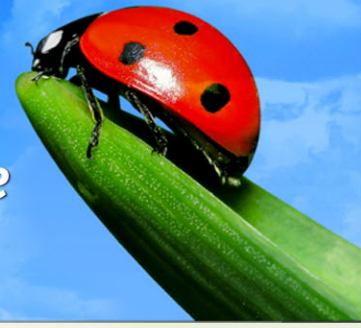


Zemea®* the Natural Choice... Purity and Renewable Performance



Zemea® renewably sourced™ propanediol

Clear Shampoo Formulation

PHASE	INGREDIENT	Wt, %
A	Deionized water	46.47
A	Disodium EDTA	0.10
A	Zemea® Propanediol	5.00
B	Ammonium Lauryl Sulfate (28%)	25.00
B	Sodium Laureth Sulfate (28%)	15.00
C	Cocamidopropyl Betaine (30%)	2.50
D	Cocamide MEA	2.00
E	Fragrance	0.15
F	DMDM Hydantoin	0.20
G	Citric Acid	0.03
H	Sodium Chloride (20% solution)	3.55

Procedure

- Heat phase A to 70^o C. Add phase B, C, and D
- Cool to 40^o C
- Add phases E and F
- Adjust pH to 6.0-6.7 with phase G
- Adjust viscosity with NaCl solution as needed

Benefits

- Excellent cloud point
- High stability
- Improved foaming
- Requires less salt addition for viscosity adjustment



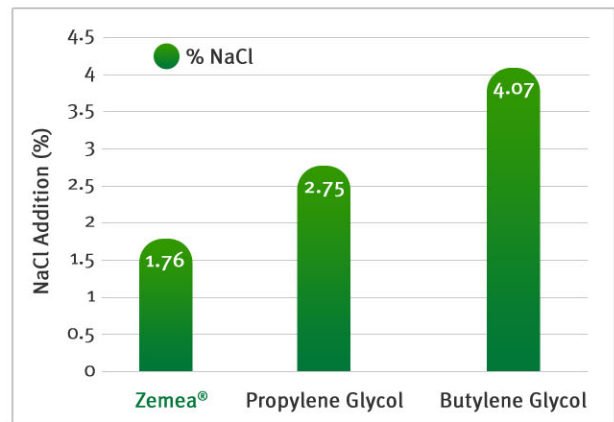
Test Results

The Zemea® propanediol formulation exhibited an increased viscosity requiring 1/3 less NaCl. All other properties showed comparable results.

Comparison of physical properties

		Zemea®	Propylene Glycol	Butylene Glycol
Viscosity, cP		4,250	4,000	2,950
pH		6.10	5.99	5.92
Foam Test		Pass	Pass	Pass
Cloud Pt (°c)	Before NaCl	4	1	4
	After NaCl	6	10	10
Foam Ht / Vol, (mm/mL)	Before NaCl	930/30	850/30	850/30
	After NaCl	840/20	830/20	820/20

Comparison of NaCl addition results



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