

Kalama® and Purox®

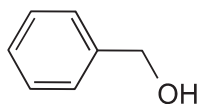
Benzoate Preservatives & Antimicrobials for Personal Care



A Safer Alternative for Personal Care and Cosmetics Applications

Kalama® and Purox® benzoates are safe, effective solutions to preserve freshness and maintain the integrity of personal care formulations—controlling yeasts, molds, and bacteria in formulations up to pH 6.5—while also meeting consumer demand for **clean labels free of parabens, formaldehyde donors, or sensitizers**. They offer an **optimal balance of preservative efficacy, economy, and a consumer-friendly profile**. In addition, they are easy to use (quick solubilizing, low agglomeration) and are **virtually odorless and colorless**.

Kalama® Benzyl Alcohol



Typically used at 0.3 – 0.5% with other antimicrobials. Slight viscosity impact.

Form: colorless liquid

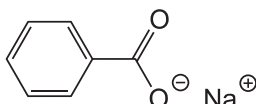
Purity: 99.0% min.

pH: effective up to 8.0

% Solubility at 25°C:

- Water — 4.0
- Propylene Glycol — 100.0
- Glycerin — 100.0
- Mineral Oil — 1.4 – 1.6
- Isopropyl Myristate — >2.0
- Cyclopentasiloxane — >2.0
- Polydimethyl Siloxane — 0.5

Purox® S Sodium Benzoate



Typically used at 0.1– 0.5% alone or with other antimicrobials. Little impact on viscosity. Use salt stable thickener.

Form: white grains, dust-free

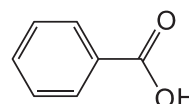
Purity: 99.98% min.

pH: effective alone up to 5.5*

% Solubility at 25°C:

- Water — 62.0
- Propylene Glycol — 15.6
- Glycerin — >2.0
- Mineral Oil — very low
- Isopropyl Myristate — 0.2
- Cyclopentasiloxane — negligible
- Polydimethyl Siloxane — negligible

Purox® B Benzoic Acid



Typically used at 0.3 – 0.5% alone or with other antimicrobials. Little impact on viscosity.

Form: white flakes (“chips”)

Purity: 99.98% min.

pH: effective alone up to 5.5*

% Solubility at 25°C:

- Water — ~1.7 (pH 4.5), ~0.5 (3.5), <0.08 (2.5)
- Propylene Glycol — 15.6
- Glycerin — >0.85
- Mineral Oil — very low
- Isopropyl Myristate — 6.0
- Cyclopentasiloxane — 0.3
- Polydimethyl Siloxane — 0.1

* Can be combined with other antimicrobials to increase pH range of effectiveness



Personal Care Applications

		Applications										
		Face/Neck/Body Care/Sun	Shampoo	Conditioner	Shower/Bath & Liq Soaps	Antiperspirant / Deodorant	Women's Fragrances	Wet Wipes	Oral Care	Feminine Hygiene	Cold/Cough/Pain	Topical Ointments/Lotions
Benzoic Acid	Purox® B Food/Pharma FCC, USP/NF, EP, JP	○	○					○	○	○	○	○
Sodium Benzoate	Purox® S Grains FCC, USP/NF, EP, BP, JP	●	●	●	●	●		●	●	●	●	●
	Kalama® Sodium Benzoate FCC, NF, EP	●	●	●	●	●		●	●	●	●	●
Benzy Alcohol	Kalama® Benzyl Alcohol FCC, NF, EP, BP	●	○	●	○	○	●	○	●			

● Typical Use ○ Effective



Effectiveness Testing

About EP and USP-51 Testing Methods

To determine preservation efficacy within a formulation, testing methodology was utilized as outlined by the European Pharmacopeia (EP) and the U.S. Pharmacopeia National Formulary Chapter 51 (USP-51). Both methods require that samples of the formulation are inoculated with $>1.0 \times 10^5$ of several undesirable and potentially harmful microorganisms (listed at right).

Both EP and USP-51 test methods grant a "pass" or "fail" result for each microorganism tested based on the log reduction at prescribed intervals. The log reduction in the microorganism concentration is calculated as the difference of the log of the initial concentration and the log of the concentration.

Microorganism Type	2 Days	7 Days	14 Days	28 Days
Bacteria	2 (99%)	3	3	No increase from 14 days
Yeast	N/A	N/A	2	No increase from 14 days
Mold	N/A	N/A	2	No increase from 14 days

Table 1. Log Reduction Required to Pass EP Efficacy Testing

Microorganism Type	14 Days	28 Days
Bacteria	2	No increase from 14 days
Yeast	N/A	No increase from 14 days
Mold	N/A	No increase from 14 days

Table 2. Log Reduction Required to Pass USP-51 Efficacy Testing

Key Takeaways

- Benzoates are **nature-identical preservatives** that are **free from parabens, sensitizers, or formaldehyde donors** and have authorization for use within cosmetic products for formulators seeking **green product certifications**, such as COSMOS and Ecolabel.
- In **formulations up to pH 5.5**, sodium benzoate — a highly water soluble material — is a **very effective and robust antimicrobial**.
- Sodium benzoate efficacy is **enhanced through synergies with benzyl alcohol and boosters**, providing preservation of a wide range of personal care products **up to a pH of 6.5**.

Under EP, four microorganisms are tested:

- Candida albicans (yeast)
- Aspergillus brasiliensis (filamentous mold)
- Pseudomonas aeruginosa (gram-negative bacterium)
- Staphylococcus aureus (gram-positive bacterium, "Staph")

Under USP-51, these same microorganisms are tested, plus one additional:

- Escherichia coli (gram-negative bacterium, "E. coli")

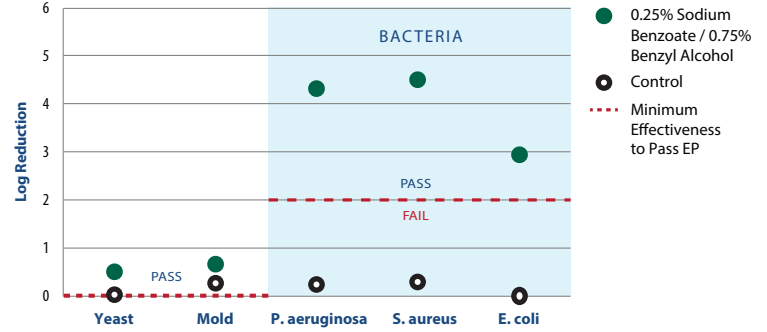


Skin Lotion (pH 5.5)

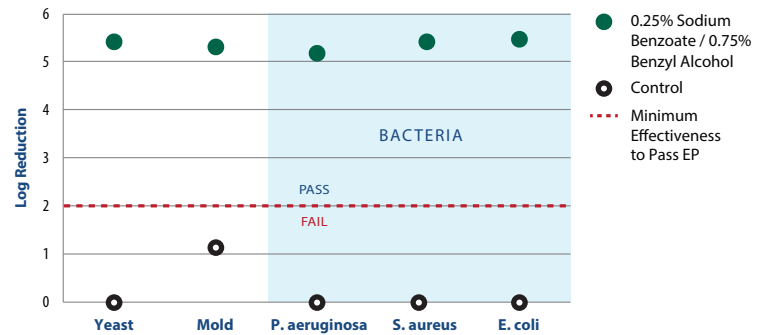
Model Formulation

Ingredient	Function	Wt (%)
Phase A		
		80.00
Water	Carrier	5.00
Glycerin	Humectant	0.10
Xanthan gum	Rheology Modifier	
Phase B		
Cetearyl Alcohol	Rheology Modifier	3.00
Steareth-21	Emulsifier	2.00
Steareth-2	Emulsifier	2.00
Mineral Oil	Emollient	5.00
Petrolatum	Emollient	2.00
Phase C		
Purox® S Sodium Benzoate	Preservative	0.25
Kalama® Benzyl Alcohol	Preservative	0.75

Skin Lotion Efficacy Results - 2 Days

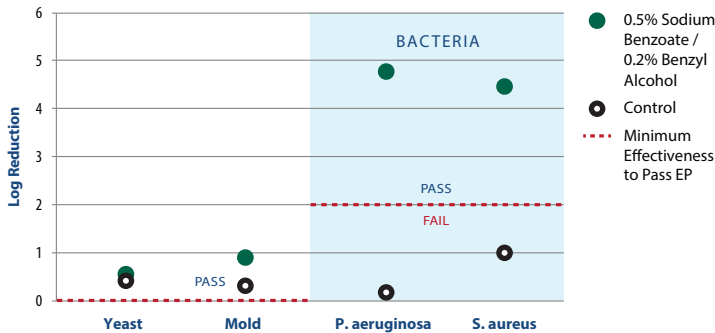


Skin Lotion Efficacy Results - 14 Days

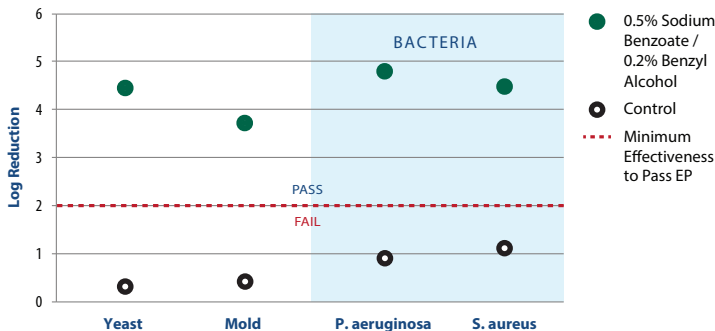


Wet Wipes Liquid (pH 6.0)

Wipes Efficacy Results - 2 Days



Wipes Efficacy Results - 14 Days



Model Formulation

Ingredient	Function	Wt (%)
Phase A		
Water	Carrier	38.60
Glycerin	Humectant	5.00
Purox® S Sodium Benzoate	Preservative	0.50
Phase B		
Mineral Oil	Emollient	2.00
Vitamin E	Antioxidant	0.20
Glucate DO	Emulsifier	0.20
Modified Acrylic Polymer	Polymeric Emulsifier	0.25
Phase C		
Sodium Hydroxide (5%)	pH Adjuster	0.25
Phase D		
Coco-Glucoside	Surfactant	2.00
Phase E		
Water	Carrier	50.8
Kalama® Benzyl Alcohol	Preservative	0.20

Regulatory

Safe Use Levels for Personal Care Products*

	Benzoic Acid	Sodium Benzoate	Benzyl Alcohol
Rinse Off	2.5%	2.9%	1.0%
Oral Care	1.7%	2.0%	1.0%
Leave On	0.5%	0.59%	1.0%

* Annex V 1223/2009 (EU)

Global Inventories

- Australia (AICS)
- Canada (DSL)
- China (IECSC)
- Europe (EINECS)
- Europe (REACH)
- Japan (ENCS)
- Korea (KECL)
- New Zealand (NZIoC)
- Philippines (PICCS)
- Taiwan
- United States (TSCA)

Additional Compliance Information †

Regulation	Guidelines	Results
REACH	OECD Guideline 404 (Acute Dermal Irritation / Corrosion)	Not irritating (Daamen P. A. M. [1989a])
Cosmetics Testing	EC Regulation 1223/2009	In compliance

† European Union Regulation (EC) No 1223/2009 regarding animal testing "On cosmetic products" – in compliance. Emerald does not perform animal testing of our materials for their use in cosmetic products. In instances where animal testing is required for another regulation, such as REACH, every effort is made to ensure that protocols and procedures are consistent with existing, accepted guidelines, and meet all relevant animal welfare regulations.

Emerald Kalama Chemical is a leading global supplier of benzoic acid, benzaldehyde, and related downstream specialties, with world-scale, backward integrated facilities in Kalama, Washington (USA) and Rotterdam, Netherlands.

Products include benzoate preservatives, intermediates, high purity flavor and fragrance ingredients, plasticizers, coalescents, antioxidants, and accelerators. With manufacturing in the United States and Europe and a global sales and distribution network, we serve customers globally.

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April 2018

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