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# Augeo Clean

Augeo Market Development Team

Coatis Solvents

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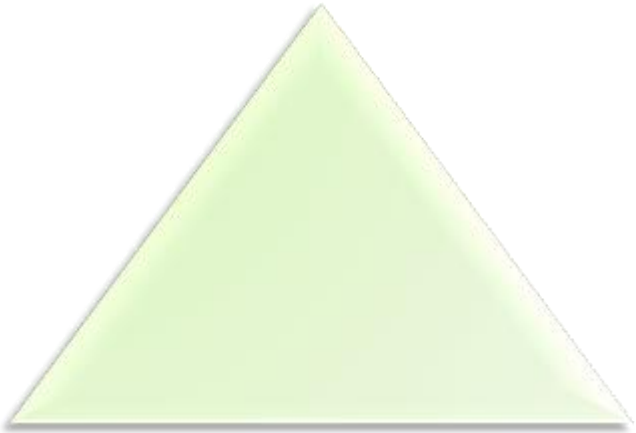
# Hard Surface Cleaners

augeo clean

# Axes drivers for new products development in Rhodia Solvay

## Sustainable Development Axes

Economical



Social

Environmental



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# Surface Cleaners Trends

## Eco-friendly Products

- “Green” raw materials
- Direct applications – less water use

## Convenience

- Improves cleaning efficiency – power cleaners
- Requires less time and effort to clean

## Cleaning on a Budget

- Improvement of performance in private labels
- Growth of “3 in 1” and “4 in 1” products

## Milder Formulations

- Dermatologically tested
- pH neutral

## Fragrance enhancement

- Longer lasting fragrance

## Eliminating Odors and Germs

- Odor neutralizing
- Antibacterial

Source Mintel 2010



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# Augeo Clean *Multi* : sustainable solvent for surface care

**HSE**

- Renewable Source with glycerin as raw material
- Low odor
- Category 4: Combustible
- Not classified as carcinogenic, mutagenic nor reprotoxic
- Not bio accumulative

**Competitiveness**

- Formulation flexibility: cost x performance

**Application**

- Alternative for glycol ethers
- Provide Higher performance due to excellent solvency power
- Good water solubility
- Fragrance enhancement

# Augeo Clean *Plus*: sustainable solvent for surface care

**HSE**

- Renewable Source with glycerin as raw material
- Low odor
- Non flammable
- Not classified as carcinogenic, mutagenic nor reprotoxic
- Not bio accumulative

**Competitiveness**

- Formulation flexibility: cost x performance
- Application: Reduction of Solvent X Performance

**Application**

- Multipurpose cleaners, Specialty cleaners and polishes
- Alternative for glycol ethers
- Provide higher performance due to excellent solvency power
- Low water solubility
- Fragrance enhancement

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# Cleaners

# Cleaning Tests – Visual Method: Without Effort

- **Standard Soil**
  - 15 g soybean oil
  - 15 g used cooking oil
  - 15 g oleic acid
  - 5 g carbon black
- **Substrate preparation**
  - White Tile 15 cm x 30 cm
- **Soil application**
  - Volume of soil: 1.0 mL
  - Painting roll: 3.5 cm x 9.0 cm
- **Inclination:** 45°
- **Volume of Multipurpose cleaner:** 5 mL

STD Test

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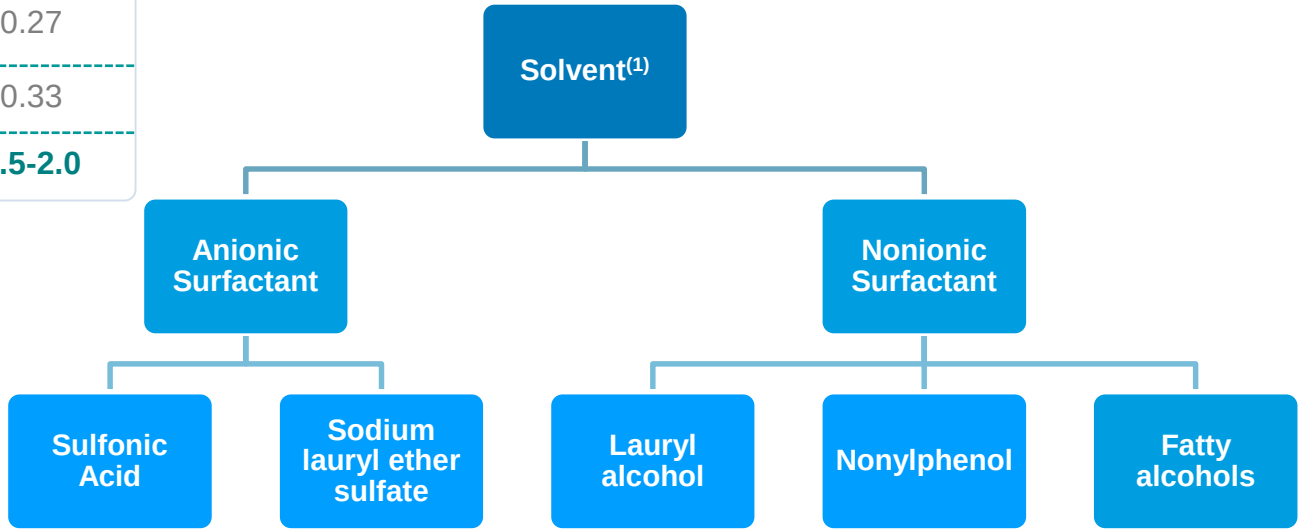
# Augeo Clean Multi *versus* DPM - EB - PPh

17/07/2015

# Visual method to evaluate cleaner performance
# Standard formula

| Component | % m/m |
|---|---|
| Water | 94-96 |
| NaOH 50% | 0.46 |
| Ethanol | 1.11 |
| **Anionic surfactant** | **1.77** |
| **Nonionic surfactant(*)** | **0.06** |
| Monoethanolamine | 0.27 |
| EDTA 40% | 0.33 |
| **Solvent** | **0.5-2.0** |

(*) 9 moles of Ethylene oxide




LESS



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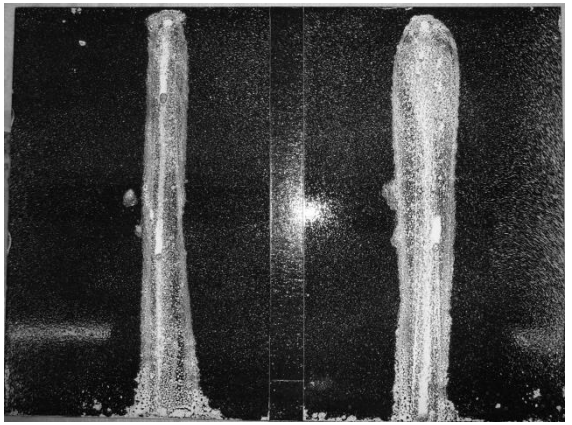
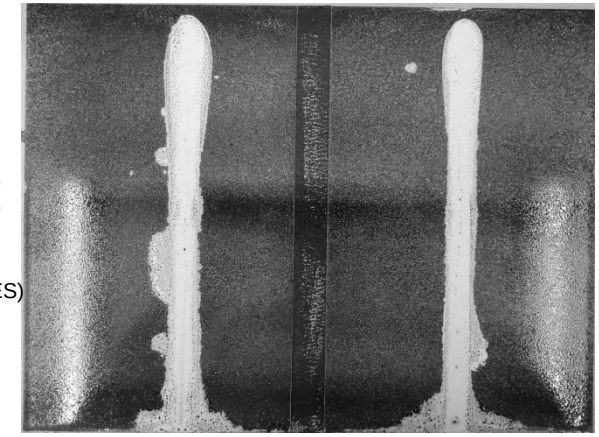
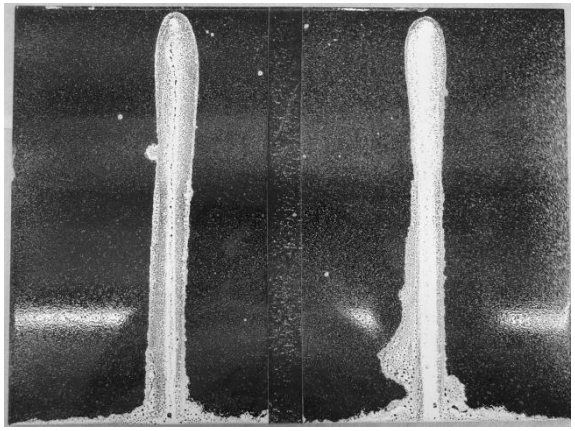
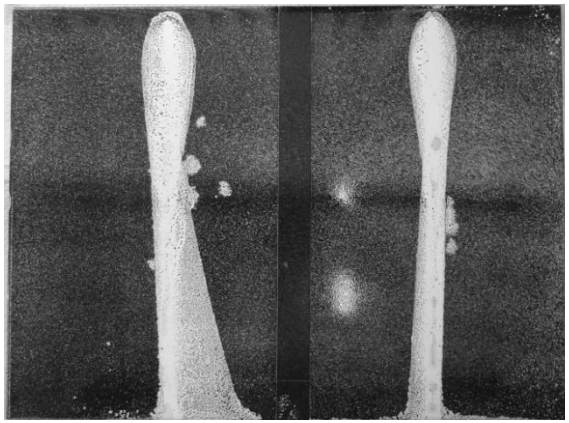
# Solvents Characteristics

| | DPM | Augeo Clean Multi |
|---|---|---|
| **Renewable Source** | No | Glycerin |
| **Odor** | Intense | Slight |
| **Flash Point (Closed Cup)*** | 75°C Category 4 | 91°C Category 4 |
| **HSE*** | Non-toxic to humans and environment | Non-toxic to humans and environment |
| **Solubility in water** | Miscible | Miscible |
| **Carbon Footprint** | 4.10 $CO_2$ eq | 1.74 $CO_2$ eq |

*GHS Category 4: 60°C ≤ Flash Point ≤ 93°C

# Visual method to evaluate cleaner performance (cleaning without effort)

## 1.0% w/w Solvent – Augeo Clean *Multi*

| | Lauric Alcohol | | Nonylphenol | | Vegetable Source | |
|---|---|---|---|---|---|---|
| | Augeo Clean Multi | DPM | Augeo Clean Multi | DPM | Augeo Clean Multi | DPM |
| Sulphonic Acid |  | |  | |  | |
| LESS (SLES) |  | |  | |  | |

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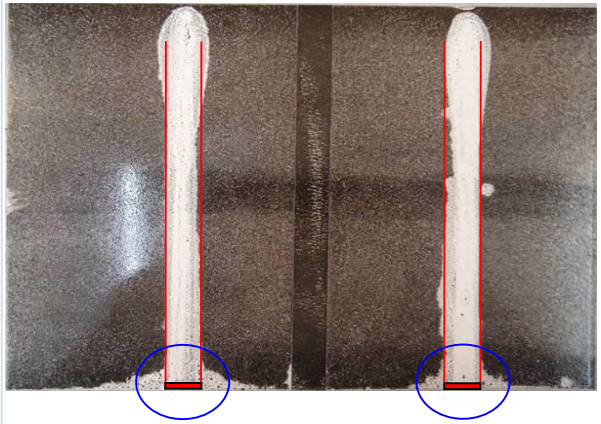
# Statistical method to evaluate cleaner performance

## Variables

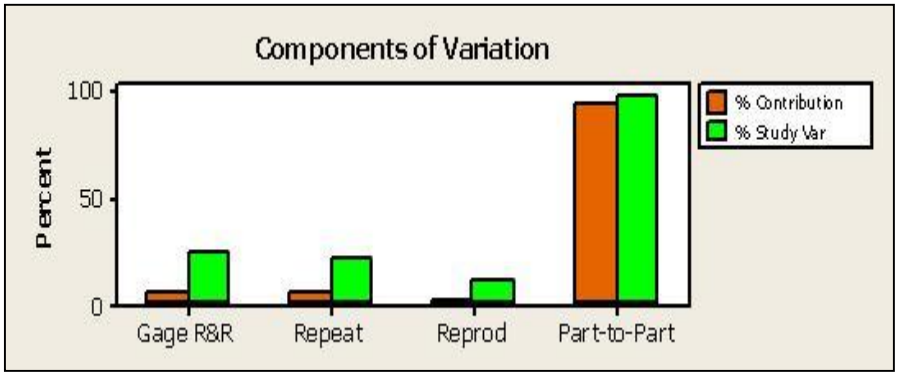
- 12 pieces of ceramic coating randomly
- 3 measures by piece of ceramic
- 2 operators

**Augeo Clean Multi** | Glycol ether



$$Y = \frac{\text{Augeo Clean Multi}}{\text{Glycol ether}}$$

## Statistical validation




| Source | Standard deviation (%) | Analysis of variance (%) |
|---|---|---|
| Gage R&R | 0,08 | **23,62** |
| Repeatability | 0,07 | 21,51 |
| Reproducibility | 0,03 | 9,75 |
| Between samples | 0,32 | 97,17 |
| Total variation | 0,33 | 100,00 |

For a method to be statistically approved the variation of the measuring must not exceed **30%**

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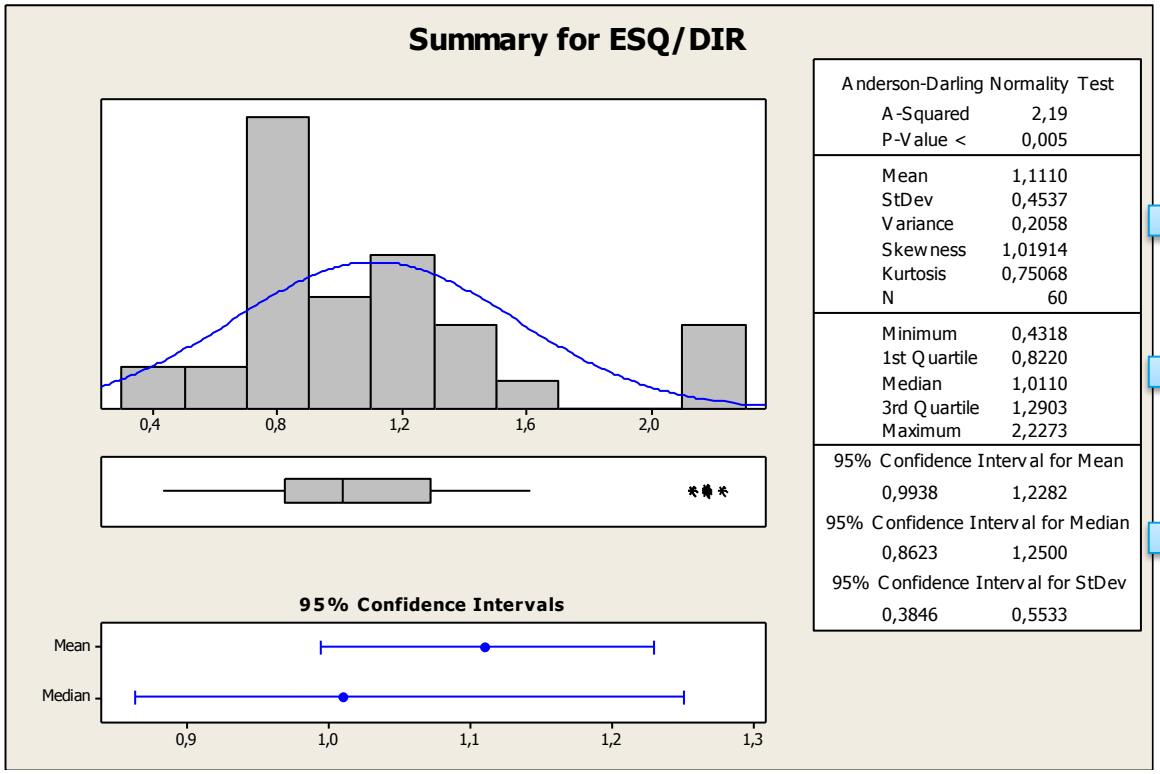
# Statistical analysis

## 1.0% w/w Solvent




| Anderson-Darling Normality Test | |
|---|---|
| A-Squared | 2,19 |
| P-Value < | 0,005 |
| Mean | 1,1110 |
| StDev | 0,4537 |
| Variance | 0,2058 |
| Skewness | 1,01914 |
| Kurtosis | 0,75068 |
| N | 60 |
| Minimum | 0,4318 |
| 1st Quartile | 0,8220 |
| Median | 1,0110 |
| 3rd Quartile | 1,2903 |
| Maximum | 2,2273 |
| 95% Confidence Interval for Mean | |
| 0,9938 | 1,2282 |
| 95% Confidence Interval for Median | |
| 0,8623 | 1,2500 |
| 95% Confidence Interval for StDev | |
| 0,3846 | 0,5533 |

**Mean = 1.1** **i.e. 10% better cleaning**

**75% of the values: Y > 1.0**

**Confidence Index 95%**

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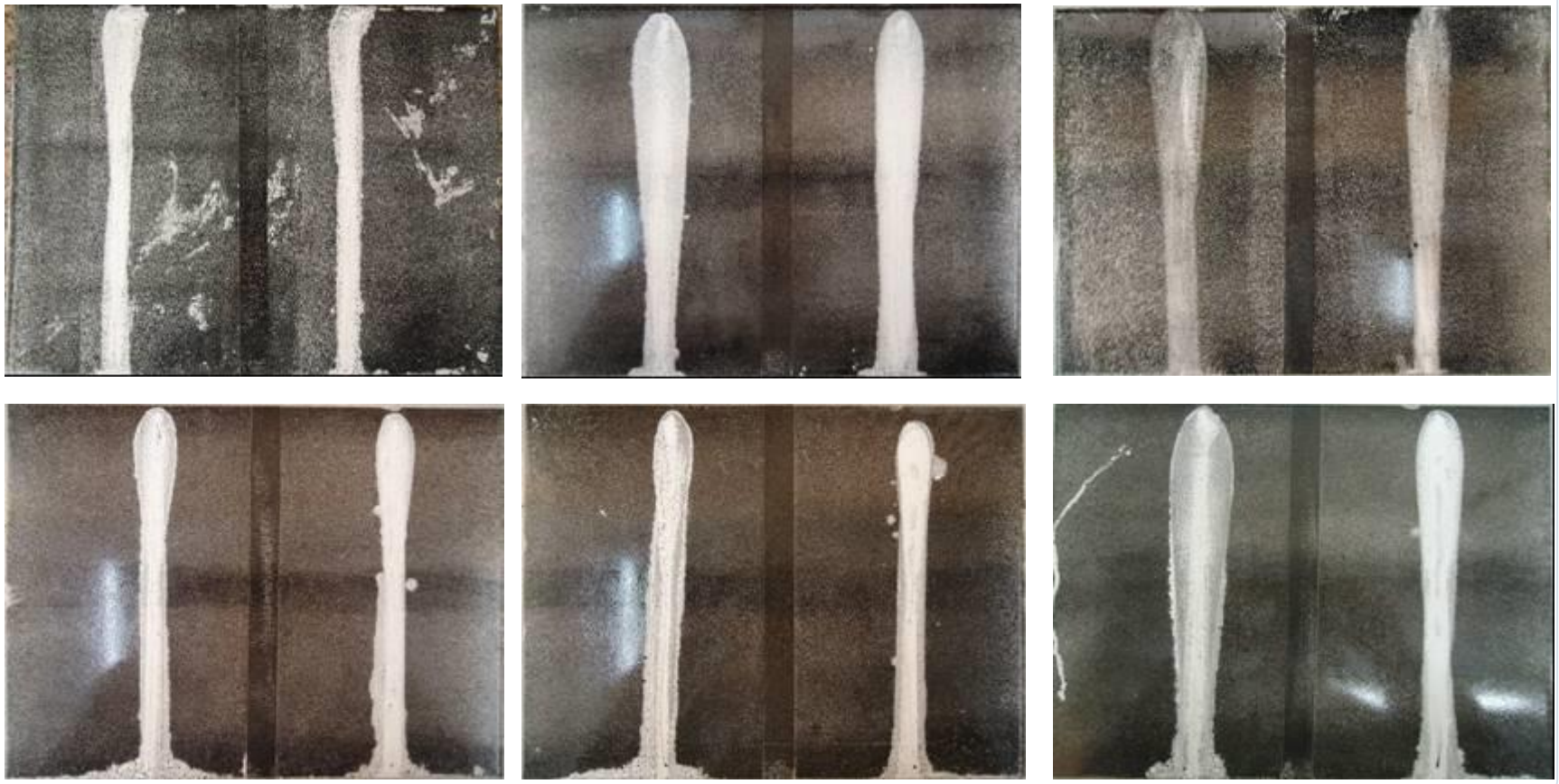
# Solvents Characteristics

| | EB<br>Butyl Glycol | Augeo Clean Multi |
|---|---|---|
| **Renewable Source** | No | Glycerin |
| **Odor** | Intense | Slight |
| **Flash Point (Closed Cup)*** | 62°C<br>Category 4 | 91°C<br>Category 4 |
| **HSE*** | Harmful | Non-toxic to humans and environmental |
| **Solubility in water** | Miscible | Miscible |
| **Carbon Footprint** | 2.80 $CO_2$ eq | 1.74 $CO_2$ eq |

*GHS - Category 4: 60°C ≤ Flash Point ≤ 93°C

# Visual method to evaluate cleaner performance (cleaning without effort)

- **1.0% w/w Solvent – Augeo Clean *Multi***



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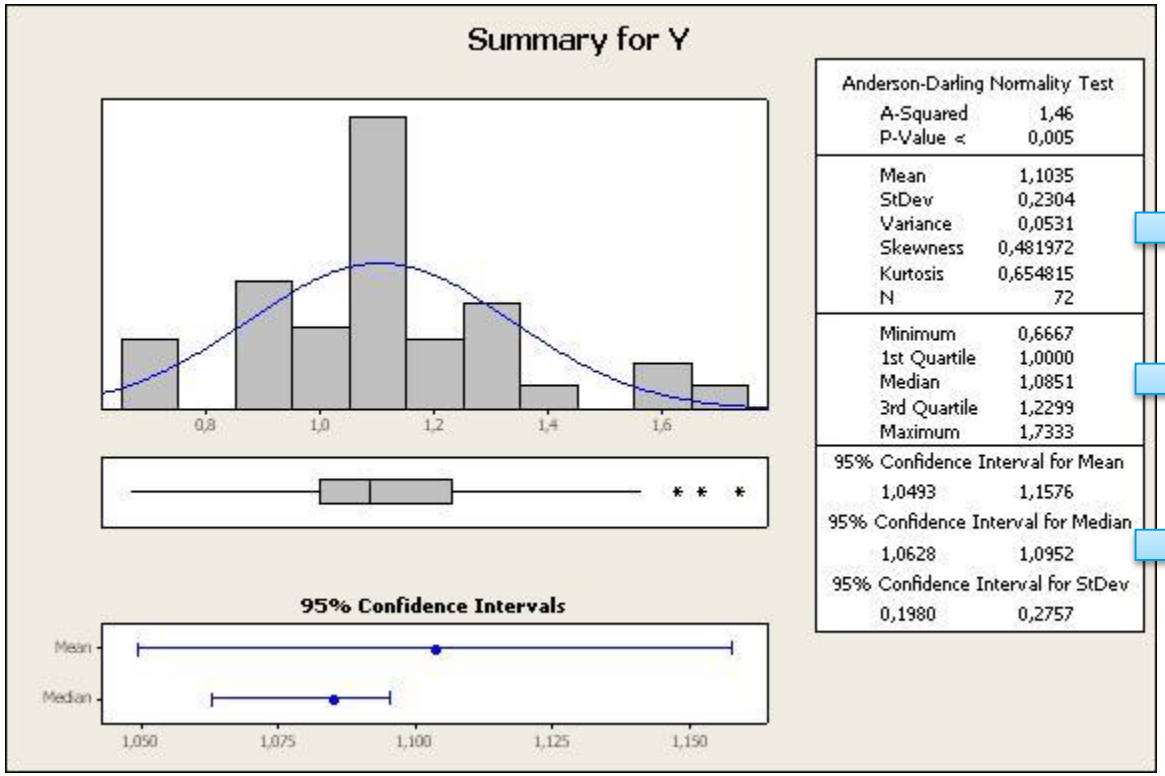
# Statistical analysis

## 1.0% w/w Solvent




| Anderson-Darling Normality Test | |
|---|---|
| A-Squared | 1,46 |
| P-Value < | 0,005 |
| Mean | 1,1035 |
| StDev | 0,2304 |
| Variance | 0,0531 |
| Skewness | 0,481972 |
| Kurtosis | 0,654815 |
| N | 72 |
| Minimum | 0,6667 |
| 1st Quartile | 1,0000 |
| Median | 1,0851 |
| 3rd Quartile | 1,2299 |
| Maximum | 1,7333 |
| 95% Confidence Interval for Mean | |
| 1,0493 | 1,1576 |
| 95% Confidence Interval for Median | |
| 1,0628 | 1,0952 |
| 95% Confidence Interval for StDev | |
| 0,1980 | 0,2757 |

**Mean = 1.1**

**75% of the values:**

**Y > 1.0**

**Confidence index 95%**

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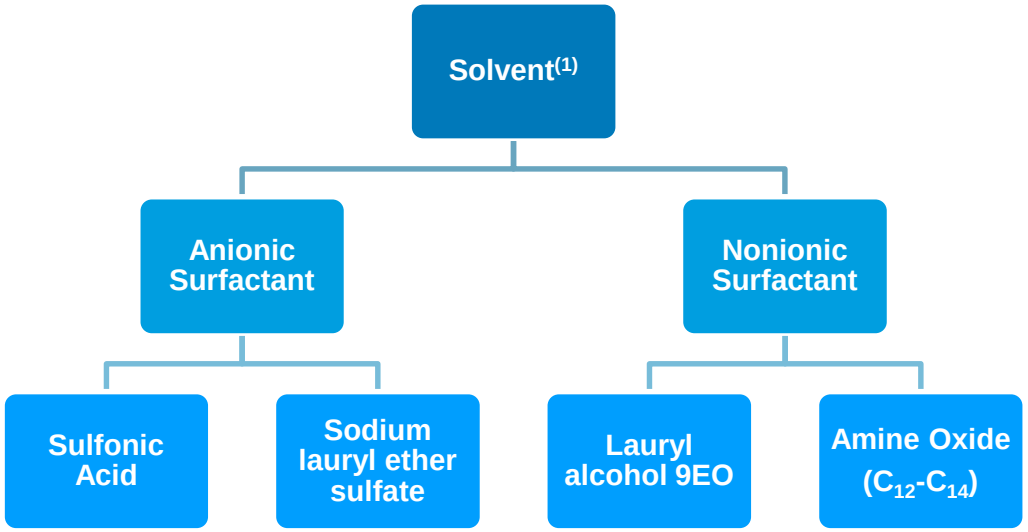
# Visual method to evaluate cleaner performance
# Standard formula

| Component | % m/m |
|---|---|
| Water | 92-96 |
| NaOH 50% | 0.46 |
| Ethanol | 1.11 |
| **Anionic surfactant** | **1.77** |
| **Nonionic surfactant** | **0.06** |
| Monoethanolamine | 0.27 |
| EDTA 40% | 0.33 |
| **Solvent** | **0.5-4.0** |



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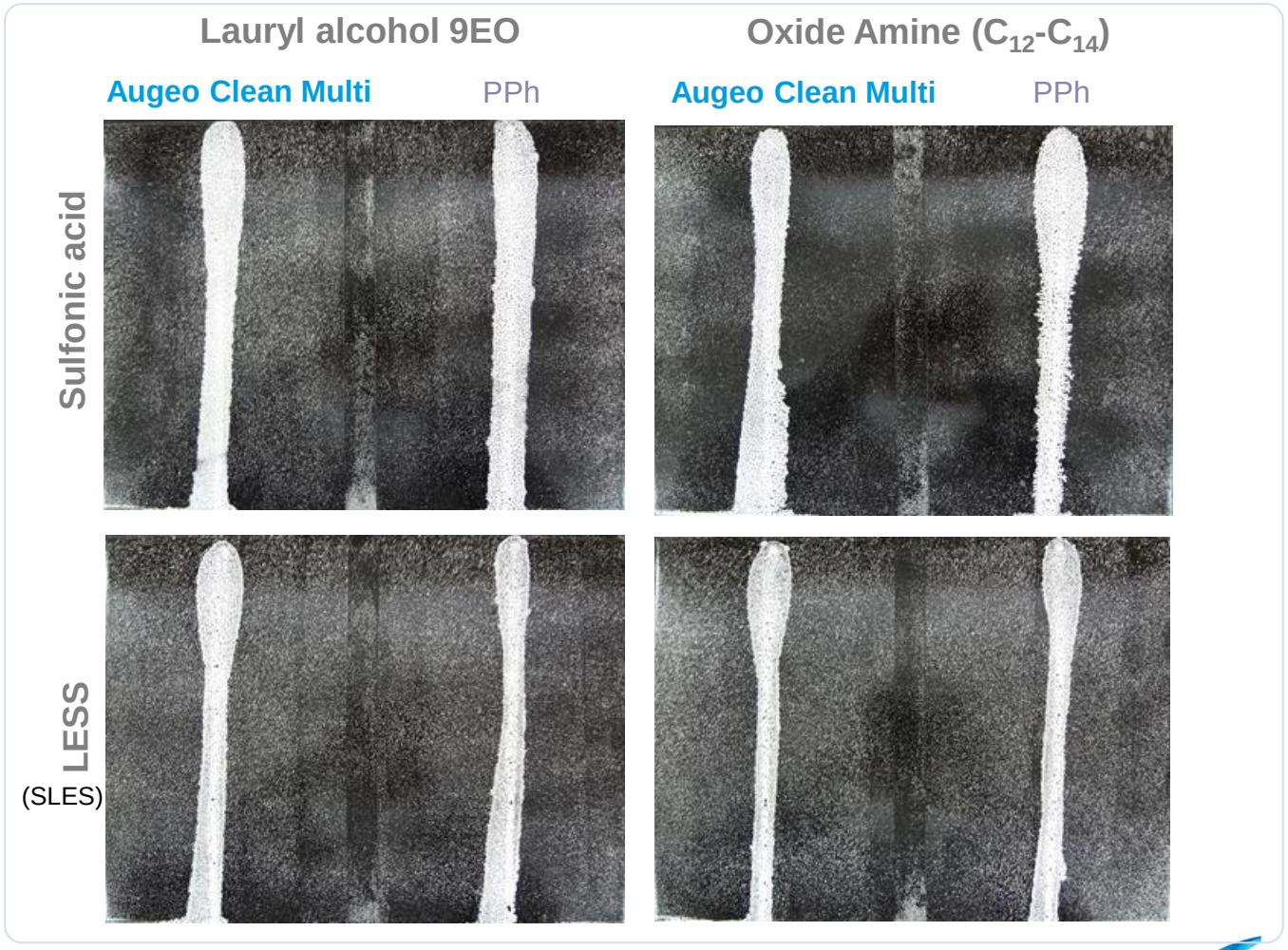
# Solvents Characteristics

| | PPh | Augeo Clean Multi |
|---|---|---|
| Renewable Source | No | Glycerin |
| Odor | Intense | Slight |
| Flash Point (Closed Cup)* | 115°C Non-flammable | 91°C Category 4 |
| HSE* | Non-toxic to humans and environment | Non-toxic to humans and environment |
| Solubility in water | 2.0% w/w | Miscible |
| Carbon Footprint | No data available | 1.74 $CO_2$ eq |

# Visual method to evaluate cleaner performance (cleaning without effort)

## 1.0% w/w Solvent - Augeo Clean *Multi*



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# Augeo Clean Plus *versus* PPh - PnB

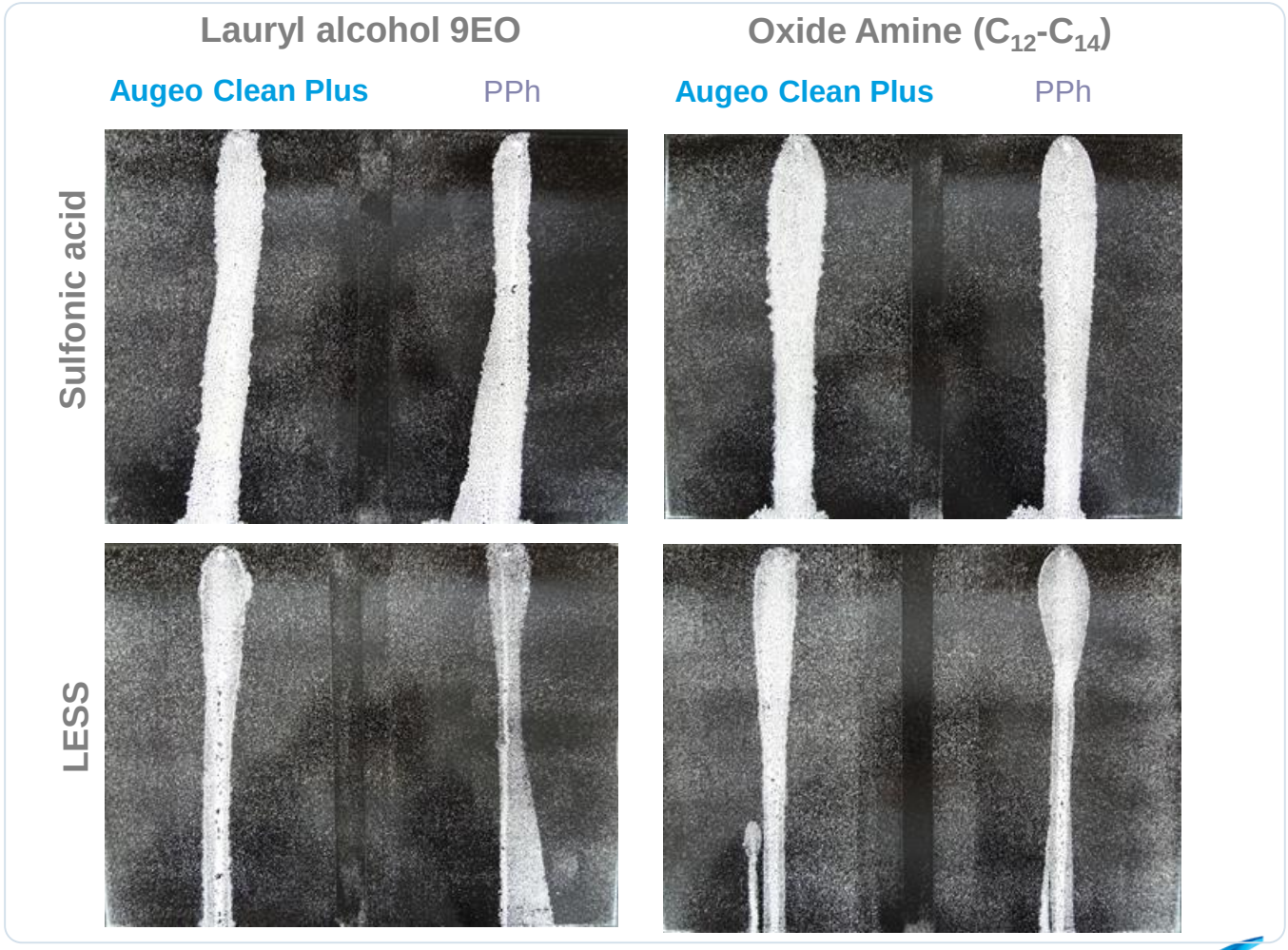
17/07/2015

# Solvents Characteristics

| | PPh | Augeo Clean Plus |
|---|---|---|
| **Renewable Source** | No | Glycerin |
| **Odor** | Intense | Slight |
| **Flash Point (Closed Cup)*** | 115°C Non-flammable | 102°C Non-flammable |
| **HSE*** | Non-toxic to humans and environment | Non-toxic to humans and environment |
| **Solubility in water** | 2.0% w/w | 3.9% w/w |

# Visual method to evaluate cleaner performance (cleaning without effort)

## 1.0% w/w Solvent – Augeo Clean *Plus*



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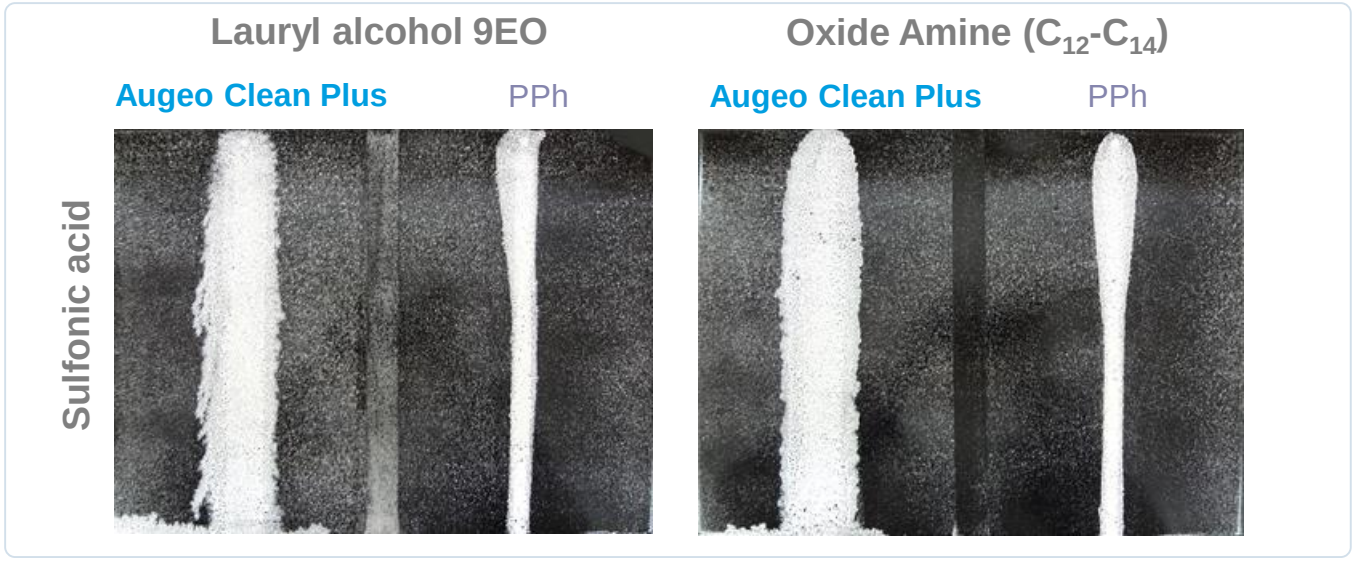
# Visual method to evaluate cleaner performance (cleaning without effort)

## 4.0% w/w Solvent – Augeo Clean *Plus*




For the formulations that contain LESS as anionic surfactant, PPh was not completely soluble at this concentration.



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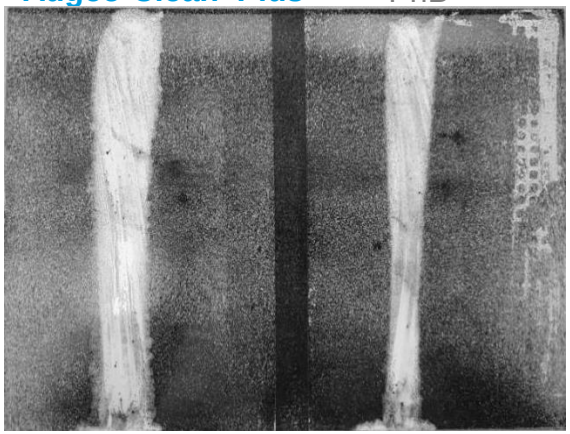
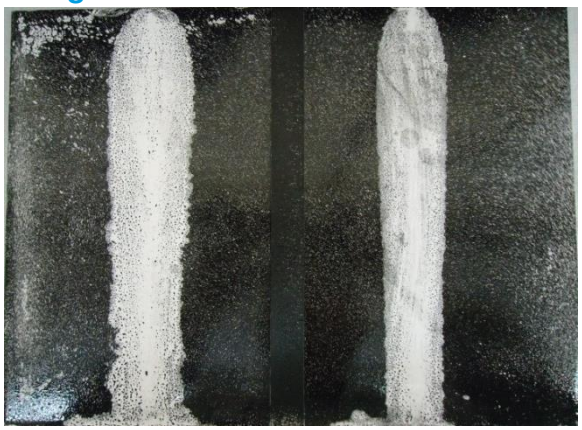
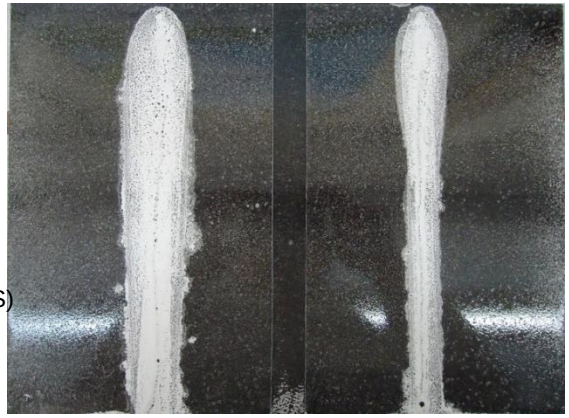
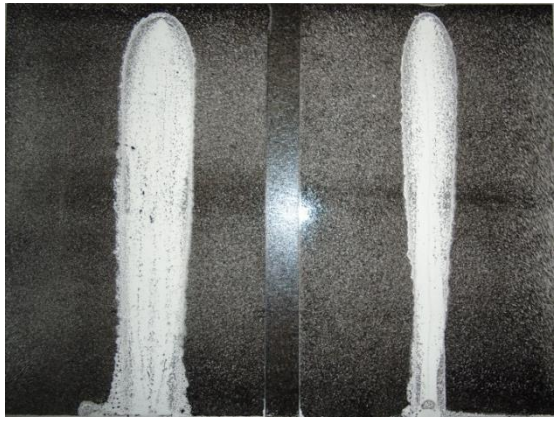
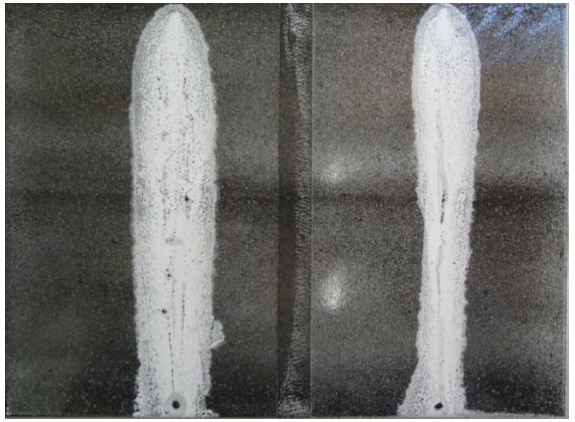
# Solvents Characteristics

| | PnB | Augeo Clean Plus |
|---|---|---|
| Renewable Source | No | Glycerin |
| Odor | Moderate | Slight |
| Flash Point (Closed Cup)* | 63°C Category 4 | 102°C Non-flammable |
| HSE* | Non-toxic to humans and environment | Non-toxic to humans and environment |
| Solubility in water | 5.5% w/w | 3.9% w/w |

# Visual method to evaluate cleaner performance (cleaning without effort)

## 1.0% m/m Solvente – Augeo Clean *Plus*

| | Lauryl alcohol | | Nonylphenol | | Fatty alcohols | |
|---|---|---|---|---|---|---|
| | **Augeo Clean Plus** | PnB | **Augeo Clean Plus** | PnB | **Augeo Clean Plus** | PnB |
| Sulfonic acid |  | |  | |  | |
| LESS (SLES) |  | |  | |  | |

# Augeo Clean: sniff tests results

| Fragrance notes | Augeo Clean Multi | Augeo Clean Plus | EB Butyl Glycol |
|---|---|---|---|
| In the bottle | Pleasant odor | Pleasant odor Fragrance enhancement | Astringent odor |
| During application | Pleasant odor | Pleasant odor Fragrance enhancement | Astringent odor |
| 5 min after application | Lasting > 5min | Lasting > 5 min | Lasting < 5 min |

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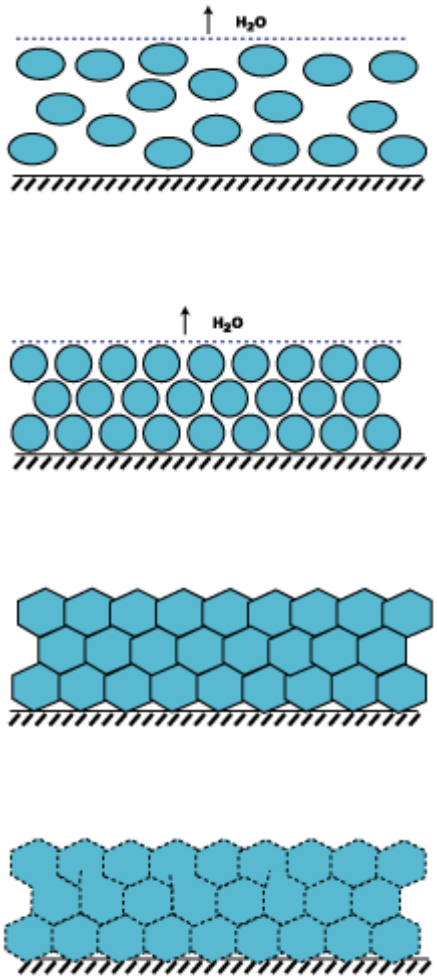
# Polishes & Removers

# Coalescents




Aqueous dispersion

Water evaporation and

Beginning of particles packing

Particles deformation

**MFFT decreasing**

Minimum Film Forming Temperature

Particles coalescence and polymers entanglement



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# Polishes

| Components | Standard | Augeo Clean *Multi* |
|---|---|---|
| Water | 40.4 | 40.4 |
| Anionic surfactant (1%) | 1.0 | 1.0 |
| Ethyldiglycol | 4.0 | - |
| Augeo Clean ***Multi*** | - | 4.0 |
| Plasticizer | 2.0 | 2.0 |
| Metalized Styren-Acrylic Resin | 43.0 | 43.0 |
| Soluble Alkali Resin | 1.6 | 1.6 |
| HDPE emulsion | 5.0 | 5.0 |
| PP emulsion | 3.0 | 3.0 |

**Solids = 20%**



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# Polishes Results

- I&I Application

| Parameters | Results | |
|---|---|---|
| | Standard | Augeo Clean *Multi* |
| Natural Gloss | 40.2 | 41.8 |
| Gloss – 1st Layer | 73.8 | 67.3 |
| Gloss – 2nd Layer | 81.0 | 83.3 |
| Spread | Good | Good |
| Drying | Good | Good |
| Slip Resistance | 0.42 | 0.38 |
| Hardness | 180 gr | 180 gr |

Augeo Clean Multi can replace Ethyldiglycol providing good spread, drying time and gloss similar to the standard.

# Polish Remover

| Components | Standard | Augeo Clean *Plus* |
|---|---|---|
| Water | 25.0 | 65.0 |
| Monoethanolamine | 30.0 | 10.0 |
| Non-ionic Surfactant | 15.0 | 15.0 |
| Butylglycol | 30.0 | - |
| Augeo Clean *Plus* | - | 10.0 |

There is no odor at the proposed remover, improving the surrounding conditions during application.

# Polish Remover Results

- I&I Application
  - 2 layers of sealer (20% solids)
  - 4 layers of waterproof polish (21% solids)

| Parameters (Dilution Rate 1:1) | Results | |
|---|---|---|
| | Standard | Augeo Clean *Plus* |
| Gloss Before | 80.2 | 80.2 |
| Gloss After | 9.6 | 9.0 |
| Spread | Easy | Easy |
| Remotion Power | Good | Great |

- Augeo Clean Plus can replace the existing solvent in removers formulation with a higher performance.
- The formula proposed can be diluted to maintain the original performance.
- Another option is to improve the performance against the original formula.

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# d-Limonene

# Solvents Characteristics

| | d-Limonene | Augeo Clean Multi |
|---|---|---|
| **Renewable Source** | Citrus | Glycerin |
| **Odor** | Citrus | Slight |
| **Flash Point (Closed Cup)** | 51°C Category 3 | 91°C Category 4 |
| **HSE** | Non-toxic to humans but toxic to environment | Non-toxic to humans and environment |
| **Solubility in water** | Non-miscible | Miscible |
| **Replacement Ratio** | Waterbased | 1:1 |
| | Solventbased | Extender |

# Standard formulation for visual method to evaluate cleaner performance

- 1st Formulation

| Component | % m/m | | | | |
|---|---|---|---|---|---|
| | STD | T1 | T2 | T3 | T4 |
| d-Limonene | 95.00 | - | 23.75 | 47.50 | 71.25 |
| Rhodasurf DA630* | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 |
| Augeo Clean Multi | - | 95.00 | 71.25 | 47.50 | 23.75 |

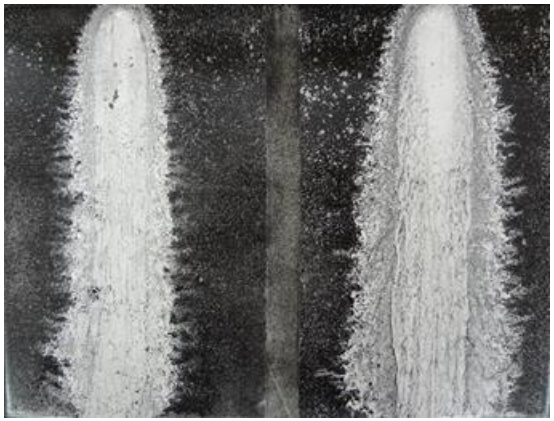
*Rhodasurf DA630 = Isodecyl Alcohol Ethoxylate (6 moles of EO)

# Visual method to evaluate cleaner performance (cleaning without effort)

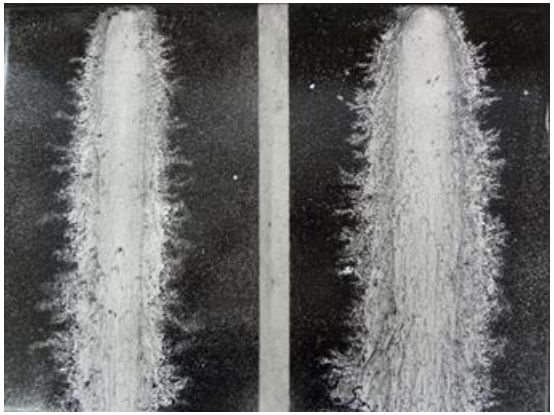
## 1st Formulation

T1 STD

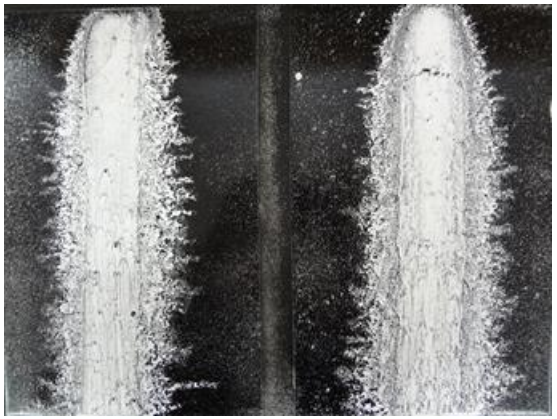
T2 STD



T3 STD



T4 STD



# Standard formulation for visual method to evaluate cleaner performance

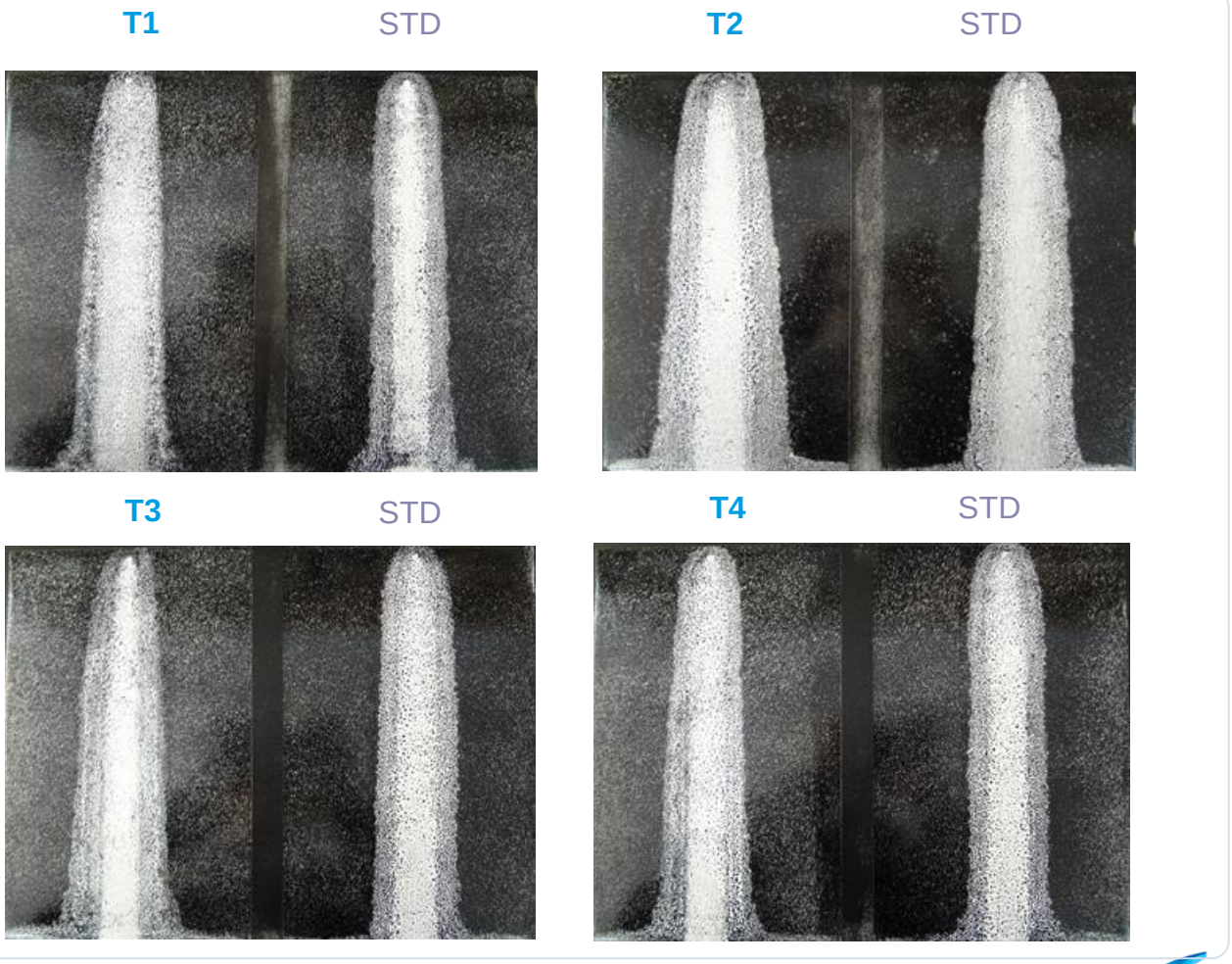
- 2nd Formulation

| Component | % m/m | | | | |
|---|---|---|---|---|---|
| | STD | T1 | T2 | T3 | T4 |
| d-Limonene | 10.0 | - | 2.5 | 5.0 | 7.5 |
| Rhodasurf DA630* | 15.0 | 15.0 | 15.0 | 15.0 | 15.0 |
| Water | 75.0 | 75.0 | 75.0 | 75.0 | 75.0 |
| Augeo Clean Multi | - | 10.0 | 7.5 | 5.0 | 2.5 |

*Rhodasurf DA630 = Isodecyl Alcohol Ethoxylate (6 moles of EO)

# Visual method to evaluate cleaner performance (cleaning without effort)

## 2nd Formulation



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# Solvents Characteristics

| | d-Limonene | Augeo Clean Plus |
|---|---|---|
| **Renewable Source** | Citrus | Glycerin |
| **Odor** | Citrus | Low |
| **Flash Point (Closed Cup)*** | 51°C Category 3 | 103°C Non-flammable |
| **HSE** | Non-toxic to humans but toxic to environmental | Non-toxic to humans and environmental |
| **Solubility in water** | Insoluble | Low |
| **Replacement Ratio** | Solventbased | 1:1 |

# Standard formulation for visual method to evaluate cleaner performance

- 1st Formulation

| Component | % m/m | | | | |
|---|---|---|---|---|---|
| | STD | T5 | T6 | T7 | T8 |
| d-Limonene | 95.00 | - | 23.75 | 47.50 | 71.25 |
| Rhodasurf DA630* | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 |
| Augeo Clean Plus | - | 95.00 | 71.25 | 47.50 | 23.75 |

*Rhodasurf DA630 = Isodecyl Alcohol Ethoxylate (6 moles of EO)

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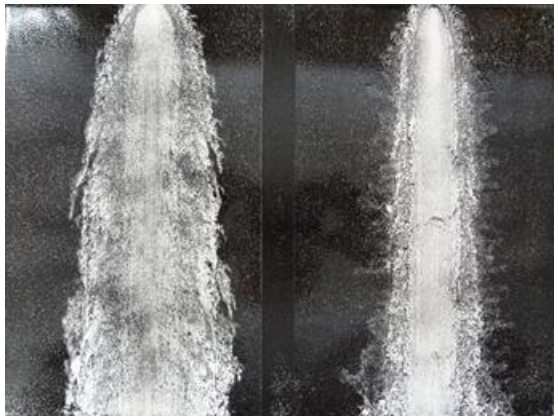
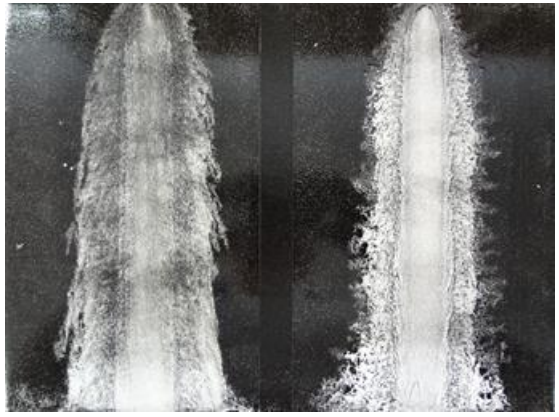
# Visual method to evaluate cleaner performance (cleaning without effort)

## 1st Formulation

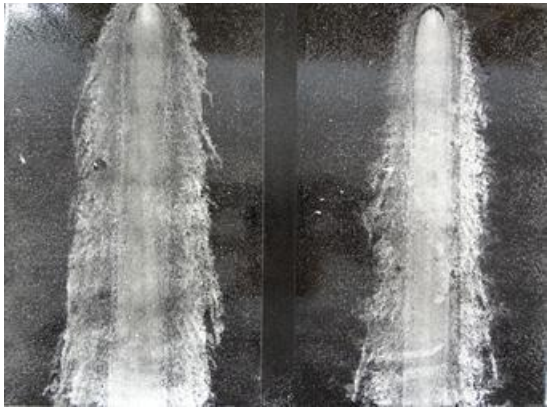
STD **T5**



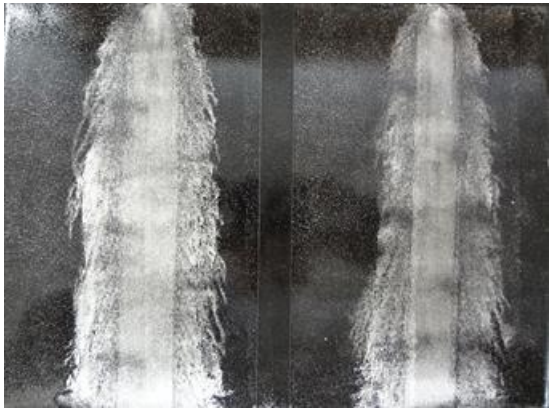
STD **T6**



STD **T7**



STD **T8**



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# Standard formulation for visual method to evaluate cleaner performance

- 1st Formulation

| Component | % m/m | | | | |
|---|---|---|---|---|---|
| | STD | T5 | T6 | T7 | T8 |
| d-Limonene | 95.00 | - | 23.75 | 47.50 | 71.25 |
| Rhodasurf L-9* | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 |
| Augeo Clean Plus | - | 95.00 | 71.25 | 47.50 | 23.75 |

*Rhodasurf L-9 = Lauryl Alcohol Ethoxylate (9 moles of EO)

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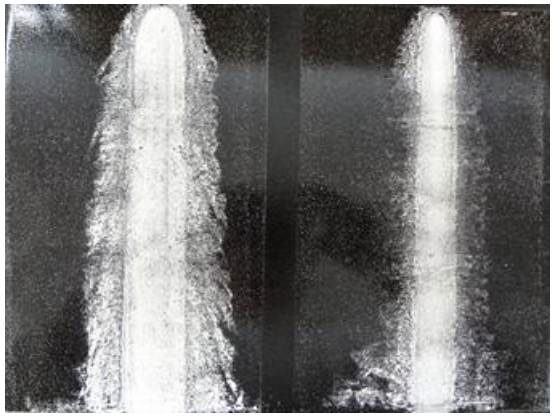
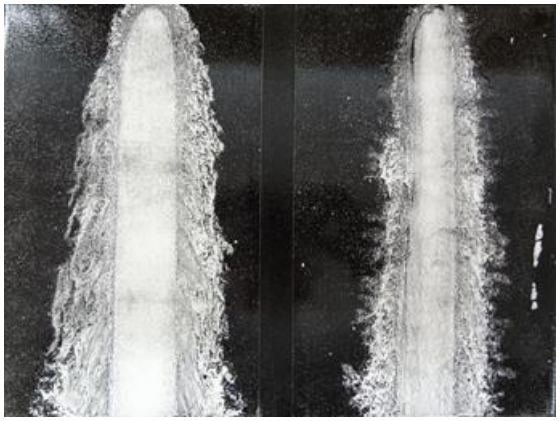
# Visual method to evaluate cleaner performance (cleaning without effort)

## 1st Formulation

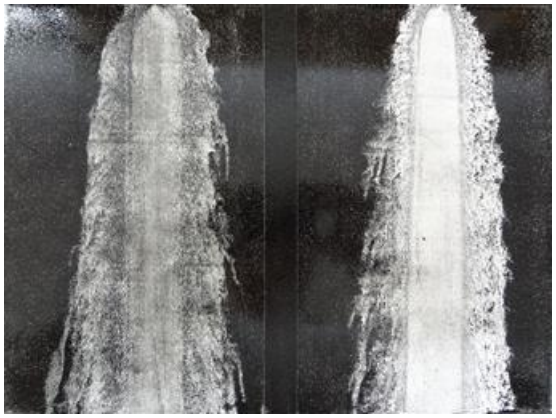
STD **T5**



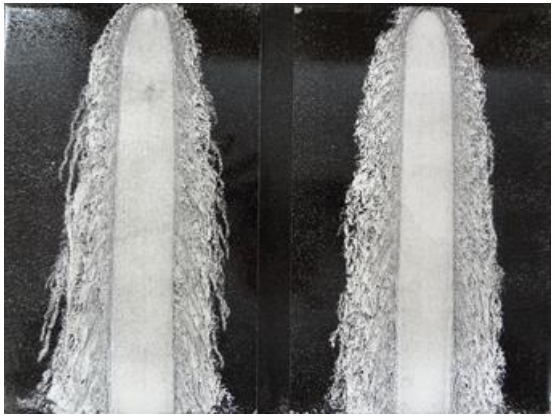
STD **T6**



STD **T7**



STD **T8**



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# Standard formulation for visual method to evaluate cleaner performance

- 1st Formulation

| Component | % m/m | | | | |
|---|---|---|---|---|---|
| | STD | T5 | T6 | T7 | T8 |
| d-Limonene | 95.00 | - | 23.75 | 47.50 | 71.25 |
| Igepal CO 630* | 5.00 | 5.00 | 5.00 | 5.00 | 5.00 |
| Augeo Clean Plus | - | 95.00 | 71.25 | 47.50 | 23.75 |

*Igepal CO 630 = Nonylphenol Ethoxylate (9 moles of EO)

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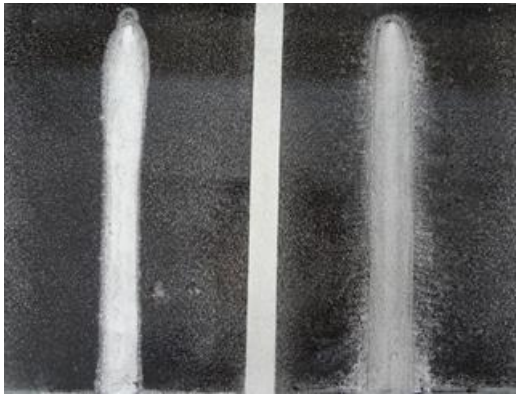
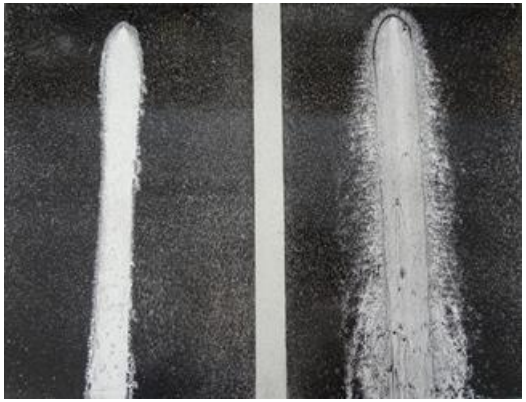
# Visual method to evaluate cleaner performance (cleaning without effort)

## 1st Formulation

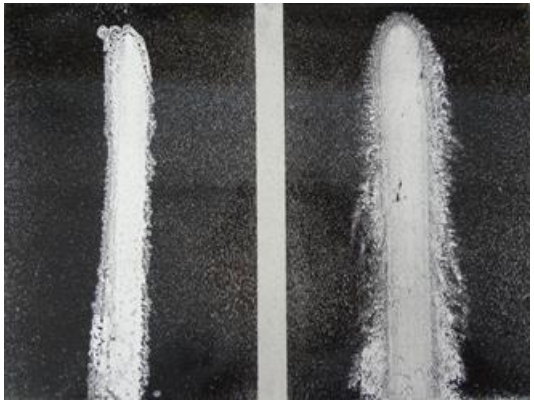
STD **T5**



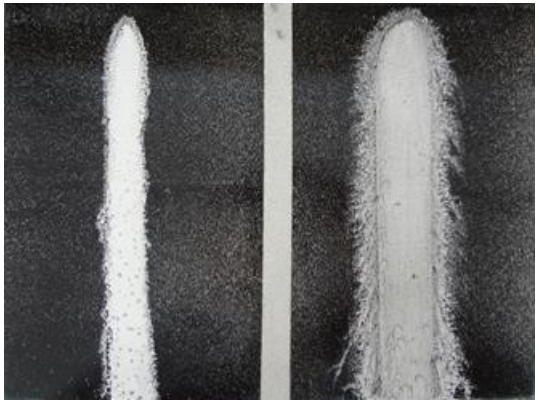
STD **T6**



STD **T7**



STD **T8**



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# Solvents Characteristics

| | d-Limonene | Augeo Clean Multi | Augeo Clean Plus |
|---|---|---|---|
| **Renewable Source** | Citrus | Glycerin | Glycerin |
| **Odor** | Citrus | Slight | Slight |
| **Flash Point (Closed Cup)*** | 51°C Category 3 | 91°C Category 4 | 103°C Non-flamable |
| **HSE** | Non-toxic to humans but toxic to environmental | Non-toxic to humans and environmental | Non-toxic to humans and environmental |
| **Solubility in water** | Insoluble | Soluble | Low |
| **Replacement Ratio** | Waterbased | 1:1 | 2:1 |

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# Glass Cleaners

# Reference Formulation

| Component | Reference (% w/w) | Proposal (% w/w) |
|---|---|---|
| Water | 92-94 | 92-94 |
| Anionic Surfactant | 0.25-1.25 | 0.25-1.25 |
| Non-ionic Surfactant | 1.5-2.5 | 1.5-2.5 |
| Chelant Agent | 0.1 | 0.1 |
| Ethanol | 1.5 | 2.0 |
| Butylglycol | 2.5 | - |
| Augeo Clean Multi | - | 2.0 |

**EB ➡ Augeo Clean Multi + Ethanol**

- **Competitiviness**
- **Performance**

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