



## Formulating across Home Care and I&I New Insights into Trilon® M

BASF Care Chemicals North America

 **BASF**

We create chemistry

**1 | Meeting the Needs**

**2 | Trilon M Performance Attributes**

**3 | Automatic Dishwashing**

**4 | Hard Surface Cleaning**

**5 | I&I Applications**

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At BASF – *We Create Chemistry* for a sustainable future.

BASF, One of the Most Innovative Companies Worldwide\*

\* On Boston Consulting Group's report since 2012



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# Understanding What Matters For Home Care & I&I Markets

**BASF**  
We create chemistry

## *Performance*

Efficacy  
Speed  
Application Range  
Safety



## *Sustainability*

Regulatory  
Ecolabels  
Resource Savings  
Renewables

## *Transparency*

Awareness  
Retailer Policies  
Chemical Policies  
Label Restriction  
GHS/SDS



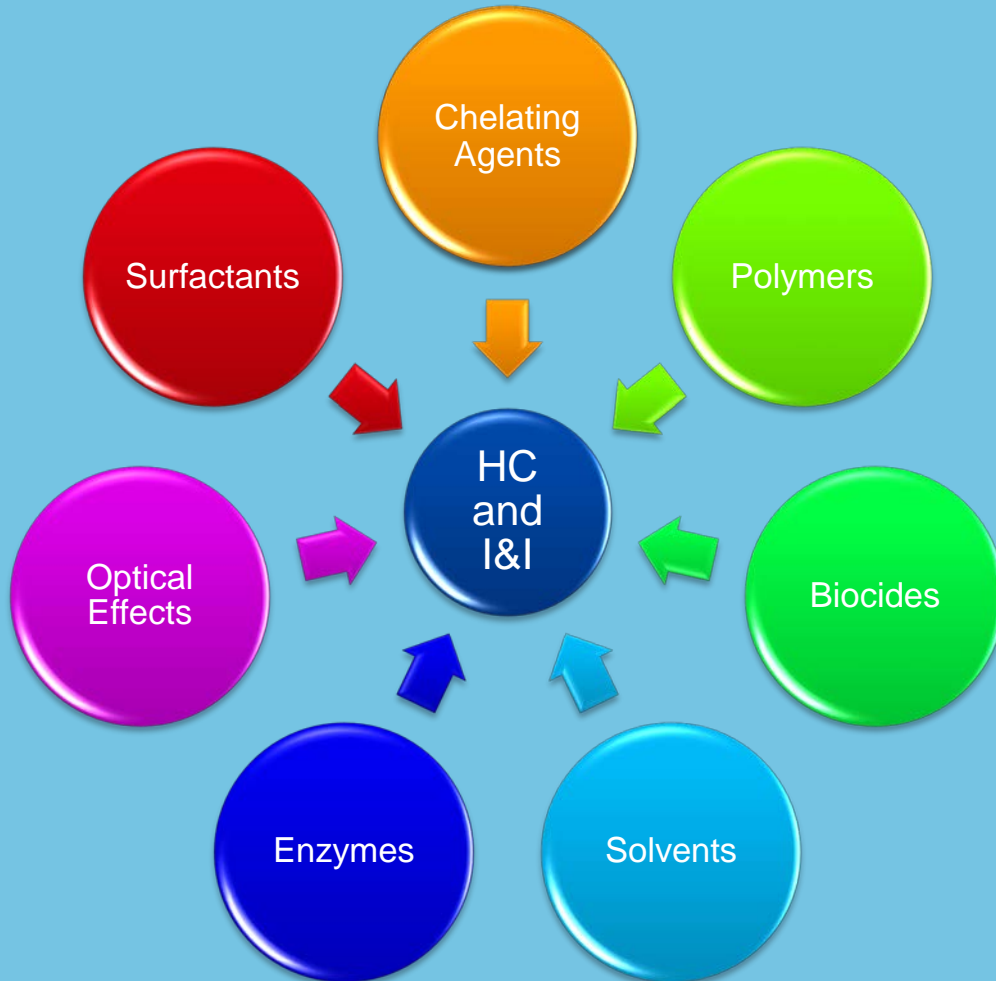
## *Experience*

Ease of Use  
Convenience  
Perceived Value  
Social Media  
eCommerce

**All Combined - Delivers Customer Expectation**

# Delivering the Needs

## Product Category Delivering Functionality





# Roles of Chelating Agents in HC + I&I

## Chelating Agents



w/o  
Chelates



w/  
Chelates

## Controls Metal Ion Concentration in Liquid Phase

- Maintain washing efficiency – Minimize interaction between hard water ions & anionic surfactants
- Detergency of metal containing stains (i.e. blood – red wine – tea )
- Water softening
- Prevents deposition of scales
- Complexes scales (i.e. bathroom cleaners)

# Meeting the Challenges Chelate Category Needs



## Trilon® M MethylGlycine Diacetic Acid Trisodium Salt (MGDA)



- Wide Range of Applications
- Readily Biodegradable
- Safer Choice Approved
- Superior Eco-Tox Data
- Direct Release Approved
  
- Fast Acting Chelates for Organic and Inorganic Scale
- Broad Spectrum Complexation across wide pH ranges
- Numerous ECOLABELS



Trilon® M  
Liquid & Granules



1 | Meeting the Needs

2 | **Trilon M Performance Attributes**

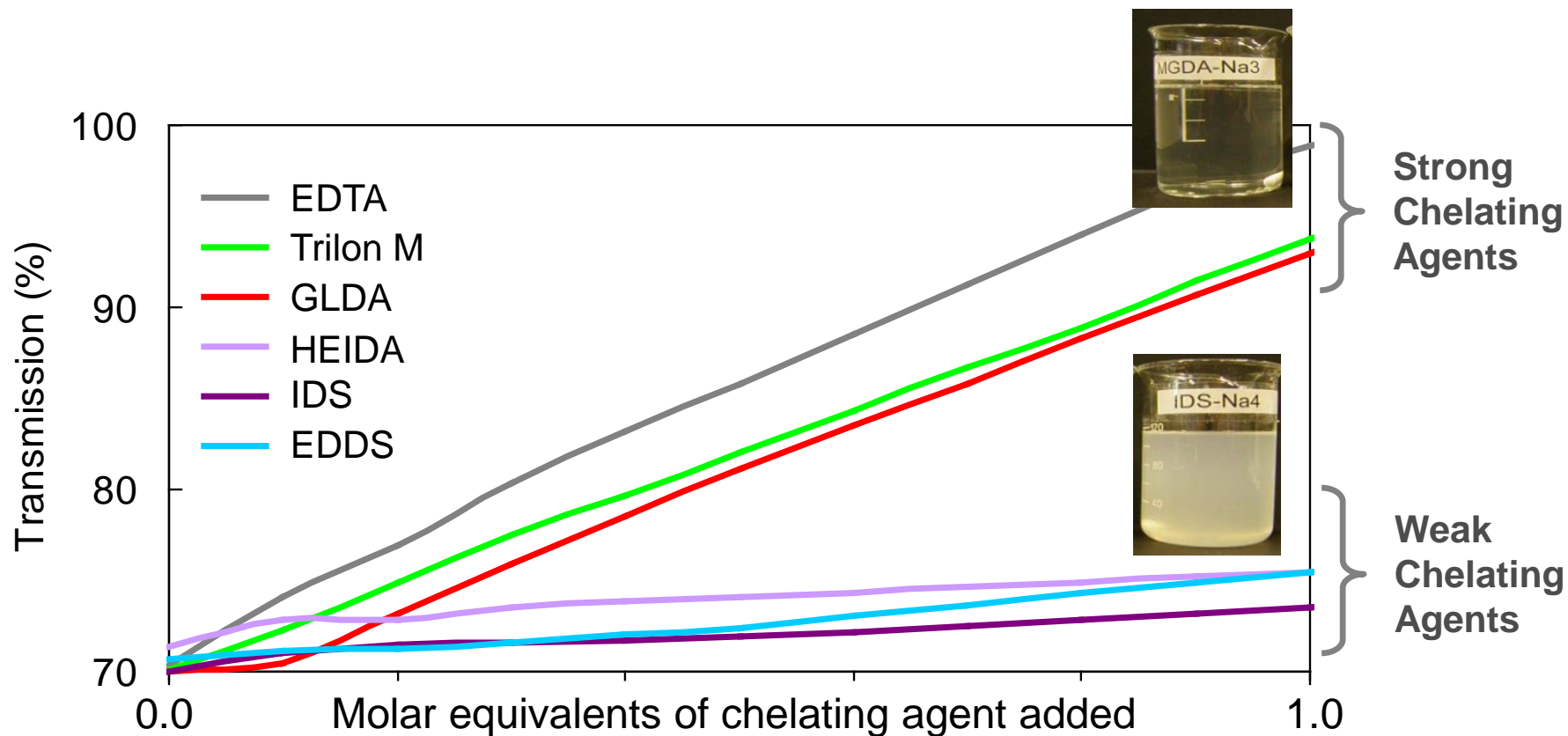
3 | Automatic Dishwashing

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# Trilon M Chelating Strength

## Clearing of a Calcium Carbonate Suspension

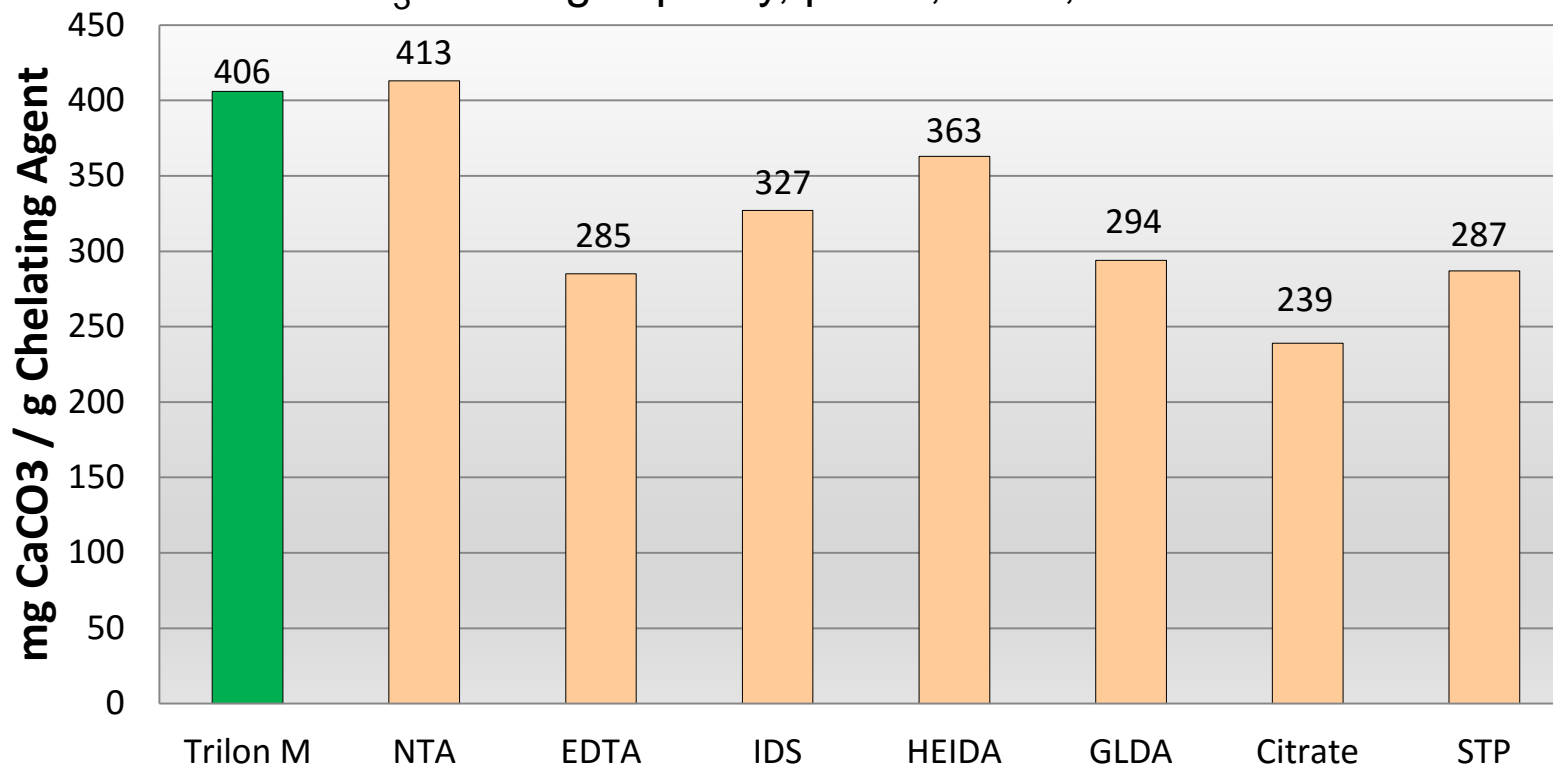


**Trilon M is a strong chelating agent**

# Choosing the Right Chelating Agent

## Trilon M - Chelating Efficiency

CaCO<sub>3</sub> binding capacity, pH 11, 23°C, 100% actives basis

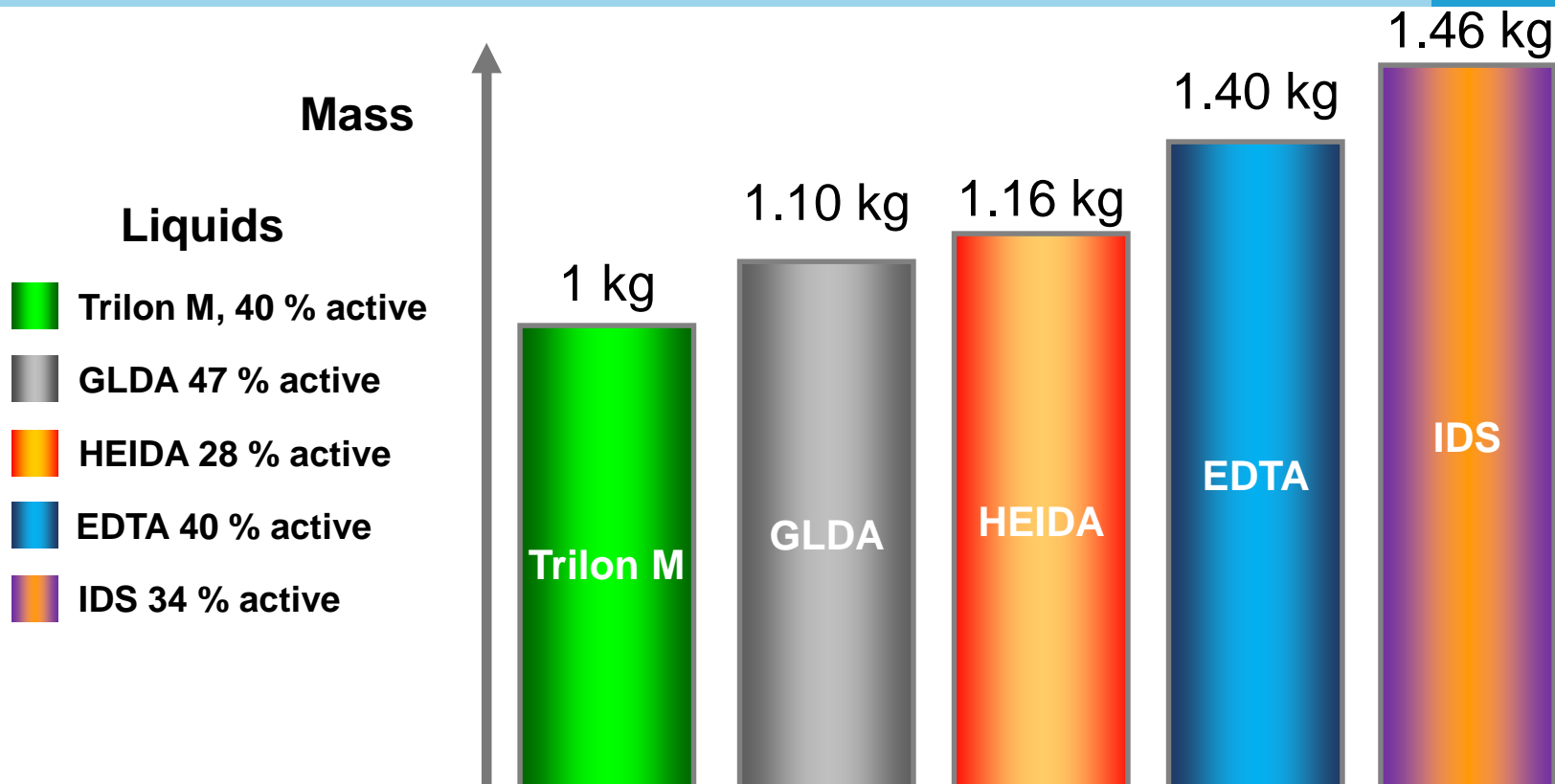


Turbidity Titration (photo electrode), Solution: Chelating Agent + Na-carbonate titrated with Ca-acetate

**Trilon M is highly efficient (~40% more efficient than EDTA or GLDA)**

# Trilon M liquid is the most efficient product

Effect of high Chelate Efficiency (low MW) and % actives



Active Ingredient	Trilon M	GLDA	HEIDA	EDTA	IDS
Molecular Weight	271	351	221	380	337
Active Concentration %	40%	47%	28%	40%	34%
Mass/Efficiency(MGDA=1)	1.00	1.10	1.16	1.40	1.46

# Choosing the Right Chelating Agent

## Trilon M – Eco Profile

### Human Safety Data

acute toxicity (oral and dermal, rat)	LD <sub>50</sub> >2000 mg/kg
Ames test (OECD 471 and 472)	negative
skin sensitization (Guinea Pig Maximization Test)	negative
skin irritation (OECD 404)	no irritation
mucous membrane / eye irritation (OECD 405)	no irritation
90 d oral application study (OECD 408)	ca. 170 mg/kg•d body weight (NOAEL)

### Environmental Safety Data

fish toxicity (OECD 203)	LC <sub>50</sub> >100 mg/l
daphnia magna toxicity (OECD 202)	EC <sub>50</sub> >100 mg/l
biodegradability ( <b>OECD 301 A, B, C, E &amp; F</b> )	<b>readily biodegradable</b>
algae toxicity (OECD 201, Ca-suppl.)	EC <sub>50</sub> >100 mg/l
fish chronic toxicity (28d, OECD 204)	NOEL 50-100 mg/l

**Trilon M: Readily biodegradable**  
**Safe for Human Contact and for the Environment**

1 | Meeting the Needs

2 | Trilon M Performance Attributes

3 | **Automatic Dishwashing**

4 | Hard Surface Cleaning

5 | I&I Applications



# Phosphate Ban Impact on Auto-Dish Washer (ADW) Market

The Phosphate ban (2010): initially consumers were very dissatisfied with non-phosphate dish detergents. Formulators needed cost effective ways to replace all the benefits of phosphates.

Leading Commercial non-P Gel ~circa 2010



Sodium Carbonate

Trilon M

STPP

NaOH

Hobart AM14; 160F 40sec wash, 180F 9sec rinse, for 100 cycles. 1200ppm builder concentration for each cycle.

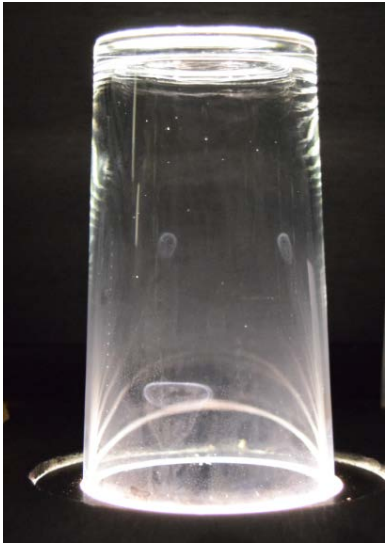
**Trilon M offers spotting & filming performance equal (or better!) than phosphates.**

# ADW Builder Systems with Trilon M

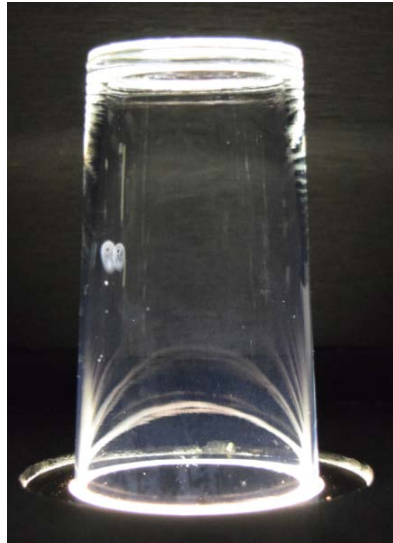
## Cost Reduction and/or Performance Boost



Synergistic combination yields less spotting & filming  
Equal Cost Mid-tier Formulations



Formula #1  
Sodium Citrate Alone  
Largest wt% of chelate



Formula #2  
Trilon M + citrate  
Intermediate wt% of chelate



Formula #3  
Trilon M alone  
Least wt% of chelate



Formula #4 Premium  
Trilon M alone  
Wt% chelate = formula #2  
No spotting or filming!

**Trilon M enables premium formulations and/or cost reduction opportunities**

# ADW Powder or Unit Dose Formulas

## Trilon M With Sodium Citrate



Ingredient	Chemical Description	Value	Wt%		Function
			Mid-tier	Premium	
<b>Trilon® M Gran SG T</b>	<b>Methylglycinediacetic acid</b>	<b>2</b>	<b>4.5</b>	<b>12</b>	<b>Stain Removal, Chelation</b>
<b>Dehypon® GRA</b>	<b>Modified alcohol polyglycol ether</b>	<b>0</b>	<b>2</b>	<b>4</b>	<b>Detergency, Shine</b>
<b>Plurafac® SLF 180</b>	<b>Alcohol alkoxyate</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>Detergency, Shine</b>
<b>Sokalan® PA 25 CL Granules</b>	<b>Polyacrylic acid, sodium salt</b>	<b>3</b>	<b>4</b>	<b>5</b>	<b>Detergency, Shine</b>
Sodium Citrate	-	10	4.5	0	Chelation
Enzymes (Protease, Amylase)	-	1	1.5	3	Tough Soil Removal
Sodium Carbonate	-	35	35	35	Builder
Sodium Percarbonate	-	15	10	3	Non-chlorine bleaching
Sodium Disilicate	-	10	10	3	Alkalinity
Sodium Sulfate	-	21	24.5	30	Filler

Mix all dry ingredients.

Add Plurafac® SLF 180 to resulting powder mixture dropwise with mixing.

Allow sufficient mixing to evenly disperse the liquid.

Dose size = 20g

Formulation Numbers: Value: TM-010; Mid-tier: TM-011; Premium: TM-012

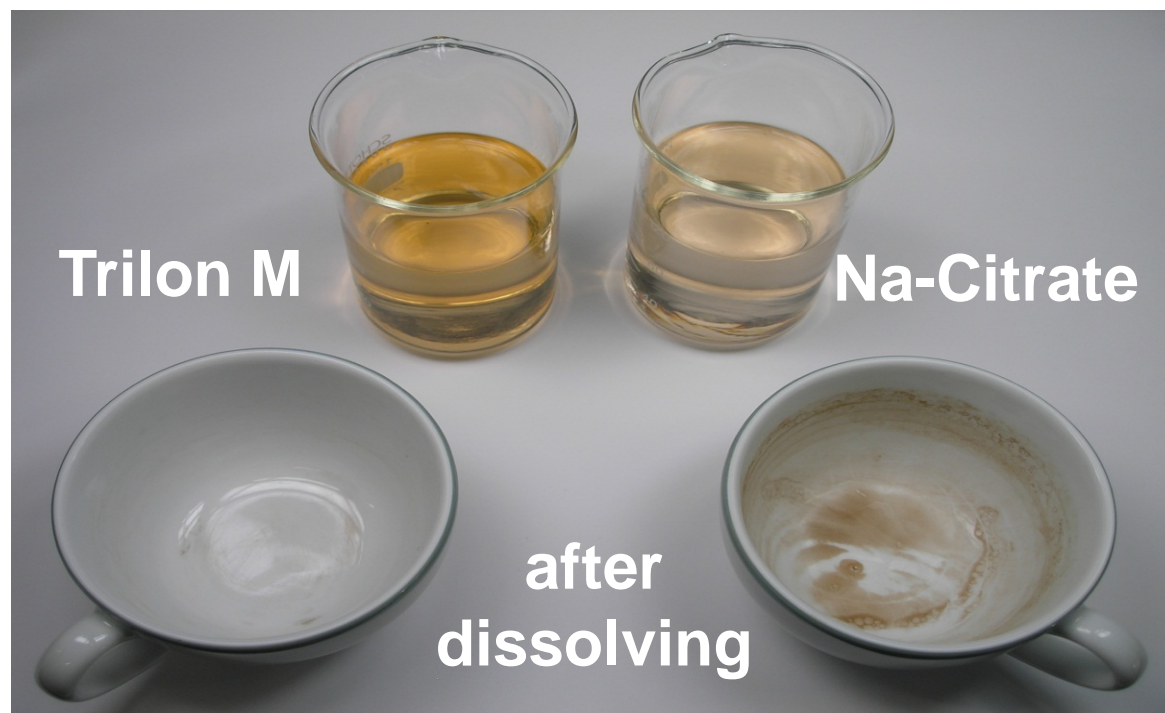
**Trilon M, Dehypon GRA, and Plurafac SLF 180** have been reviewed by EPA's Safer Choice Program and qualifies for use in Safer Choice-labeled Products



# Trilon M for Stain Removal in Automatic Dish

## Best Removal of Oxidizable Stains

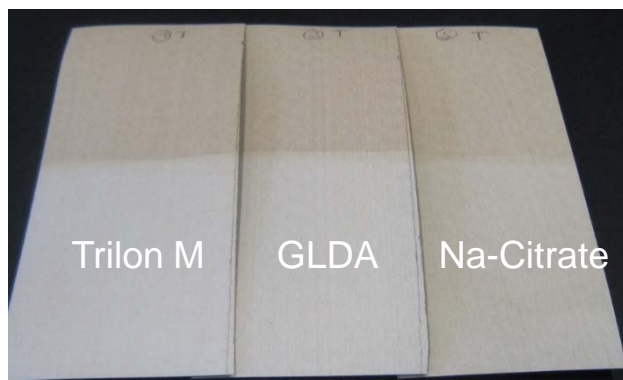
Removing tea stain with Trilon M vs. Na-citrate (2% active)



**Trilon M provides stain removal**

# Trilon M for Stain Removal in Automatic Dish

## Best Removal of Oxidizable Stains

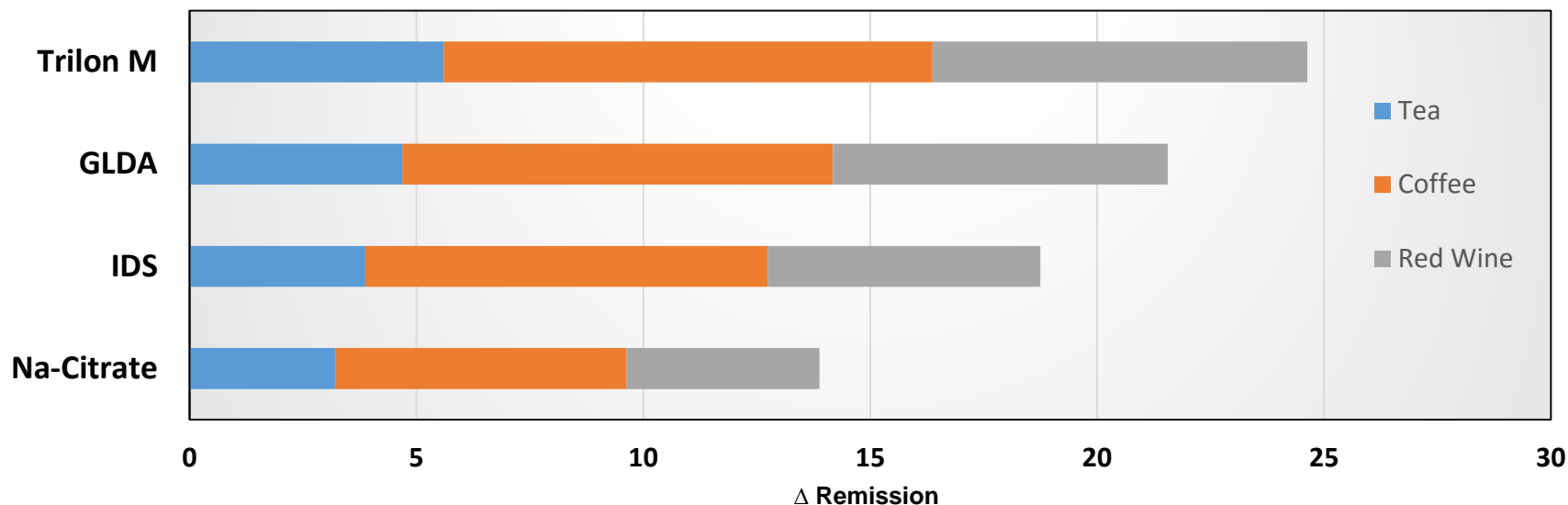


Soiled Melamine Plates (10x12cm)

### Simulated ADW Test Conditions

- Partially submerged in 0.5% active chelate solution for 30 minutes
- Temperature, 50°C
- pH = 10.8

### Stain Removal after 30 minutes of soaking



1 | Meeting the Needs

2 | Trilon M Performance Attributes

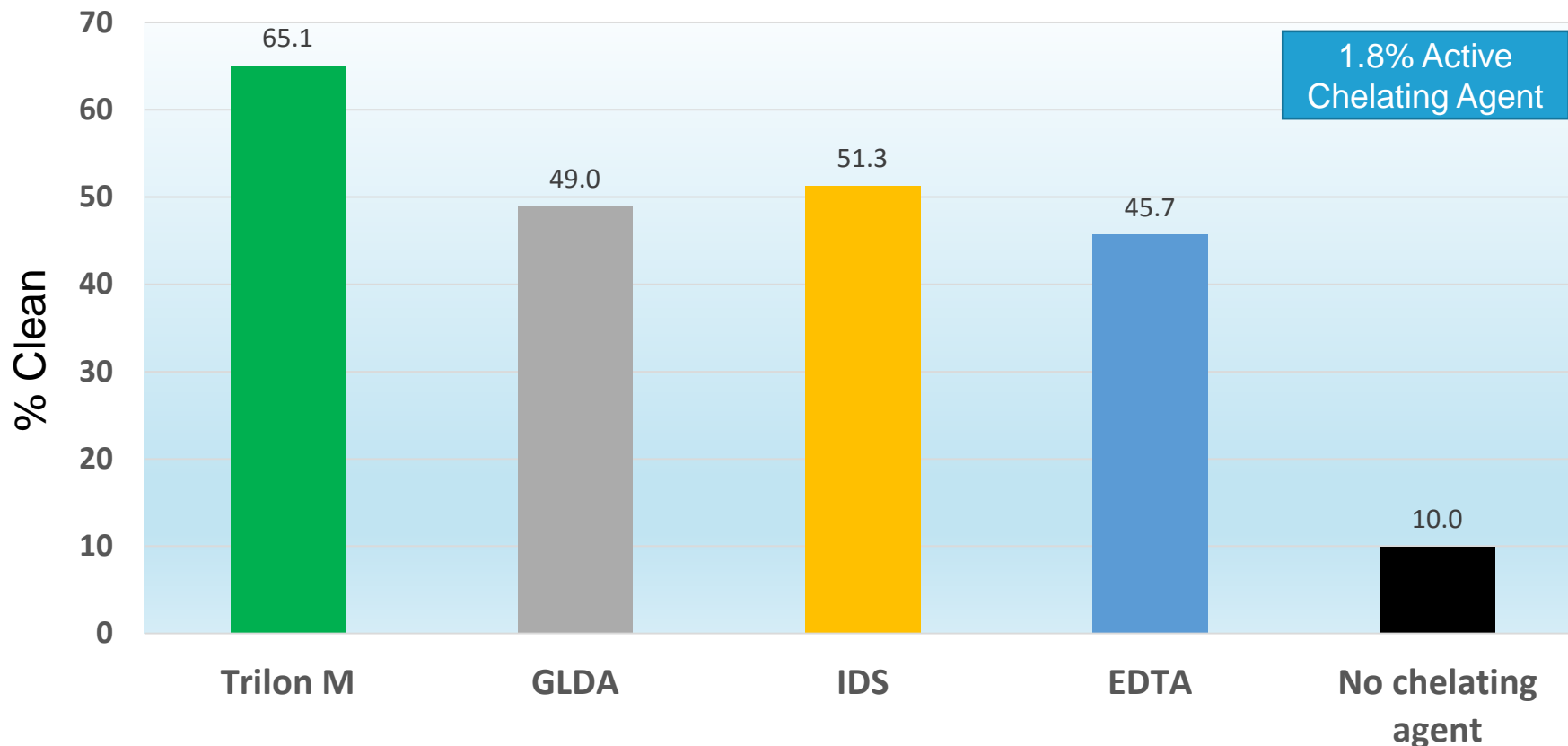
3 | Automatic Dishwashing

4 | **Hard Surface Cleaning**

5 | I&I Applications



# Trilon M Hard Surface Cleaning Anionic Surfactant Based Formulation



**Surface:** Vinyl Tile, **Soil:** FSTM Soil heated at 100°C for 60 minutes); **Water Hardness:** 250 ppm; **Measurement:** Reflectance before and after soiling (% clean). **Equipment:** Gardner Scrubber, VWR 58540-047 sponge. **Methodology:** 11 ml of cleaning solution on sponge, additional 4 ml added every 25 cycles for a total of 100 cycles.

**Less Hard Water Antagonism with Trilon M  
Better Cleaning for Hard Surfaces!**

# Soap Scum Removal Power of Trilon M



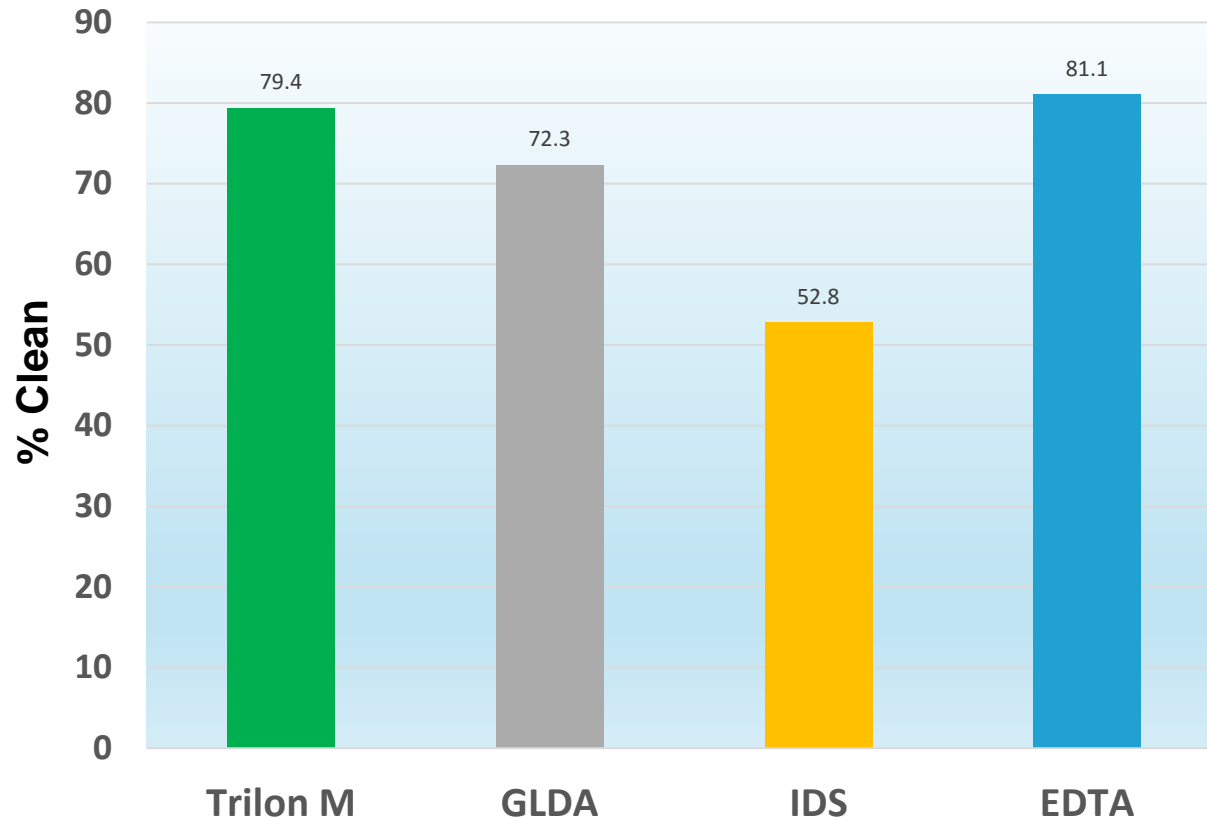
Before  
treatment

Trilon M

Weak  
chelating agent

# Trilon M in Hard Surface Cleaning Alkaline Bathroom Cleaner

Primary Cleaning - Soap Scum Soil on Cermaic Tile



Alkaline Bathroom Cleaner (see <i>TM-06</i> )	
Ingredient	Weight %
Chelating Agent (active)	2.6
Glucopon 420 UP	2.0
Butyl Diglycol	1.5
NaOH	To pH 12.3
Water	Balance

Simulated Soap Scum  
On ceramic black tile  
20 passes on Gardener Scrubber  
At room temperature



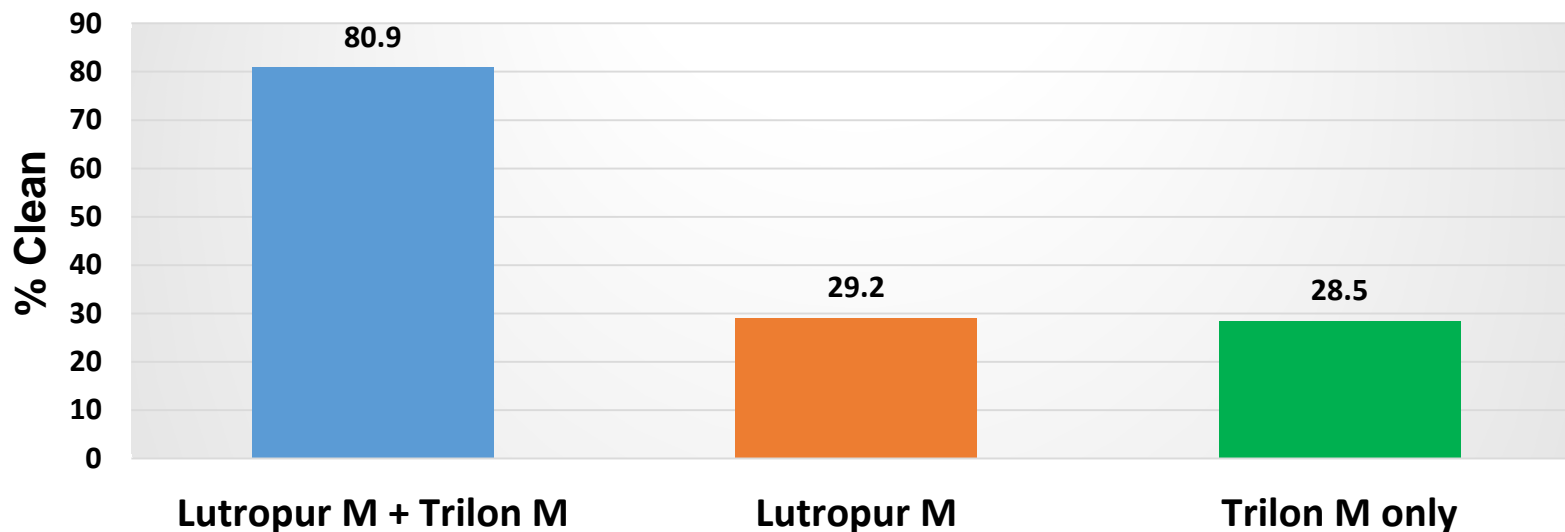
# Trilon M in an *Acidic* Bathroom Cleaner?! Exceptional Synergy with strong acids

## Conventional Wisdom on Acidic Cleaners

- Chelating agents don't work at low pH
- Acid strength is most important for cleaning



## Cleaning Calcium Stearate on Ceramic Tile, Acidic Formulas



All formulas made to pH = 2.4. Trilon M only and Lutropur M only formulas adjusted to pH = 2.4 with citric acid and NaOH respectively

**New BASF technology: Synergistic Cleaning with Lutropur<sup>®</sup> M + Trilon M**  
Premium performance or cost savings for difficult bathroom scales

# Trilon M Bathroom Cleaner Formulations

## Designed with BASF's Safer Choice Ingredients



### Traditional Alkaline Cleaner with Trilon M (TM-06)

Ingredient	Chemical Description	Wt%	Function
<b>Trilon® M liquid T</b>	<b>Methylglycinediacetic acid, 40%</b>	<b>6.50</b>	<b>Chelation, Scale dissolution</b>
<b>Glucopon® 420 UP</b>	APG based on natural fatty alcohol C8-C14, 50%	<b>2.00</b>	<b>Surfactant, Detergency</b>
Butyl Diglycol		1.50	Solvent
Water		90.00	Diluent
Add ingredients to water in the order listed. Mix until homogeneous. pH (as is) = 12.0, Specific Gravity = 1.012, Non-volatiles = 3.60%			

### Acidic Cleaner with Trilon M (TM-05)

Ingredient	Chemical Description	Wt%	Function
<b>Lutropur® M</b>	<b>Methanesulfonic acid, 70%</b>	<b>1.75</b>	<b>Strong acid, scale dissolution</b>
<b>Trilon® M liquid T</b>	<b>Methylglycinediacetic acid, 40%</b>	<b>3.81</b>	<b>Chelation, Scale removal</b>
<b>Lutensol® XL 80</b>	C10-Guerbet alcohol alkoxylate	<b>1.2</b>	<b>Surfactant, Detergency</b>
Butyl Diglycol		1.50	Solvent
Water		91.74	Diluent
Add ingredients to water in the order listed. Mix until homogeneous. pH (as is) = 2.4, Specific Gravity = 1.012, Non-volatiles = 3.95%			

**Trilon M, Glucopon 420 UP, Lutropur M, and Lutensol XL 80** have been reviewed by EPA's Safer Choice Program and qualifies for use in Safer Choice-labeled Products



# Trilon M Formulation – All Purpose Cleaner

## Designed with BASF's Safer Choice Ingredients



### Ready-to-use All Purpose Cleaner (TM-09)

Ingredient	Chemical Description	Wt%	Function
<b>Trilon® M liquid</b>	<b>Methylglycinediacetic acid, 40%</b>	<b>0.80</b>	<b>Chelation, Scale dissolution</b>
<b>Lutensol® XL 40</b>	C10-Guerbet alcohol alkoxyate	<b>0.60</b>	<b>Surfactants, Detergency</b>
<b>Glucopon® 420 UP</b>	APG based on natural fatty alcohol C8-C14, 50%	<b>0.80</b>	<b>Surfactant, Detergency</b>
<b>Texapon® 842 UP</b>	Sodium n-octyl sulfate, 42%	<b>1.85</b>	<b>Surfactant, Hydrotrope</b>
Preservative		q.s.	Antimicrobial / Antifungal
Water		95.95	Diluent

Add ingredients to water in the order listed. Mix until homogeneous.  
 pH (as is) = 11.50, Specific Gravity = 1.002, Non-volatiles = 2.10%

**Trilon M, Lutensol XL 40, Glucopon 420 UP, and Texapon 842 UP** have been reviewed by EPA's Safer Choice Program and qualifies for use in Safer Choice-labeled Products





**1 | Meeting the Needs**

**2 | Trilon M Performance Attributes**

**3 | Automatic Dishwashing**

**4 | Hard Surface Cleaning**

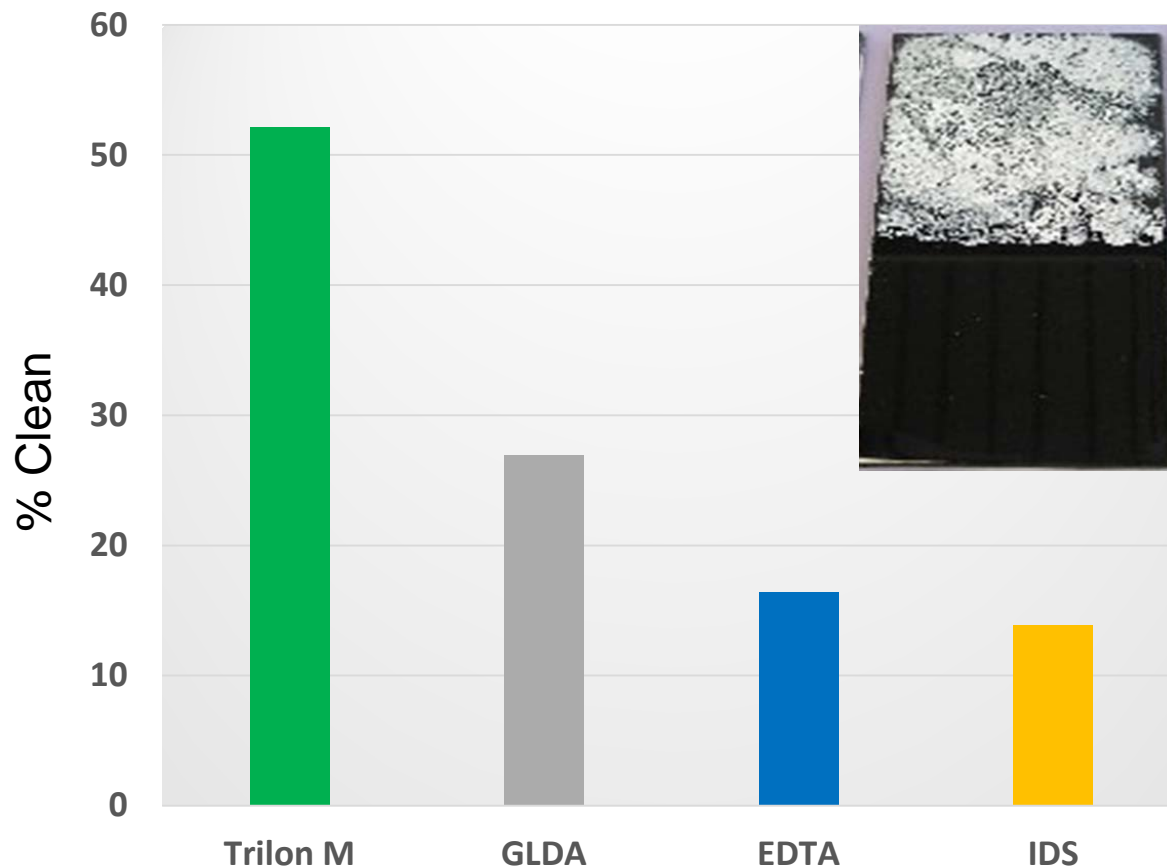
**5 | I&I Applications**

# Trilon M in I&I Cleaning Bathroom Cleaner Concentrate MGDA most effective (strength & efficiency)

I&I Bathroom Cleaner Concentrate	
Ingredient	%
Chelating Agent (active)	12
Glucopon® 215 UP	6
BTC® 2125M quat	5
Water	Balance

Concentrate diluted to 1:18  
pH adjusted to 10.0

Simulated Soap Scum  
On ceramic black tile  
20 passes on Gardener  
Scrubber  
At room temperature



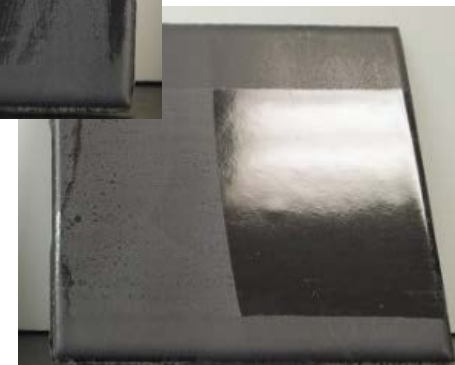
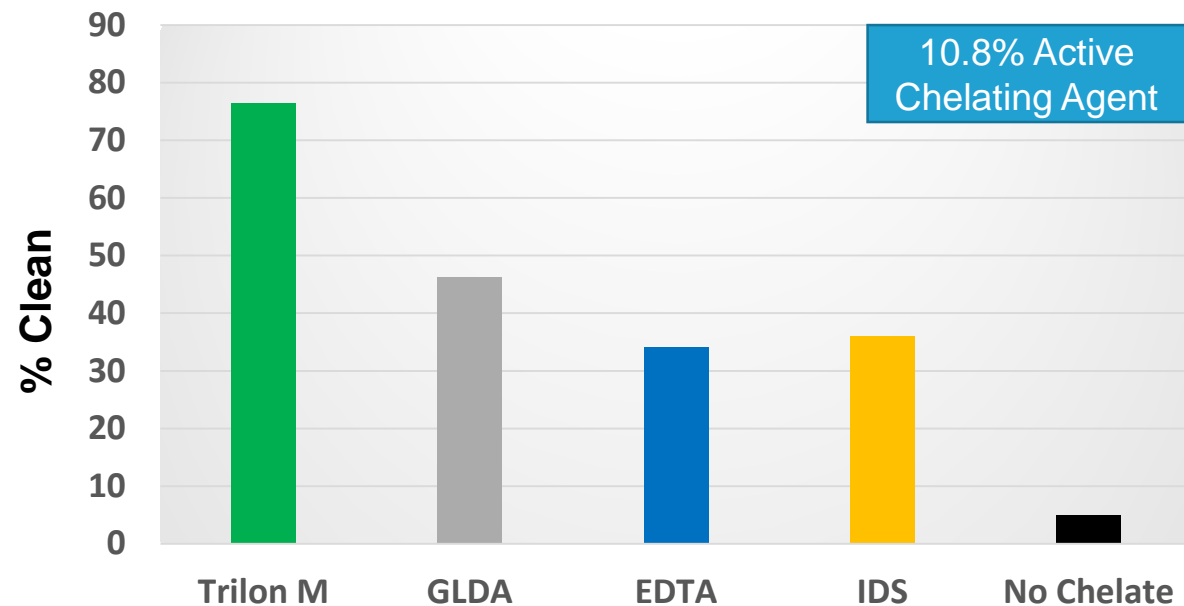
**30% Cleaning Performance Advantage of Next Best Chelating Agent**

# Trilon M in an *Acidic* I&I Bath Cleaner?! Exceptional Synergy with strong acids

## Conventional Wisdom on Acidic Cleaners

- Chelating agents don't work at low pH
- Acid strength is most important for cleaning
- I&I Bath Cleaner Concentrate (pH = 3.5) w/ Chelating agent (see Formulation TM-013)

Formulation diluted 1:7 in DI water; Simulated Soap Scum on ceramic black tile; 20 passes on Gardener Scrubber at room temperature



**Dramatic cleaning synergy with Lutropur M + Trilon M**

# Trilon M in I&I Cleaning

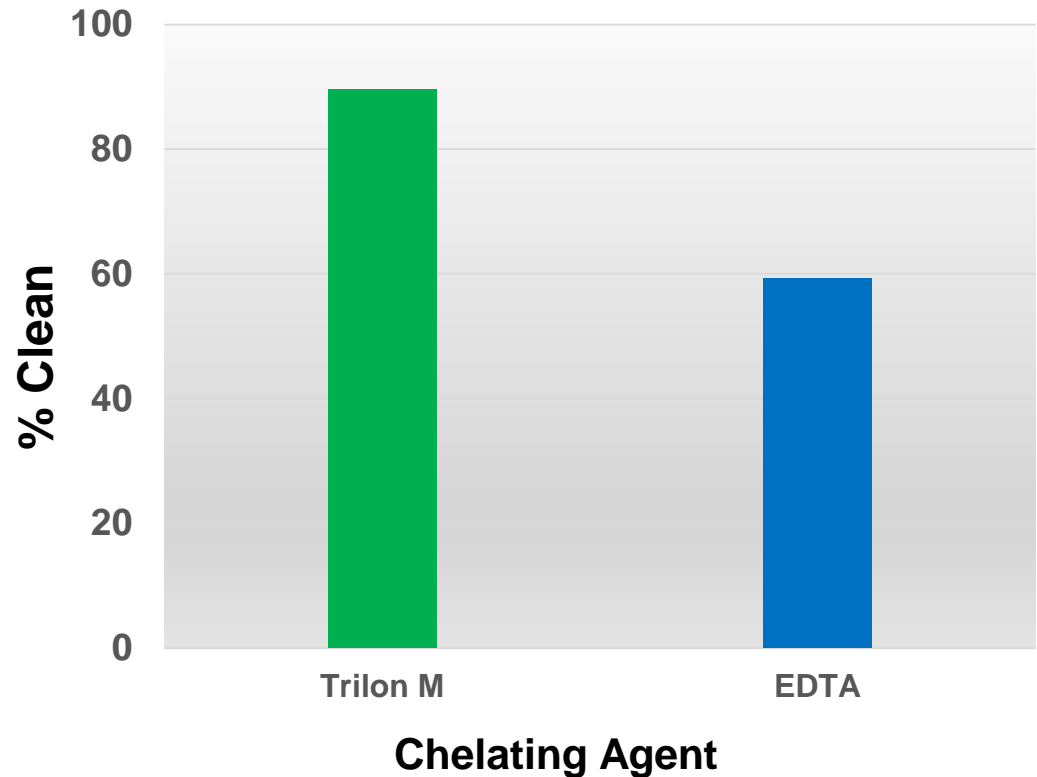
## Industrial Descaling

### CIP: Alkaline Milk-scale Cleaner



Formulation	
Ingredient	% actives
Chelating Agent	4.25
Sodium Hydroxide	10
Water	qs to 100

Use Level Dilution 1:100



Simulated milk scale on stainless steel coupons  
Soak test in cleaning solution

**Trilon M results in more effective descaling than EDTA**

# Trilon M in Ware Wash Baked on Egg and Oatmeal Removal



Worst



Best



## Ware Wash Formulation (see *TM-14*)

Ingredient	%
Chelating Agent (as-is)	50
Sodium Silicate 5H <sub>2</sub> O	5.0
Sokalan PA 30 CL	2.2
Sodium Hydroxide (50%)	40.0
Water	2.8

Trilon M helps remove more baked on egg and oatmeal

# Trilon M in Vehicle Wash

## Prevents Hard Water Antagonism with Anionic Surfactant



### Vehicle Wash Formula

<b>Lutensol XP 40</b>	<b>10</b>
<b>Anionic Surfactant</b>	<b>5</b>
<b>Chelating agent (active)</b>	<b>4</b>
<b>De-ionized Water</b>	<b>Up to 100</b>

### Greasy Soil

58% Motor Oil  
17% Spindle Oil  
25% Carbon Black

### Test Parameters

Soiled metal tile, place at 45° angle  
5 mL of cleaner on lower 80% of tile  
4 minute contact time,  
followed by flush with water



No chelating agent



Trilon M



GLDA



IDS



Sodium Citrate



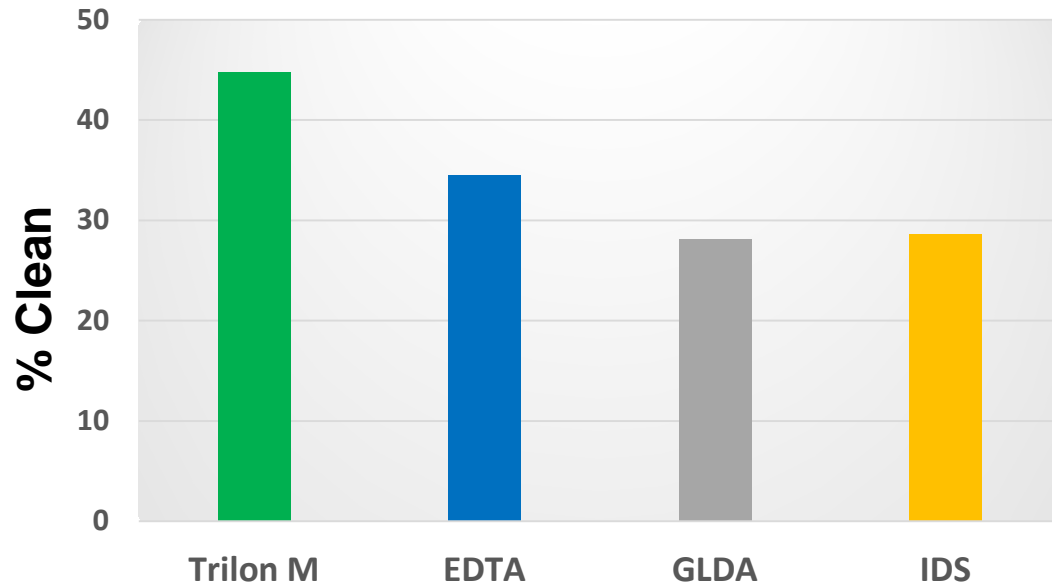
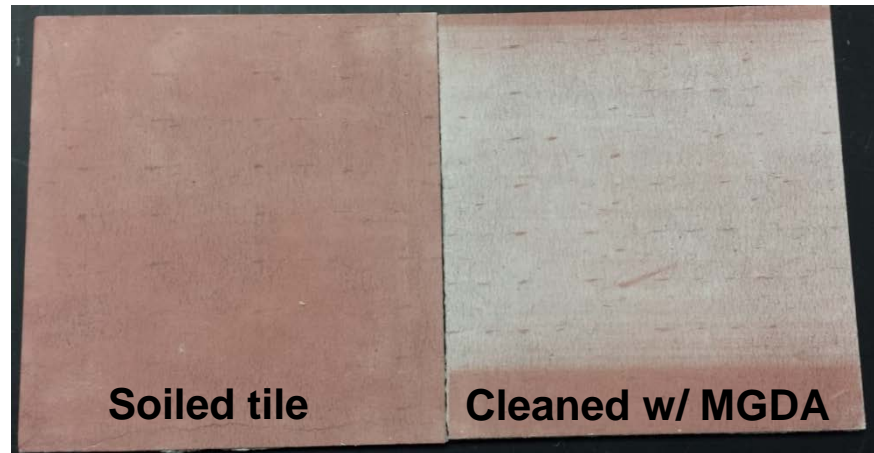
**Trilon M formula achieves near complete soil removal**



# Trilon M in Vehicle Wash

## Providing detergency, Brake Rust Removal

Vehicle Wash Formula (See <i>TM-15</i> )	
Glucopon 225 DK	30%
Lutensol XL 70	20%
Chelating agent (active)	4%
De-ionized Water	Up to 100



### Greasy Soil with Brake Rust

58% Motor Oil  
17% Gear Oil  
25% Brake Rust (Iron Oxide)

### Test Parameters

Vinyl tiles, soil dried for 24 hrs  
Formula dilution: 1:100  
30 grams of diluted formula  
Gardener scrubber, 10 passes

# Trilon M Formulary

## I&I Hard Surface Cleaner Concentrates



### All Purpose Cleaner Concentrate (*TM-07*)

Ingredient	Chemical Description	Wt%	Function
Citric Acid, Anhydrous		0.56	pH adjustment
<b>Glucopon® 420 UP</b>	APG based on natural fatty alcohol C8-C14, 50%	<b>24.00</b>	<b>Surfactant, Detergency</b>
<b>Trilon® M liquid T</b>	<b>Methylglycinediacetic acid, 40%</b>	<b>5.00</b>	<b>Chelation, Water conditioner</b>
Preservative		q.s.	Solvent
Water	-	70.44	Diluent

Add ingredients to water in the order listed. Mix until homogeneous.  
 Usage: 2.0 oz / gal  
 pH (as is) = 10.60, Specific Gravity =1.072, Non-volatiles = 14.6%

### Acidic Bathroom Cleaner Concentrate (*TM-13*)

Ingredient	Chemical Description	Wt%	Function
<b>Trilon® M liquid T</b>	<b>Methylglycinediacetic acid, 40%</b>	<b>10.5</b>	<b>Chelation, Scale removal</b>
<b>Lutropur® M</b>	<b>Methanesulfonic acid, 70%</b>	<b>10.5</b>	<b>Strong Acid, Scale dissolution</b>
<b>Lutensol® XL 80</b>	<b>C10-Guerbet alcohol alkoxyate</b>	<b>0.7</b>	<b>Surfactant, Detergency</b>
<b>Dehyton® PK 45</b>	<b>Cocoamidopropylbetaine, 45% solids</b>	<b>3.1</b>	<b>Cosurfactant, Detergency</b>
Sodium Hydroxide		To pH = 3.5	pH adjustment
Water	-	qs to 100	Diluent

Add ingredients to water in the order listed. Mix until homogeneous.  
 Usage: 1:7 dilution  
 pH (as is) = 3.5

**Trilon M, Glucopon 420 UP, Lutropur M, Lutensol XL 80, and Dehyton PK 45** have been reviewed by EPA's Safer Choice Program and qualifies for use in Safer Choice-labeled Products



# Trilon M Formulary

## I&I Formulation



### Warewash Formula (TM-14)

Ingredient	Chemical Description	Wt%	Function
Sodium MetalSilicate * 5H <sub>2</sub> O		5.00	Builder
<b>Sokalan® PA 30 CL</b>	Polyacrylate, sodium salt, 40%	<b>2.20</b>	<b>Polymeric builder</b>
<b>Trilon® M liquid T</b>	<b>Methylglycinediacetic acid, 40%</b>	<b>50.0</b>	<b>Chelation, Water conditioner</b>
Sodium Hydroxide (50%)		40.0	Alkalinity source
Water	-	2.8	Diluent

Add ingredients to water in the order listed. Mix until homogeneous.  
Non-volatiles = 46.3%

### Vehicle Wash Formula (TM-15)

Ingredient	Chemical Description	Wt%	Function
<b>Glucopon® 225 DK</b>	APG based on natural fatty alcohol C8-C10, 70%	<b>30</b>	<b>Surfactant, detergent</b>
<b>Lutensol® XL 70</b>	C10-Guerbet alcohol alkoxyate	<b>20</b>	<b>Surfactant, detergent</b>
<b>Trilon® M liquid T</b>	<b>Methylglycinediacetic acid, 40%</b>	<b>10</b>	<b>Chelation, Water conditioner</b>
Water	-	40	Diluent

Add ingredients to water in the order listed. Mix until homogeneous.

**Trilon M, Glucopon 225 DK, and Lutensol XL 70** have been reviewed by EPA's Safer Choice Program and qualifies for use in Safer Choice-labeled Products



# Summary

## Home Care Applications



Laundry Detergent - Fabric Treatment - Auto Dishwashing Detergents - Hard Surface Cleaners - All-Purpose & Bathroom Cleaners - Degreaser - Floor Cleaner

Auto Dishwashing Detergents

- Reduce spotting & filming
- Effective stain removal

Hard Surface Cleaners

- Performance synergy with strong acid cleaners
- Boost performance in alkaline cleaner



Trilon® M has been reviewed by EPA's Safer Choice Program and qualifies for use in Safer Choice-labeled products.

## I&I Applications



Laundry - Warewash - Hard Surface Cleaners - Degreaser - Descaler - Floor Cleaner - Water Treatment - Marine Descaler - Vehicle Wash - Dye Fixer

Clean-in-Place (CIP)

- Superior removal of industrial scale removal
- Up to 50% more cleaning power over standard chelating agent

Hard Surface Cleaners

- Increase cleaning performance for alkaline and acidic cleaners
- Up to 100% more efficient over next best

Vehicle Wash

- Increase cleaning performance with near complete removal of soil

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Use biocides safely. Always read the label and product information before use.



We create chemistry

# Questions?

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