zemea®
bio-based performance

TECHNICAL BULLETIN

Zemea® Propanediol: Evaluation in Degreasing / Hard Surface Cleaner

Introduction

The relative cleaning performance of Zemea® propanediol in a generic degreasing / hard surface cleaner was evaluated. Screening experiments were conducted using modified standard methods from the Consumer Specialty Products Association (CSPA) for cleaning Soap Scum and Oil-Grease soils. For comparison, similar evaluations were completed using a propylene glycol (PG) based solution.

Experimental Design

A. Substrate Solutions

The substrate solutions were chosen based on published CSPA Methods DCC-16: Guidelines for Evaluating the Efficacy of Bathroom Cleaners, and DCC-17: Greasy Soil Test Method for Evaluating Spray-and-Wipe Cleaners Used On Hard, Non-Glossy Surfaces. A separate soap scum solution and melted oil-grease solution with carbon black were prepared as follows:

Soap Scum (CSPA DCC-16: Guidelines for Evaluating the Efficacy of Bathroom Cleaners)

Step 1: Solid soil recipe

Ingredient	Wt, g
Stearic acid bar soap	3.90
Shampoo surfactant	0.35
Clay	0.06
Artificial sebum	0.15
Hard water	95.54

Step 2: Soil solution recipe

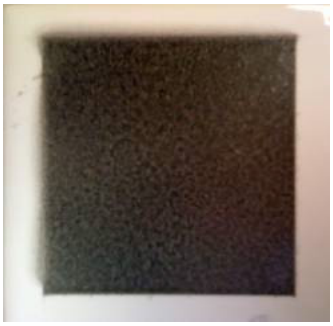
Ingredient	Wt, g
Solid Soil (Step 1A)	40
Isopropyl alcohol	360

Melted Oil-Grease with Carbon Black (CSPA DCC-17: Greasy Soil Test Method for Evaluating Spray-and-Wipe Cleaners Used On Hard, Non-Glossy Surfaces)

Ingredient	Wt, g
Carbon black	2.5
Olive oil	25
Soy oil	10
Butter	25
Isopropyl alcohol	360

B. Substrate Surfaces

Black and white glossy ceramic tiles were chosen as the substrate surface to provide the appropriate cleaning performance contrast between surface and soil substrate. Nine black and nine white ceramic tiles were cleaned with isopropyl alcohol and dried. Using an air driven spray coating system, the soap scum solution was applied to the black tiles and the oil-grease solution was applied to the white tiles. The tiles were dried overnight at 50°C.



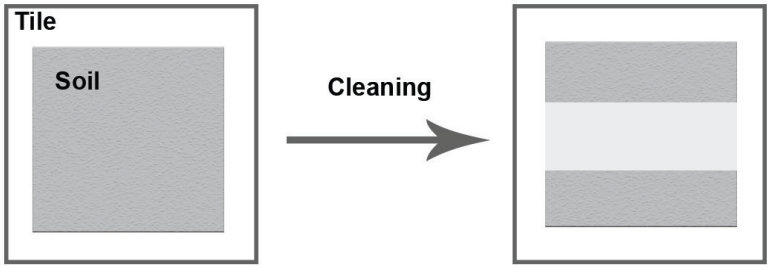
C. Prepared Cleaning Solutions

The following generic cleaning solutions were prepared. The solutions were prepared to provide minimal performance impact from the base ingredients and allow any potentially measurable cleaning performance from the glycols.

	Soap Scum Cleaner		Oil-Grease Cleaner	
	A	B	A	B
Deionized water	93.6	93.6	94.5	94.5
85% Phosphoric acid	1.20	1.20	0	0
Ethoxylated alcohol surfactant (Tergitol TMN-10)	0.20	0.20	0.50	0.50
Zemea® Propanediol	5.00	0	5.00	0
Propylene glycol	0	5.00	0	5.00

D. Washing Procedure

A measured amount of each prepared cleaning solution was applied to a single clean tile and allowed to set for 30 seconds. A retail sponge was used to scrub the middle portion of the soiled tile using a manual straight-line washing motion with limited applied weight. Two cleaning strokes were used on the oil-grease tiles, while four strokes were used on the soap scum tiles in a back-and-forward motion.



E. Performance Measurements

Color measurements and visual observations were used to document the cleaning performance. A clean control tile and cleaned test tile were evaluated using a portable chromameter. The distance between the three-dimensional results were recorded as L,a,b color. Coordinates of the cleaned test tile and the clean control tile were calculated to compare performance The cleaning performance of each solution is expressed as “distance from control“. The closer a reading is to the control, the cleaner it is.

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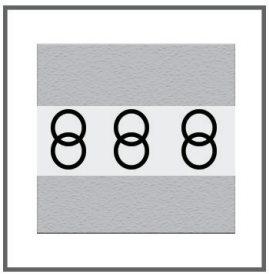
18 readings per solution =
(6 measurements) x (3 tiles)



Results

A.Visual Observations

Based on the photogrpahs, the cleaning performance of the Zemea® propanediol solution is comparable to the PG solution for both the soap scum and oil-grease substrates.

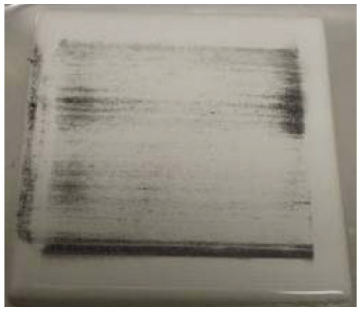
Soap Scum →

Cleaned with Zemea® propanediol solution

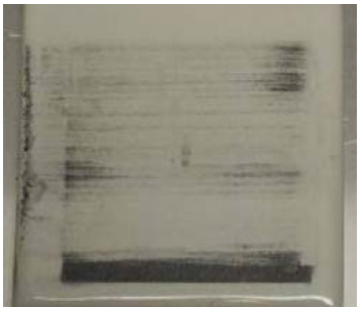
Cleaned with PG Solution

Oil & Grease →

Cleaned with Zemea® propanediol solution



Cleaned with PG solution



B. Color measurements

Based on the calculated results using the Chromameter, the cleaning performance of the Zemea® propanediol solution is comparable to the PG solution on both soap scum and oil-grease.

Shorter distance from control = Better cleaning performance

Soap Scum

Sample	L, avg	a, avg	b, avg	Distance from Control*
Control	4.0	-0.4	0.3	0
PG	16.2	-0.8	-0.8	12.2 †
Zemea® Propanediol	17.2	-0.7	-0.1	13.2 †

Oil-Grease

Sample	L, avg	a, avg	b, avg	Distance from Control*
Control	90.7	-0.3	2.6	0
PG	85.9	-0.1	2.8	4.8
Zemea® Propanediol	86	-0.2	2.9	4.7

*Distance from Control = SQRT[$(L_c-L_s)2+(a_c-a_s)2+(b_c-b_s)^2$]
(c=control, s=sample)
† No statistical difference

Conclusion

- A Zemea® propanediol based solution provides similar cleaning performance as one based on propylene glycol.
- Zemea® propanediol can be used to succesfuly as a replacement for propylene glycol in cleaning solutions.
- Zemea® propanediol may be a good alternative based on the CARB LVP-VOC status, Readily Biodegradable profile, lack of skin irritation, DfE certification, and GRAS status.

Summary

- The relative cleaning performance of Zemea® propanediol in a generic degreasing / hard surface cleaner was evaluated. Screening experiments were conducted using modified standard methods for cleaning Soap Scum and Oil-Grease soils. For comparison, similar evaluations were completed using a propylene glycol (PG) based solution.
- The cleaning performance of the Zemea® propanediol solution was comparable to the PG solution for both the soap scum and oil-grease substrates. The results were confirmed by visual observation and analytical color measurements.
- A Zemea® propanediol based solution provides similar cleaning performance as one based on PG. The results provide directional information and confirmation to formulators that there is no loss of performance when replacing PG with Zemea®.propanediol.
- Zemea® propanediol may be a good alternative based on the CARB LVP-VOC status, Readily Biodegradable Profile, lack of skin irritation, DfE certification, and GRAS status.

For additional information or samples:

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