LSI

Glydant Plus® Liquid (patented)

Broad Spectrum Product Protection

INCI Name: DMDM Hydantoin & Iodopropynyl Butylcarbamate

Key Product Attributes:

- Highly cost-effective use level
- Stable in sunlight and over a wide range of temperatures and pH
- Low free formaldehyde and improved toxicology profile
- Compatible with virtually all raw materials used in personal care formulations
- Low odor
- Liquid product, water soluble
- Ease of use, no pre-mixing
- Patented blend of DMDMH and IPBC
- Synergistic, broad spectrum mode of action: no need for auxiliary preservatives
- Has a wide range of global regulatory acceptance

Recommended Use Level

0.15–0.36%

Description

Glydant Plus® Liquid is a synergistic preservation system that combines two well-known and traditional chemistries for personal care. The combination of DMDM Hydantoin and Iodopropynyl Butylcarbamate allow for a dual mode of action, offering broad spectrum efficacy. These chemistries been used in personal care for years. This product contains the same amount of active ingredient as LSI's Glydant Plus® but is offered as a liquid form.

Compositional Breakdown

Chemical Compound Breakdown	Cas No.	EINECS No.
DMDM Hydantoin	6440-58-0	229-222-8
Butane-1,3-diol	107-88-0	203-529-7
3-iodo-2-propynyl butylcarbamate	55406-53-6	259-627-5
Water	7732-18-5	231-791-2

Chemical Compound Breakdown	Percentage
DMDMH range	64–72%*
Butane-1,3-diol	5% min
IPBC	2.2-2.8%
Water	22.0–26.0 %

*Note : This is the DMH + Formaldehyde solids content.

Glydant Plus® Liquid does not use the 2:1 ratio Formaldehyde to DMH.

Applications

- Anhydrous
- Baby care (rinse-off only)
- Body wash
- Conditioner
- Cream
- Deo / Anti-perspirant
- Eye creams/gels
- Eye shadow
- Face lotion
- Face wipes
- Facial cream
- Foundation
- Hair gel
- Hand soap
- Lotion
- Make up remover
- Mascara
- Oil in Water
- Powder
- Shampoo
- Suncare
- Toner
- Water in Oil

Efficacy

Microbiological Challenge Studies

Studies were run using different concentrations of Glydant Plus® Liquid in various formulations to see efficacy against various bacteria, yeast and fungi. All samples were inoculated at the beginning of the study, sampled at 24 hours, 3, 7, 14, 21 and 28 days.

GMS Cream

Ingredients (all unpreserved)	% wt/wt
Glyceryl monostearate	6.0%
POE 20 glyceryl monostearate	4.0%
Cetearyl alcohol	1.5%
Myristyl propionate	8.0%
Glycerin	5.0%
Sterile DI water	75.5%
Total	100%

% Glydant Plus® Liquid required to achieve < 10 cfu/g of mix inocula in the GMS cream

	Glydant Plus® Liquid	Competitor A	Competitor B	Competitor C	Competitor D
Bacteria[1]					
Day7	0.15	0.2	0.3	>0.6	>0.8
Day14	0.15	0.2	0.4	>0.6	<0.8
Day21	0.15	0.2	0.3	>0.6	<0.8
Day28	0.15	0.2	0.3	>0.6	<0.8
Fungi[2]					
Day7	0.2	>0.8	>0.8	>0.6	>1.0
Day14	0.2	0.8	>0.8	>0.6	>0.8
Day21	0.2	0.8	>0.8	>0.6	>0.8
Day28	0.2	0.8	>0.8	>0.6	>0.8

[1] Mix inoculum of bacteria consists of *E.coli*, *P.aeruginosa* and *S.aureus*.

[2] Mix inoculum of fungi consists of *C.albicans* and *A.niger*.

NT = Not Tested

Competitor A: commercially available blend containing 60% Propylene Glycol + 39.6% Diazolidinyl Urea + 0.4% IPBC.

Competitor B: commercially available blend containing 56% Propylene Glycol + 30% Diazolidinyl Urea + 11% Methylparabens + 3% Propylparabens.

Competitor C: 0.4% Methylparabens + 0.2% Propylparabens.

Competitor D: commercially available blend containing 70% Phenoxyethanol + 15% Methylparabens + 5% Isopropylparabens + 5% Isobutylparabens + 5% Butylparabens.

Shampoo Formulation

Ingredients	% wt/wt
Sodium lauryl ether sulfate	35.0%
Triethanolamine laurylsulfate	25.0%
Cocamide DEA	3.0%
Anhydrous protein	1.0%
Sterile DI water	36.0%
Total	100.0%

% Glydant Plus® Liquid required to achieve < 10 cfu/g of mix inocula in the Shampoo

	Glydant Plus® Liquid	Competitor C	Competitor D
Bacteria[1]			
Day7	0.1	NT	NT
Day14	0.1	NT	NT
Day21	0.1	NT	NT
Day28	0.1	NT	NT
Fungi[2]			
Day7	0.1	>0.6	>0.8
Day14	0.1	>0.6	>0.8
Day21	0.1	>0.6	>0.8
Day28	0.1	>0.6	>0.8

[1] Mix inoculum of bacteria consists of *E.coli*, *P.aeruginosa* and *S.aureus*.

[2] Mix inoculum of fungi consists of *C.albicans* and *A.niger*.

NT = Not Tested

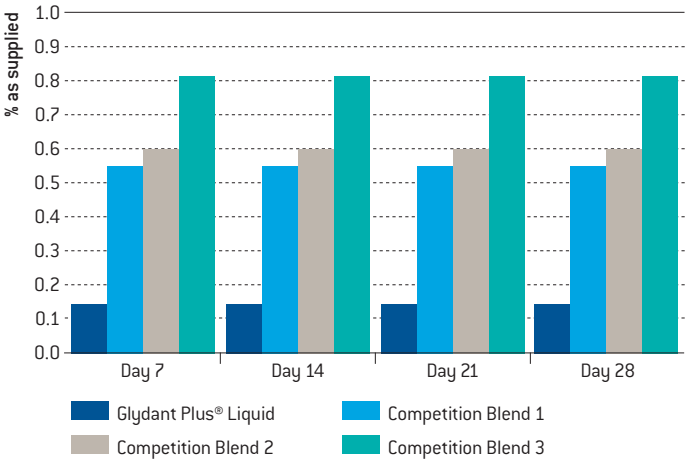
Competitor A: commercially available blend containing 60% Propylene Glycol + 39.6% Diazolidinyl Urea + 0.4% IPBC.

Competitor B: commercially available blend containing 56% Propylene Glycol + 30% Diazolidinyl Urea + 11% Methylparabens + 3% Propylparabens.

Competitor C: 0.4% Methylparabens + 0.2% Propylparabens.

Competitor D: commercially available blend containing 70% Phenoxyethanol + 15% Methylparabens + 5% Isopropylparabens + 5% Isobutylparabens + 5% Butylparabens.

% Glydant Plus® Liquid required to achieve <10 cfu/g of mixed bacteria* in a Non-ionic Cream



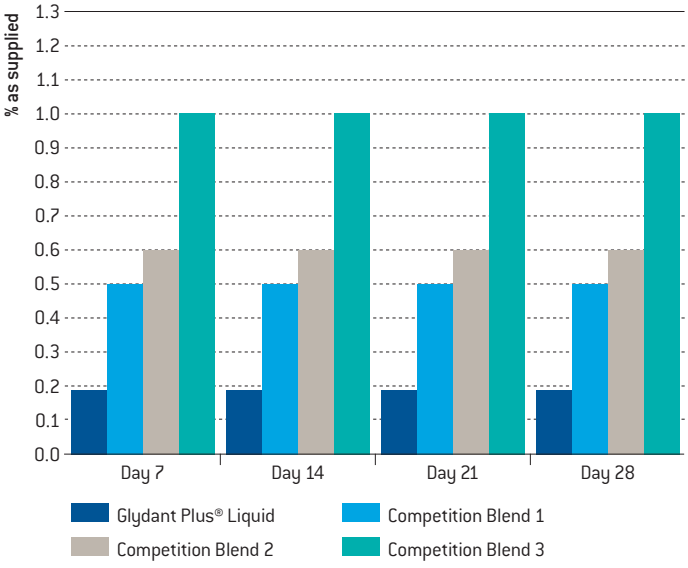
**P. aeruginosa* ATCC #9027, *S. aureus* ATCC #6538, *E. coli* ATCC #8739

1 Commercially available blend of 72% Phenoxyethanol + 17% Methylparabens + 2% Ethylparabens + 2% Propylparabens

2 Commercially available blend of 73% Benzyl alcohol + 18% Methylparabens + 9% Propylparabens

3 Commercially available blend of 70% Phenoxyethanol + 15% Methylparabens + 5% Isopropylparabens + 5% Isobutylparabens + 5% Butylparabens

% Glydant Plus® Liquid required to achieve <10 cfu/g of mixed fungi* in a Non-ionic Cream



**A. Niger* ATCC #16404, *C. albicans* ATCC #10231

1 Commercially available blend of 72% Phenoxyethanols + 17% Methylparabens + 2% Ethylparabens + 2% Propylparabens

2 Commercially available blend of 73% Benzyl alcohol + 18% Methylparabens + 9% Propylparabens

3 Commercially available blend of 70% Phenoxyethanol + 15% Methylparabens + 5% Isopropylparabens + 5% Isobutylparabens + 5% Butylparabens

Formulation Recommendations

- Can be added at both room and elevated temperatures as high as 60°C for 2–3 hours
- At high temperatures, mixing should be carried out in a closed vessel
- Wide pH range: 3–10
- Readily soluble in any aqueous phase, as well as in polar organic solvents like alcohols, glycols, glycol esters, alkyl sulfates, amphoterics, and alkanolamides
- Compatible with virtually all raw materials used in personal care formulations including anionic, cationic and nonionic surfactants, thickening agents, chelating agents, colors and fragrances

Additional Information

Stability: Recovery % of Actives vs. Temperature

	% total HCHO			% IPBC		
Time (months)	23°C	40°C	50°C	23°C	40°C	50°C
1	100	100	100	100	100	> 90
3	100	> 95	NT	> 90	> 95	NT
12	> 95	NT	NT	> 95	NT	NT
18	> 95	NT	NT	> 90	NT	NT

Viscosity, pH, Color and Homogeneity

A stability study has been conducted by adding 0.3% Glydant Plus® Liquid in a broad variety of personal care products, and by checking viscosity, pH, color and homogeneity of the end products after one month at room temperature and 50°C. Glydant Plus® Liquid proved to be compatible with all of the tested products. No major change was observed for either criteria.

Color

Water-white to light yellow color of Glydant Plus® Liquid is stable when stored at 23°C.

Homogeneity Stability

Glydant Plus® Liquid homogeneous phase is stable when stored at 23°C. After storage of three months at 40°C, one month at 50°C and three months exposure to sunlight, Glydant Plus® Liquid maintains its homogeneity.

Glydant Plus® Liquid Solubility & Compatibility Characteristics

General Class	Specific Example	
Water	Water	Soluble
Alcohols	Ethanol	Soluble
Glycols	Propylene Glycol	Soluble
Alkyl Sulfates	Sodium Lauryl Sulfate	Compatible
Quaternized Compounds	Dicetyl Dimethyl Ammonium Chloride	Compatible
Amphoterics	Cocoamidopropyl Betaine	Compatible
Glycol Esters	PEG-4 Laurate	Compatible
Alkanolamide	Cocamide DEA	Compatible

Typical % Free HCHO level

	% Free HCHO
Glydant Plus® Liquid	< 0.1%
Competitor A	> 1.0%
Competitor B	> 1.0%

Global Regulatory

Europe

- Both active ingredients approved, Annex V to Regulation EC/1223/2009.
- Finished products containing DMDMH must be labeled with the warning “contains formaldehyde” if the (free) formaldehyde concentration exceeds 0.05%
- Max use level: 0.6% DMDMH and 0.01% IPBC (leave-on except in creams and lotions aimed to be applied on a large part of the body), 0.6% DMDMH and 0.02% IPBC (rinse-off). Allowed in rinse-off products up to 0.02% IPBC and up to 0.01% IPBC
- Not allowed for oral and lip products
- Cannot be used in products for children under three years (except for rinse-off)

Japan

- Listed in the positive list. The following warning must be labeled: “should not be used by infants or by people who are hypersensitive to formaldehyde.”
- Cannot be used in leave-on due to DMDMH
- Max use level: 0.3% DMDMH and 0.02% IPBC for rinse-off
- Not permitted in oral care

USA

- Approved by CTFA for both rinse-off and leave-on applications
- Max use level of 0.6% DMDMH and 0.01% IPBC

General

- Not for use in oral and lip care

Typical Properties	
Appearance	Liquid
Color (APHA)	Water white to light yellow, 50 Max
Odor	Characteristic

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