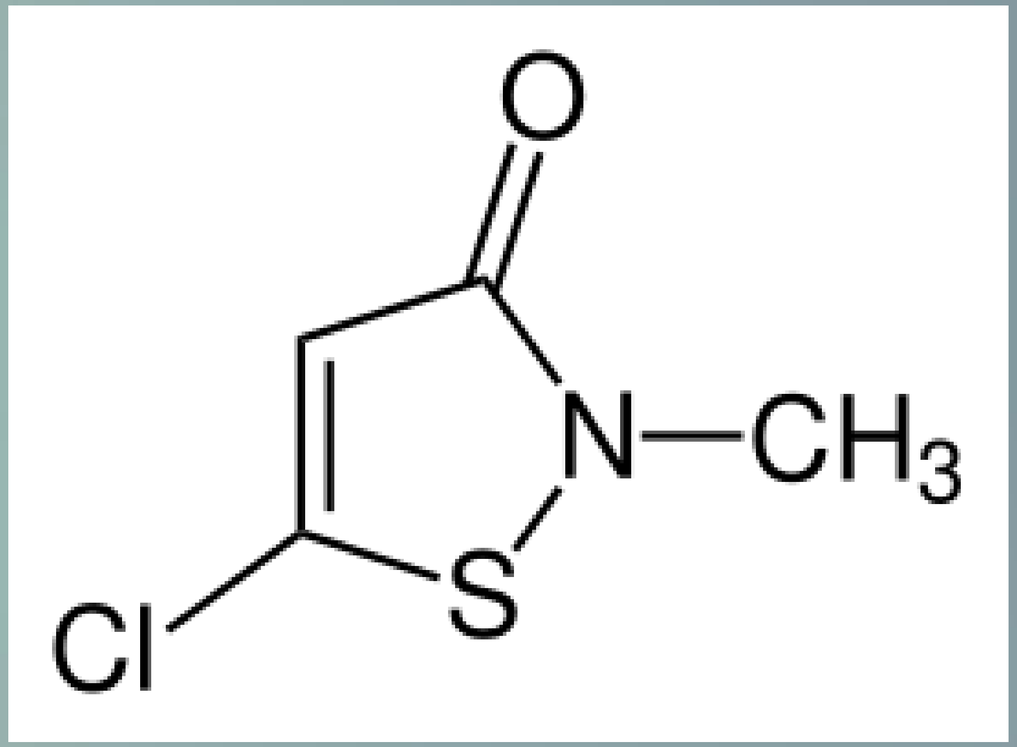
- Formulating tips
  - pH range: 3.0 - 10
  - Compatibility
    - Highly soluble in water
    - FD can be slightly soluble in oils
    - Reacts with proteins
    - Can react with Avobenzone
  - Poor heat stability
  - Use range: 0.1 – 0.8%



Isothiazolinones

- Methylchloroisothiazolinone
- Methylisothiazolinone

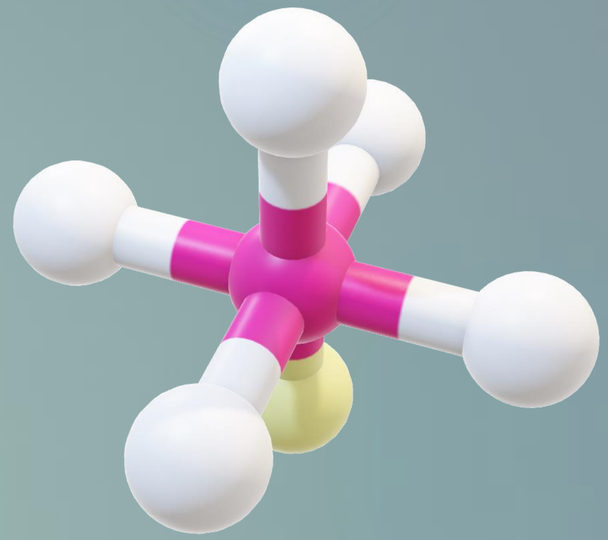
- Typically supplied in 3:1 ratio (MCI/MI)



Isothiazolinones

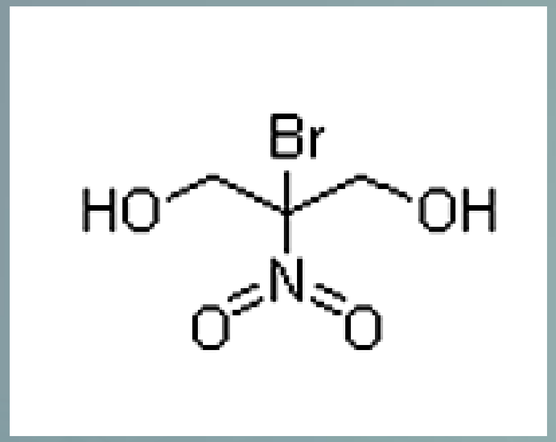
- Pros
  - Active at low levels
  - Compatible with non-ionics
  - Formaldehyde free / Paraben free
  - Biodegradable
  - Broad spectrum
- Cons
  - Poor pH stability >9
  - Known skin irritant (2 – 3% of population)
    - MI version less irritating
  - Rinse-off only applications

Isothiazolinones

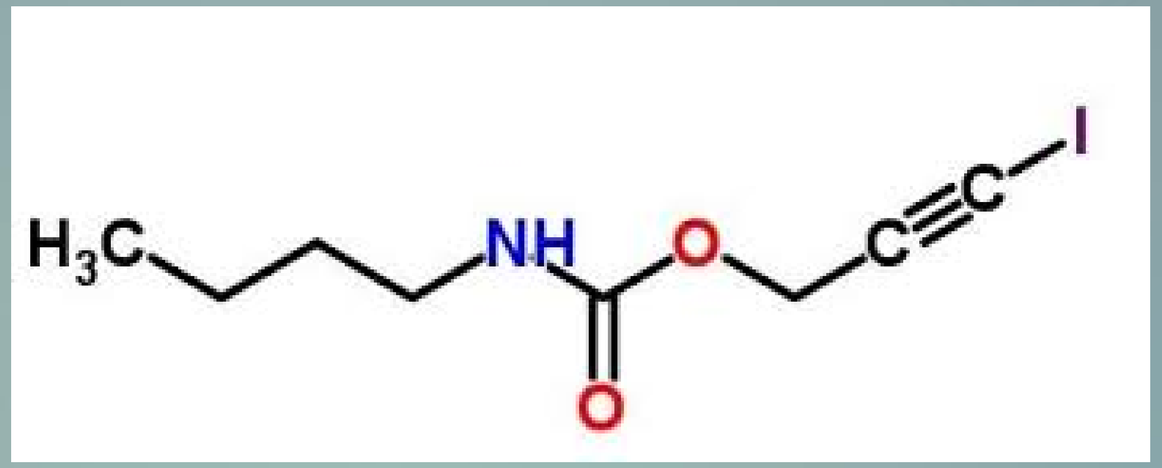


- Formulating tips
  - pH range: 2.0 – 9.0
- Compatibility
  - Water soluble
  - Compatible with nonionics, emulsifiers, surfactants
- Use range: 7.5 – 15ppm
  - (0.0015% in case you were curious)

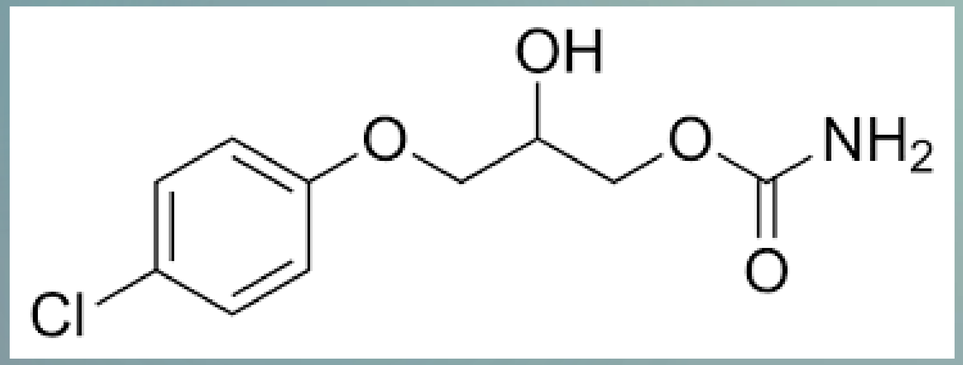
Other preservative compounds



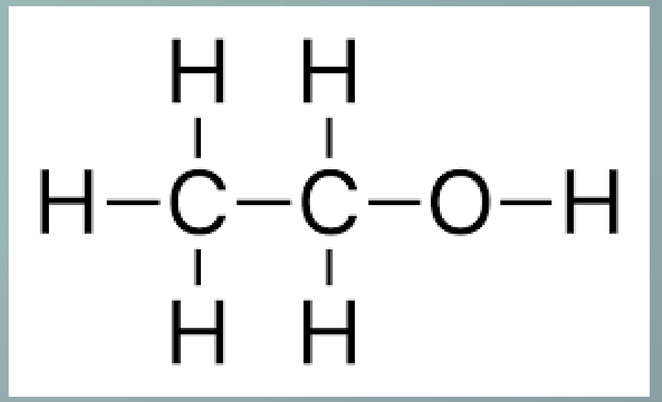
Bronopol



Iodopropynyl Butylcarbamate (IPBC)



Chlorphensin



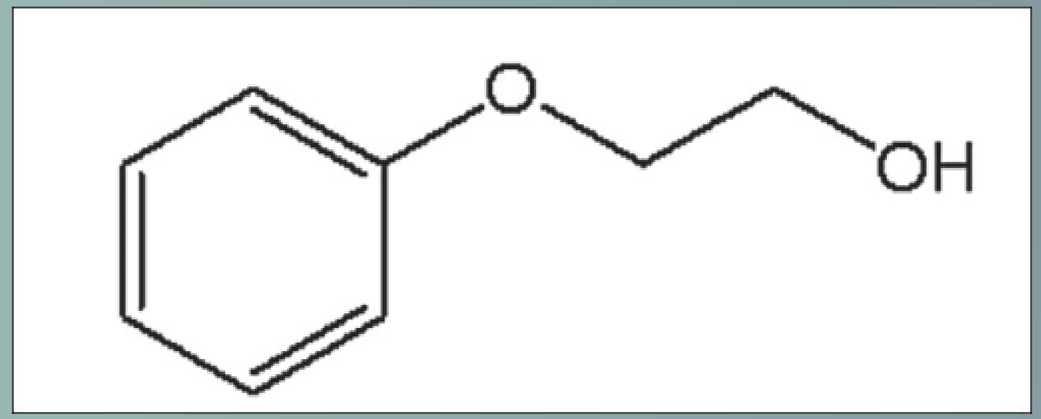
Alcohol

Natural-ish Preservation

- Phenoxyethanol
- Organic Acids
- Benzyl Alcohol

Phenoxyethanol

- Reaction of ethylene oxide and phenol
- Solvent for fragrance + floral aroma
- Colorless
- Stable
- Low toxicity

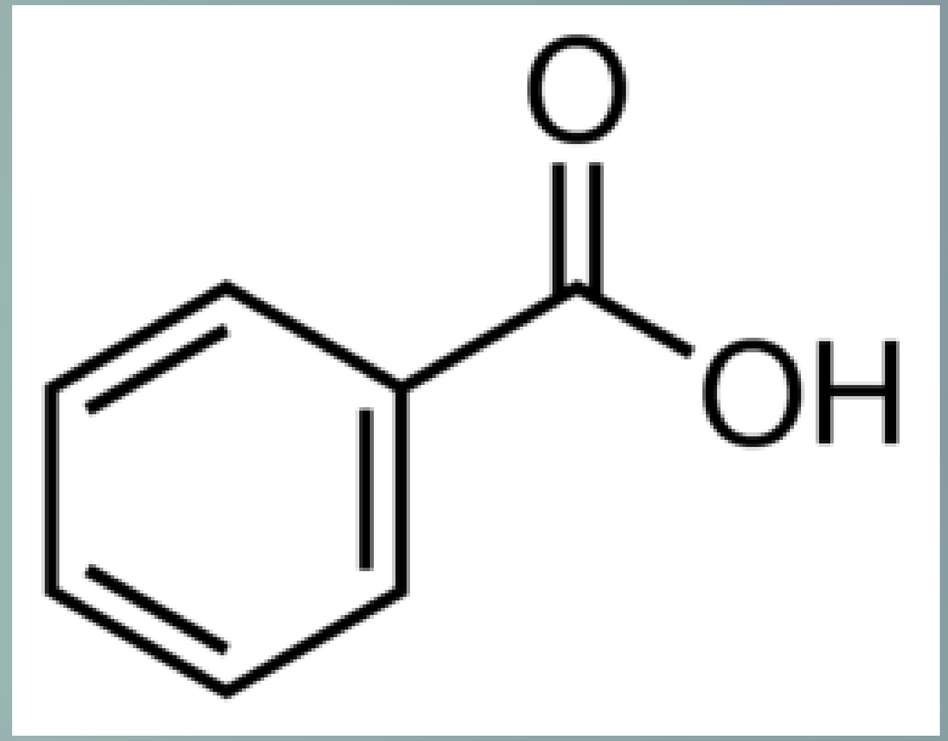


Phenoxyethanol

- Formulating tips
  - pH range: 3.0 – 10.0
  - Compatibility
    - Low solubility in water
    - Compatible with nonionics & proteins
    - Can sometimes reduce viscosity
  - Heat stable
  - Use range: 0.4 – 1.0%

Organic Acids & their Salts

- Benzoic Acid
- Sodium Benzoate
- Sorbic Acid
- Potassium Sorbate
- Dehydroacetic Acid
- Sodium Dehydroacetate
- Salicylic Acid

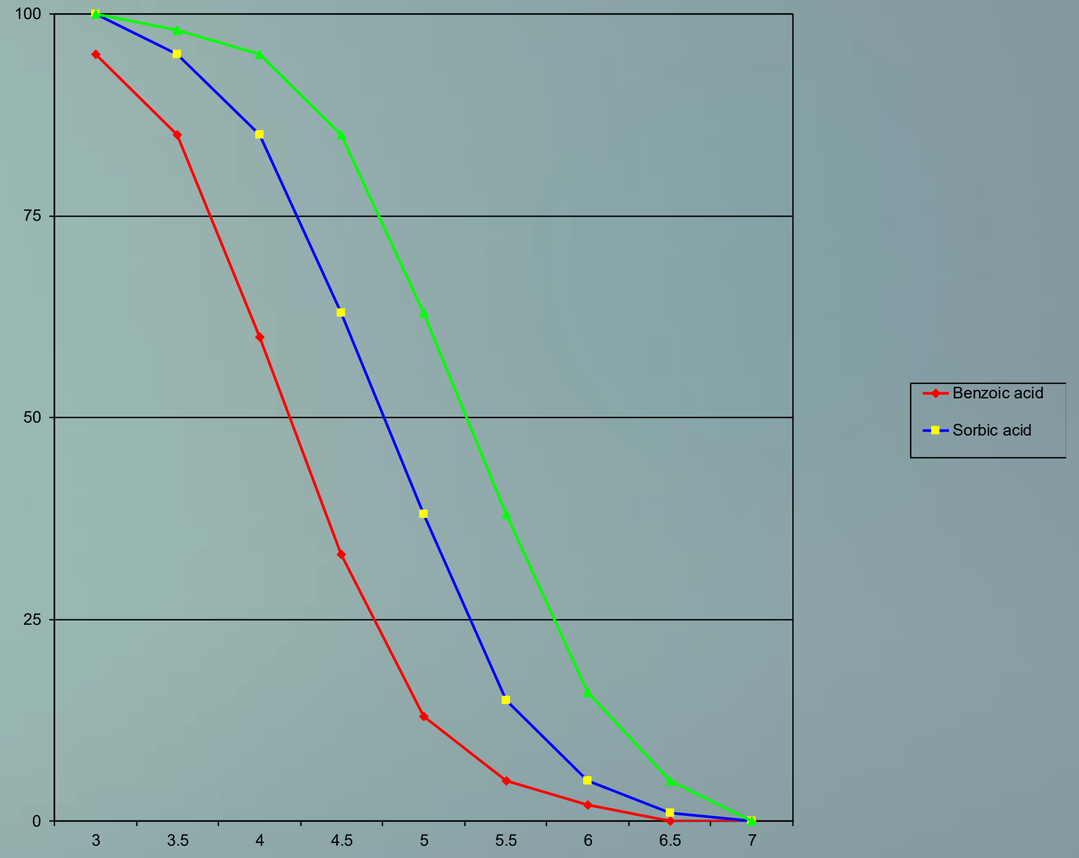


Organic Acids & their Salts

- Benefits
  - Low toxicity
  - Approved for most natural standards
  - Occurs in nature
  - Nature identical versions are primarily used
  - Food grade preservative
- Effectiveness
  - Fungicidal
  - Weak against bacteria
  - Only effective at low pH
- Mode of action
  - Cause membrane leakage of ions
  - Similar to parabens

Organic Acids & their Salts

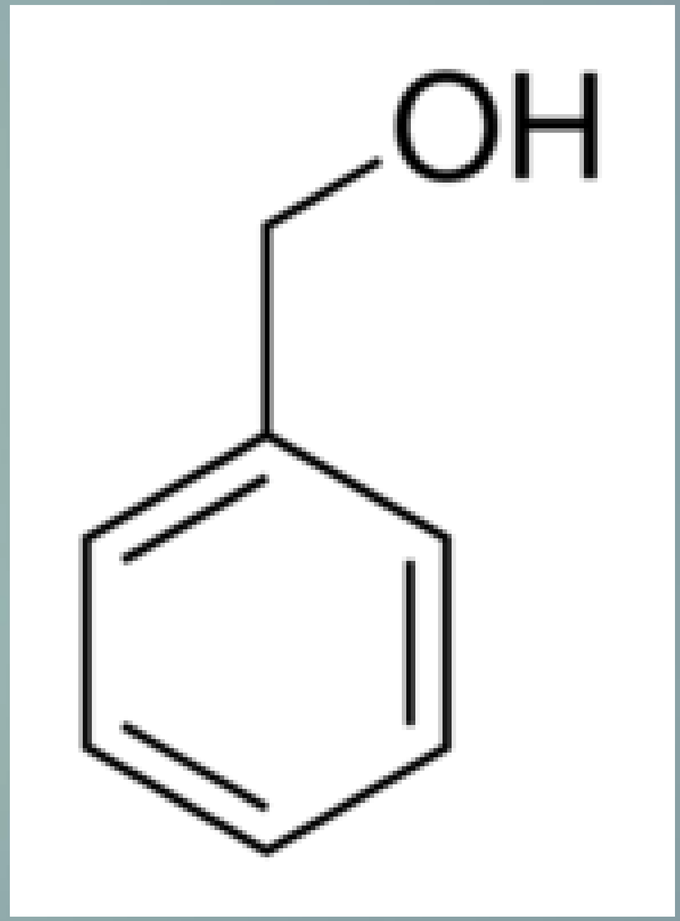
- pH range: most activity below 5.0
- Compatibility
  - Low solubility in water
  - Incompatible with cationics, some proteins, nonionics
  - Can be light sensitive
  - Can cause discoloration
- Use range: 0.2 – 0.5%



Benzyl Alcohol

- Broad spectrum activity
- Low toxicity
- Occurs in plants & fruits / essential oils
- Approved by most natural standards

- High concentrations required
- Fragrance allergen
- Broad spectrum - bacteria



Benzyl Alcohol

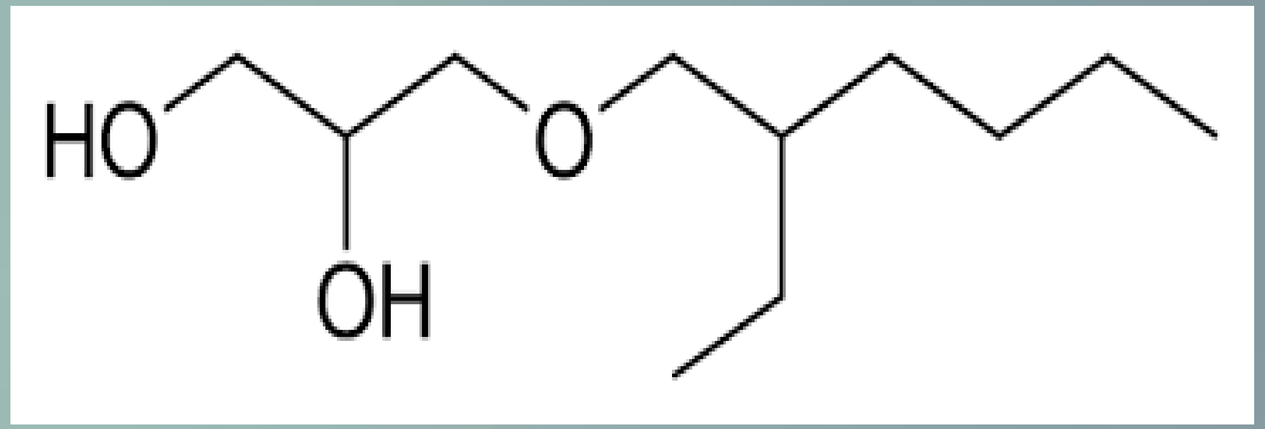
- Formulating tips
  - pH range: most activity below 5.0
  - Use range: 0.4 – 1.0%
- Compatibility
  - Compatible with nonionics & proteins
  - Can be used in aqueous systems
- Listed as skin allergen

Non-Traditional Preservation

- Materials are not preservatives but have some efficacy
- Have alternate purposes
- Used in combination with traditional preservatives
- Allow for lower preservative use

Surface Active Membrane Disrupters

- Caprylyl Glycol
- Ethylhexylglycerin
- Caprylyl Glycine
- Glyceryl Caprylate



- Reduce water activity
- Can be irritating at high levels
- Negative impact on viscosity

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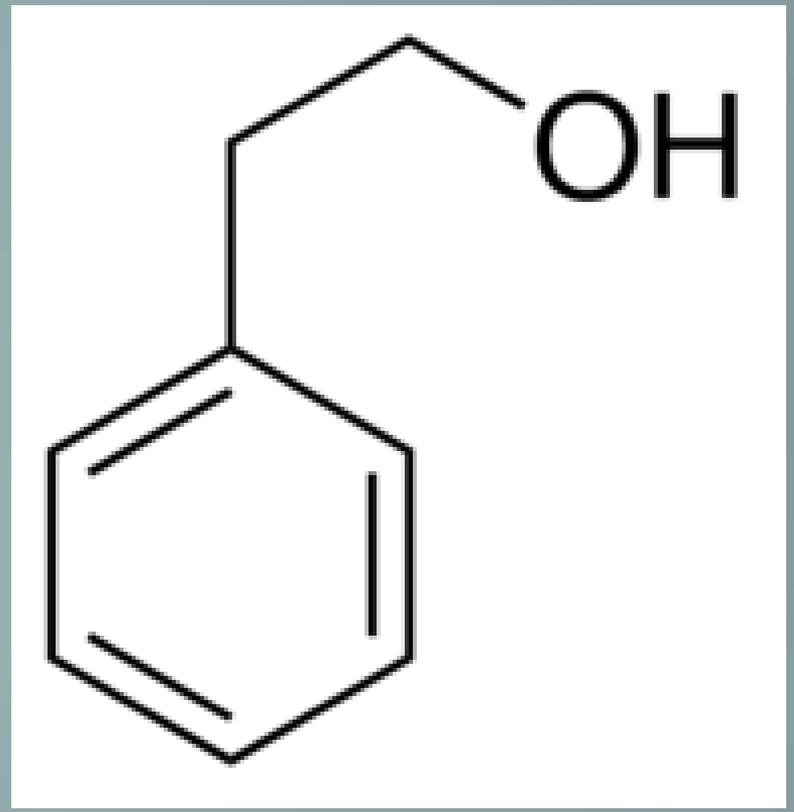
Fragrance Components

- p-Anisic Acid
- Levulinic Acid
- Phenylethyl Alcohol



- Can boost other preservatives
- More formulation flexibility than glycols
- pH limitations

Enzymatic systems

- Glucose Oxidase
- Lactoperoxidase

- 2-step system

Ferments

- Naturally produced by fermentation
- Lactobacillus Ferment
- Leuconostoc kimchii ferment
- Natural broad-spectrum antimicrobial

“Green” Preservatives

- Essential Oils
  - Tea Tree oil
  - Rosemary
  - Cinnamon
- Botanicals
  - Aspen bark extract
  - Grapefruit seed extract
  - Honeysuckle extract

Green Preservatives

Green Chem Finder®

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Discover, Assess, Select Green Ingredients for Cosmetic Preservation

Access data about ingredients to simplify the selection process according to regulatory, sustainability and cosmetic science criteria

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Formulation Tips

- Hurdle technology – Make it difficult for microbes to grow
- Use materials with inherent antimicrobial activity
- Reduce water activity – use glycols
- Use chelating agents, e.g. NaEDTA – (0.1%)
- Control your pH range
  - Bacteria grow best pH 5.5 – 8.5
- Use preservative blends – Broad spectrum

Why use Preservative Blends?

- Blends improve preservation
- Companies sell a wide range of blends
- Easier to incorporate into formulas
- Use less overall preservative
- Save time
- Reduces preservative cost
- Reduce raw material inventory

Picking a Preservative

- Analyze ingredient lists
- Choose products from big companies to emulate

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Case study #1

Aqua / Water / Eau • Sodium C14-16 Olefin Sulfonate • Cocamide Mea • Glycerin • Cocamidopropyl Betaine • Glycol Distearate • Sodium Lauroyl Sarcosinate • Parfum / Fragrance • Hexylene Glycol • Citric Acid • Sodium Hydroxide • Sodium Chloride • Sodium Benzoate • Peg-55 Propylene Glycol Oleate • Propylene Glycol • Coco-Betaine • Hydroxypropyl Guar Hydroxypropyltrimonium Chloride • Carbomer • Arginine • Salicylic Acid • Benzoic Acid • Polyquaternium-7 • Linalool • Limonene • Benzyl Alcohol • Citronellol • Sodium Hyaluronate

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Case study #1

Aqua / Water / Eau • Sodium C14-16 Olefin Sulfonate • Cocamide Mea • Glycerin • Cocamidopropyl Betaine • Glycol Distearate • Sodium Lauroyl Sarcosinate • Parfum / Fragrance • Hexylene Glycol • Citric Acid • Sodium Hydroxide • Sodium Chloride • Sodium Benzoate • Peg-55 Propylene Glycol Oleate • Propylene Glycol • Coco-Betaine • Hydroxypropyl Guar Hydroxypropyltrimonium Chloride • Carbomer • Arginine • Salicylic Acid • Benzoic Acid • Polyquaternium-7 • Linalool • Limonene • Benzyl Alcohol • Citronellol • Sodium Hyaluronate

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Case study #2

Water, Glycerin, Decyl Cocoate, Beeswax, Butyrospermum Parkii (Shea) Butter, Cocos Nucifera (Coconut) Oil, Fragrance, Glyceryl Stearate Citrate, Helianthus Annuus (Sunflower) Seed Oil, Cetyl Alcohol, Olea Europaea (Olive) Fruit Oil, Polyglyceryl-3 Stearate, Sodium Stearoyl Lactylate, Theobroma Cacao (Cocoa) Seed Butter, Theobroma Grandiflorum Seed Butter, Hydrolyzed Jojoba Esters, Xanthan Gum, Potassium Sorbate, Lactic Acid, Jojoba Esters, Tocopherol, Glycine Soja (Soybean) Oil, Citric Acid, Phenoxyethanol.

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Case study #1

Water, Glycerin, Decyl Cocoate, Beeswax, Butyrospermum Parkii (Shea) Butter, Cocos Nucifera (Coconut) Oil, Fragrance, Glyceryl Stearate Citrate, Helianthus Annuus (Sunflower) Seed Oil, Cetyl Alcohol, Olea Europaea (Olive) Fruit Oil, Polyglyceryl-3 Stearate, Sodium Stearoyl Lactylate, Theobroma Cacao (Cocoa) Seed Butter, Theobroma Grandiflorum Seed Butter, Hydrolyzed Jojoba Esters, Xanthan Gum, Potassium Sorbate, Lactic Acid, Jojoba Esters, Tocopherol, Glycine Soja (Soybean) Oil, Citric Acid, Phenoxyethanol.

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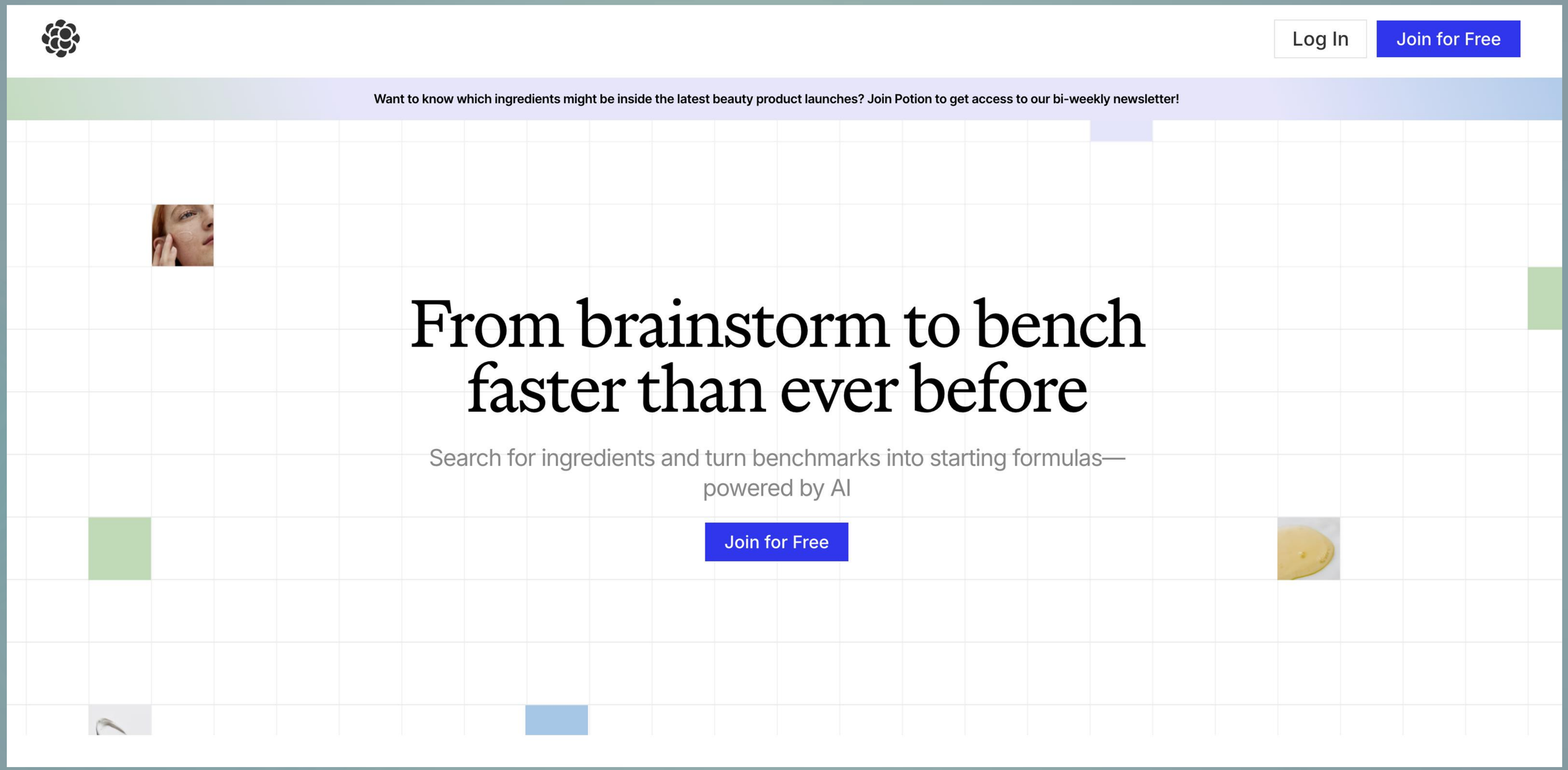
AI

Analyzing Ingredient Lists

Prompt: *“You are a professional cosmetic chemist. Here is an ingredient list of a Body Lotion that I have. Please review the ingredient list and identify the components of the preservative system. [INGREDIENT LIST]"*

Potion AI



Preservation Testing

- Various protocols available
- Recommend this work be outsourced

- Contamination test
- Preservative efficacy test – (PET)

Preservation Testing

- Contamination test
  - Run on every batch of product
  - Conduct standard plate counts
    - Bacteria
    - Fungi
  - 2 – 5 days of incubation
  - Plate counts <10 per gram is considered safe

Preservation Testing

- Challenge Test
  - Done during development
  - Purposely introduce microbes & determine growth potential
  - Incubated for 7 days then evaluated
    - 14, 21, 28 days further evaluation
  - Should be minimal to no growth

Summary

- Microbes can make products unsafe
- Preservation is more than just preservative
- Traditional preservatives are effective
- Natural preservation requires a better strategy
- Blends are typically more effective
- Use AI tools to help you pick preservatives

Don’t let Marketing trump product safety!

ALWAYS PRESERVE YOUR PRODUCTS!

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