DuPont Tate & Lyle BioProducts™

Improvements in Stick Deodorants and Roll-On Antiperspirants with Zemea® Propanediol

zemea® bio-based performance

Introduction

In this study, three new deodorant formulations were developed and evaluated using high concentration levels of Zemea® propanediol. A clear, natural deodorant stick was developed with a high level of Zemea® propanediol and a unique solubilizer. This formulation solved the key challenges of clarity, aesthetics and durability using naturally-derived ingredients. Two roll-on antiperspirants were also developed—a conventional, opaque formulation and a clear one. Zemea® propanediol functioned as an effective solvent for the aluminum salts and solved some of the challenges with roll-ons such as stability, aesthetics and roller ball mobility issues.

Formulating Clear, Natural Deodorant Sticks

Why a Natural Deodorant Stick?

- Propylene glycol sensitivity
- Triclosan aversion
- PEG-free trend
- Natural bias

Classic Deodorant Sticks

- Clear to translucent
- Based on propylene glycol, water, and sodium sterate
- Triclosan for deodorancy

Challenges with Deodorant Sticks

- Clarity
- Durability
- Aesthetics

Table 1: Formulation of Clear Deodorant Stick

Phase	Ingredients (wt, %)	A	B	C	D	E	F	G	H	I	J	K
A	Distilled Water	54.5%	44.5%	34.5%	22.5%	45.25%	43.25%	35.5%	33.5%	31.5%	31%	16%
	Zemea® Propanediol	30%	40%	50%	60%	45%	45%	45%	45%	45%	45%	60%
	Sodium Hydroxide (10% Sol.)	9.5%	9.5%	9.5%	9.5%	3.75%	4.75%	9.5%	9.5%	9.5%	9.5%	9.5%
B	Stearic Acid	6%	6%	6%	6%	2%	3%	6%	6%	6%	6%	6%
C	POLYALDO® 10-1-CCKFG	-	-	-	2%	4%	4%	4%	6%	8%	8%	8%
D	Fragrance	-	-	-	-	-	-	-	-	-	0.5%	0.5%
		Opaque			Clarity							

Low ◄——► High

Procedure:

- Add phase A in a clean beaker and heat to 85-95°C.
- Add phase B into phase A and continuously mix the mixture at high temperature (85-95°C). A clear solution will be observed.
- Add the water that was evaporated from heating and add phase C into the clear mixture.
- Reduce the heat to 80°C and add phase D with stirring.
- Transfer to packaging at 80°C.

Discussion

- Zemea® propanediol used at 60% provided shorter duration for mixture to solidify and a firmer deodorant stick.
- Combining Zemea® propanediol and a solubilizer provides greater stick clarity at room temperature and the use of higher fragrance loads without the use of triclosan.

Formulating Conventional and Clear Antiperspirant Roll-Ons

Why Roll-on Antiperspirants?

- Convenient, effective
- No flaking or whitening
- Ease of production
- Fragrance delivery

Classic Roll-on Antiperspirants

- Opaque thin emulsion
- Non-volatile solvent/ emollient phase
- High level of aluminum salt

Challenges with Roll-on Antiperspirants

- Stability
- Roller ball mobility issues
- Aesthetics

Table 2: Formulation of Conventional Opaque Antiperspirant Roll-On Emulsion

Phase	INCI	Trade name	Supplier	Wt, %
A	Cyclopentasiloxane	SF 1202	Momentive	5%
	Steareth-2	Brij® S2	Croda	2%
	Steareth-21	Brij® S721	Croda	2%
B	Propanediol	Zemea® propanediol	DuPont Tate & Lyle	7%
	Silica	Cab-O-Sil® M-5	Cabot	0.2%
	Water	-	-	68.8%
C	Aluminum Chlorohydrate	ACH-321	SummitReheis	15%

Procedure:

- Add phase A into a clean beaker and heat until the wax is completely melted.
- Prepare phase B in another beaker and heat to 70°C.
- Add phase A into phase B with stirring.
- Remove the mixture from hot plate and continue to stir.
- Once the emulsion is formed, add phase C slowly into the emulsion and mix until the ACH is completely dissolved.
- Transfer the emulsion to a roll-on container when it cools to room temperature.

Table 3: Formulation of a Clear Antiperspirant Roll-On Solution

Phase	INCI	Trade name	Supplier	Wt, %
A	Polyglyceryl-10 Caprylate/ caprate	POLYALDO® 10-1-CC KFG	Lonza	5%
	Propanediol	Zemea® propanediol	DuPont Tate & Lyle	10%
B	Fragrance	-	-	0.5%
C	Water	-	-	69.5%
D	Aluminum Chlorohydrate	ACH-321	SummitReheis	15%

Procedure:

- Add phase A together in a beaker and mix well.
- Add phase B into phase A with stirring.
- Add phase C into phase (AB) and mix homogeneously. The mixture is clear at room temperature.
- Finally, add phase D slowly into phase (ABC) with mixing until all the ACH is completely dissolved.

Discussion

- Smooth-feeling, non-sticky, quick-drying opaque and clear roll-on antiperspirant formulations obtained through use of Zemea® propanediol.

Conclusion

- Zemea® propanediol works well as a replacement for other glycols in deodorant and antiperspirant applications.
- Zemea® propanediol helps formulators solve key challenges of clarity, stability, aesthetics and durability.
- Zemea® propanediol works well with solubilizers, and is an effective solvent for aluminum salts.
- Zemea® propanediol improves skin moisturization and sensory aesthetics without causing skin irritation.
- Zemea® propanediol can reduce water activity and boost preservative efficacy.