

Encapsulation Technologies for Stabilisation of Actives in Consumer Cleaning Products

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OVERVIEW

Introduction to Revolymer

The formulation challenge

Revolymer's technical solution - Active encapsulation

Oxygen bleach for unit-dose liquids and bulk powders

RevPerox™ SPC - encapsulated Sodium Percarbonate particle

Oxygen bleach for multi-compartment unit-dose pods

Eureco™ RP103 - stabilised PAP bleach granule

Bleach catalyst for ADW tablets

RevCap™ MnTACN - stabilised Manganese catalyst particle

Summary

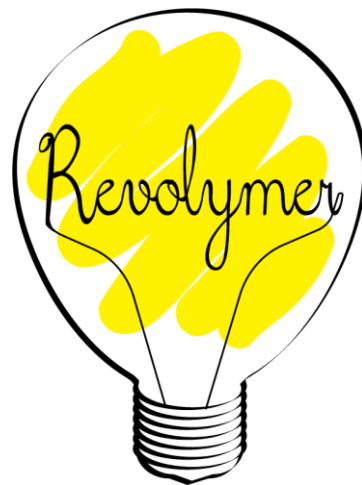
REVOLYMER

THE POLYMER TECHNOLOGY COMPANY

*Improving the performance of our partners' products
using innovative polymer and encapsulation systems*

Competency

Polymer expertise,
QA/QC, Regulatory, cGMP,
Food Standards, Supply
chain, Licensing



Capability

design, synthesis,
optimisation, process,
formulation & testing

People

30 Employees, 20 in R&D, 9 PhDs,
>20 years average experience
drawn from diverse backgrounds:
FMCG, Pharma, Polymer, Colloids,
biocides, food, paints...

REVOLYMER

THE POLYMER TECHNOLOGY COMPANY

Home & Professional Care

Laundry, Dishwash, Surface cleaners, Active delivery

Personal Care & Cosmetics

Hair, Skin and Oral Care

Industrial

Barrier coatings, Adhesives and Sealants

Medicated Chewing Gum

Nicotine Chewing Gum

The Formulation Challenge

Stabilising Actives in Solid and Liquid
Detergent Products

REVOLYMER IN HOME CARE

A GROWING FORMULATION CHALLENGE

The growing formulation challenges associated with stabilisation of active benefit agents in detergent formulations is a consequence of the move to consumer convenient products without compromising performance

Challenges:

- Shelf life - maintaining stability of the active in the product
- Releasing active quickly in-use
- Effective at low temperatures and short cycles



bulk powder



powder tablet



unit dose liquid



bulk liquid

REVOLYMER IN HOME CARE

ACTIVE ENCAPSULATION

On the shelf

Product challenges

Incompatible components
Reactivity of media
Protection of actives
Stability and release of active



Example Actives

Peroxide/peracid
Catalysts
Enzymes
Activators

In the end use

Triggers

pH change
Ionic strength change
Dilution



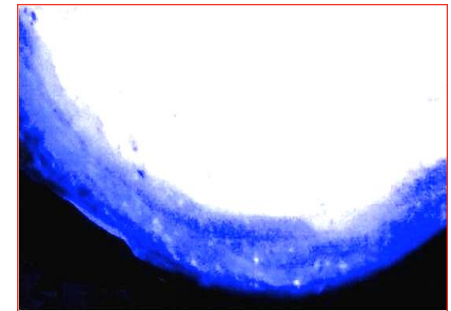
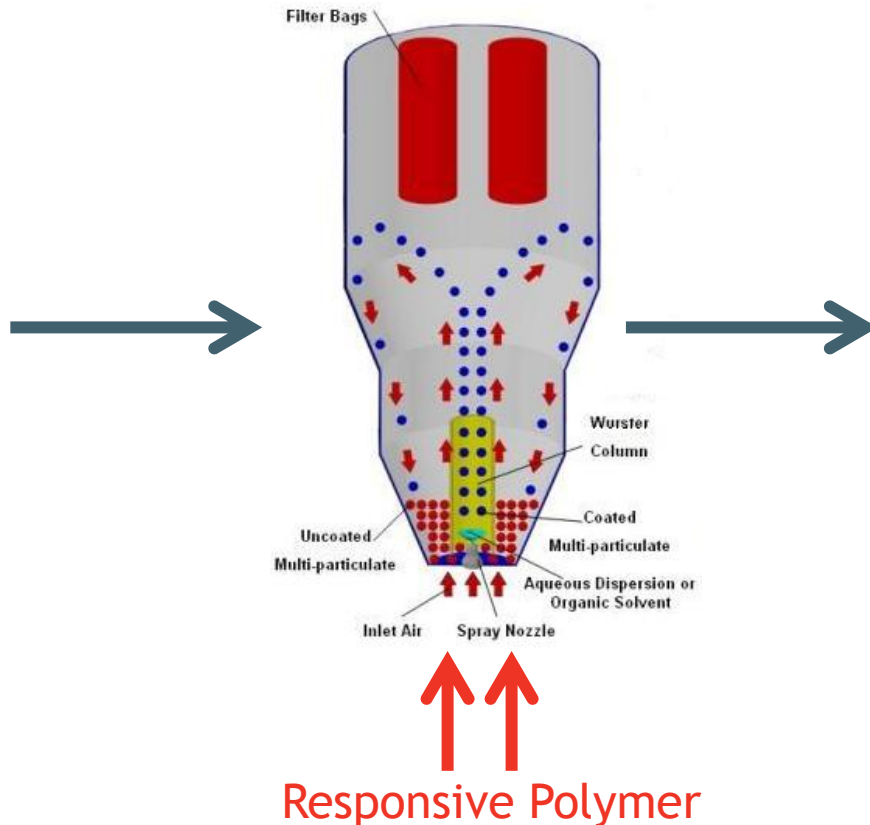
REVOLYMER'S TECHNICAL SOLUTION

ENCAPSULATION WITH RESPONSIVE POLYMERS

Particles containing the active are coated with a responsive material through processes such as spray coating



Uncoated Particles



Polymer coating protects the active from incompatible media components

REVOLYMER'S TECHNICAL SOLUTION

RELEASE OF ACTIVE WITH RESPONSIVE POLYMERS

The responsive polymer that is coated onto the active particles provides:

- Impermeable barrier to formulation ingredients
- Tuneable release of active when product is used
 - Triggered by pH, dilution, ionic strength change...



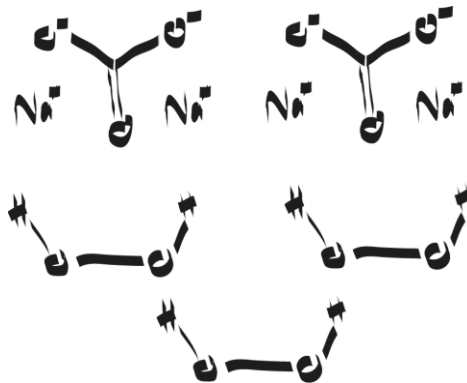
Polymer coating remains intact as a barrier



Coating dissolves in end use application to release the active efficiently into solution

Oxygen Bleach for Unit-dose Liquids

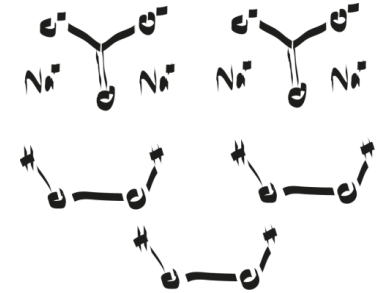
RevPerox[™] SPC - Responsive Polymer Coated Sodium
Percarbonate



REVPEROX™ SPC

SUCCESSFUL INNOVATION - ENCAPSULATED SPC GRANULE

- Responsive polymer coated SPC particle
- Dust free, mechanically stable, robust particles
- Excellent stability in a range of formulations:
 - Laundry and ADW
 - Unit dose liquid capsule
 - Bulk powder
- Rapid dissolution at low temperature



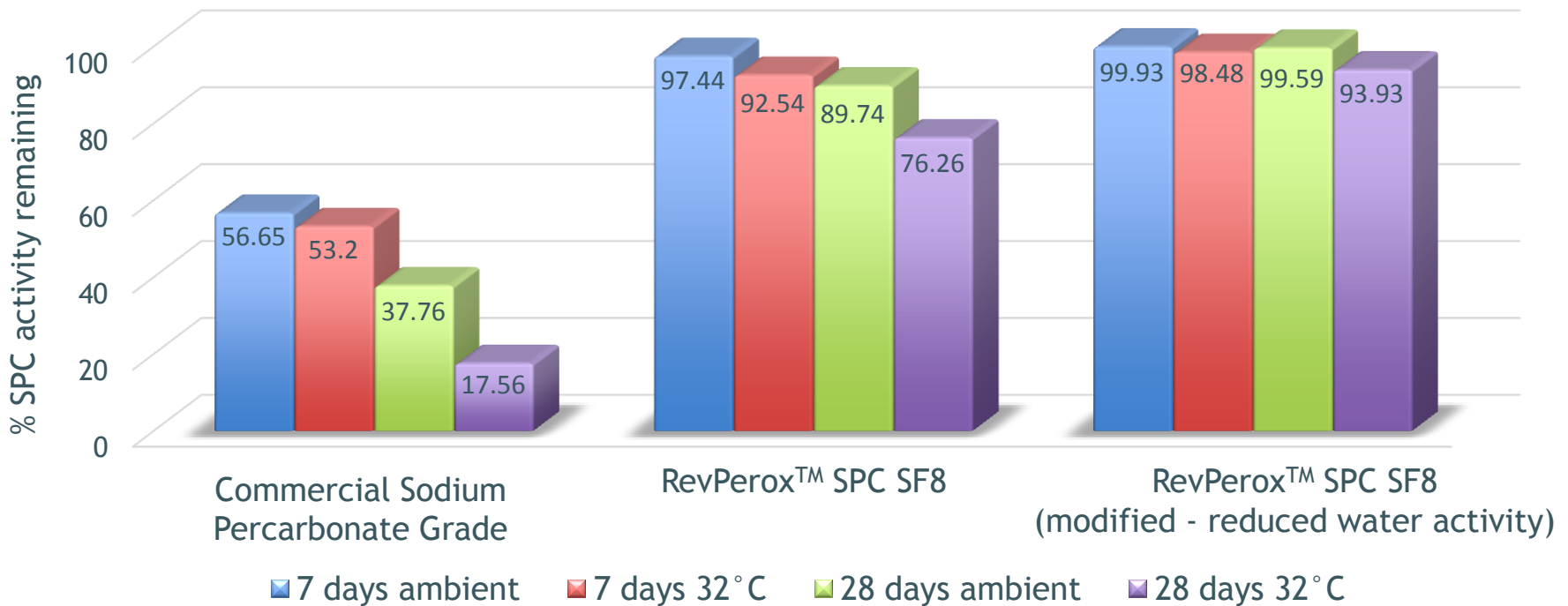
STABILITY OF REVPEROX™ SPC

LIQUID UNIT-DOSE LAUNDRY

- ✓ Successful incorporation of stabilised SPC particles into liquid laundry pod
- ✓ Dramatic improvement of SPC stability with responsive polymer coating



Stability of RevPerox™ SPC
in commercial unit-dose laundry pod



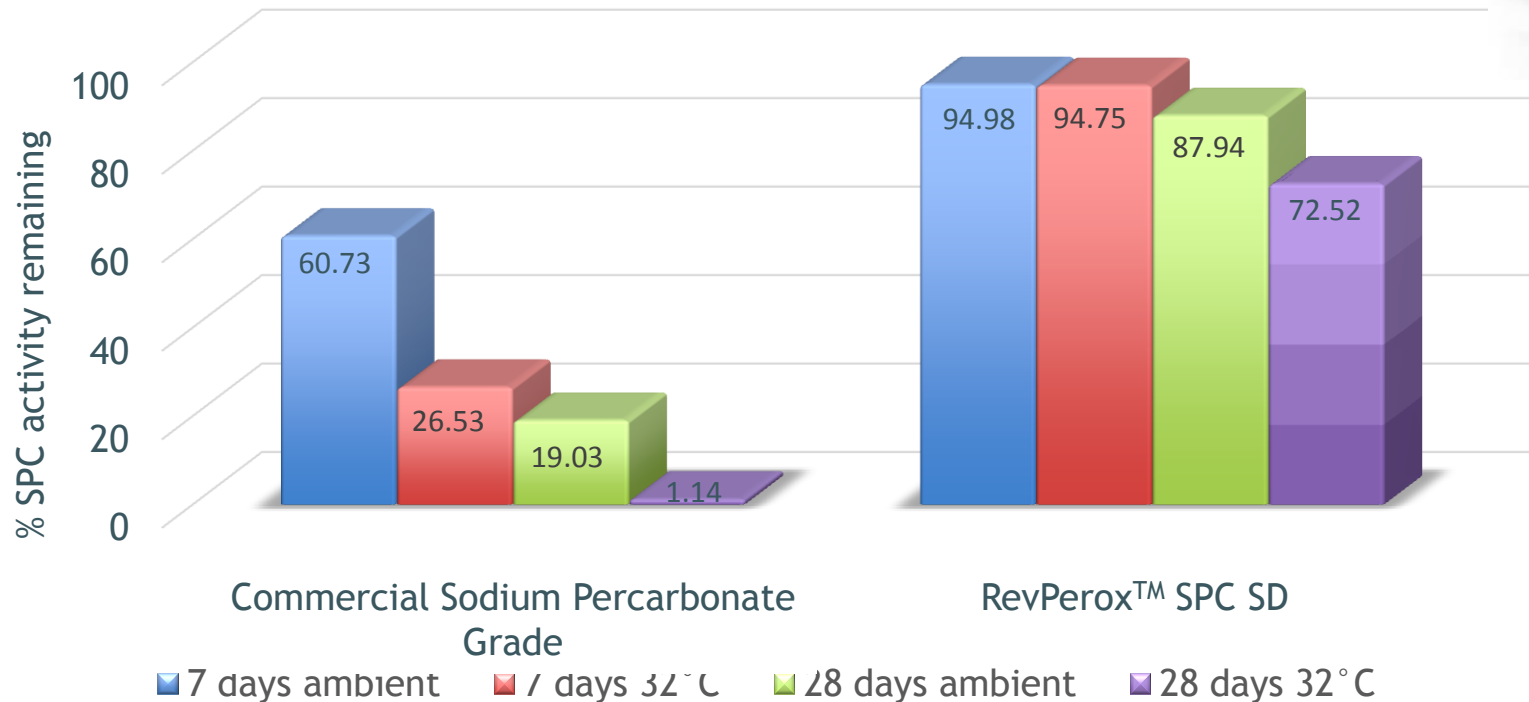
STABILITY OF REVPEROX™ SPC

LIQUID UNIT-DOSE ADW

- ✓ Successful incorporation of stabilised SPC particles into liquid ADW pod
- ✓ Dramatic improvement of SPC stability with responsive polymer coating



Stability of RevPerox™ SPC
in modified commercial unit-dose ADW pod

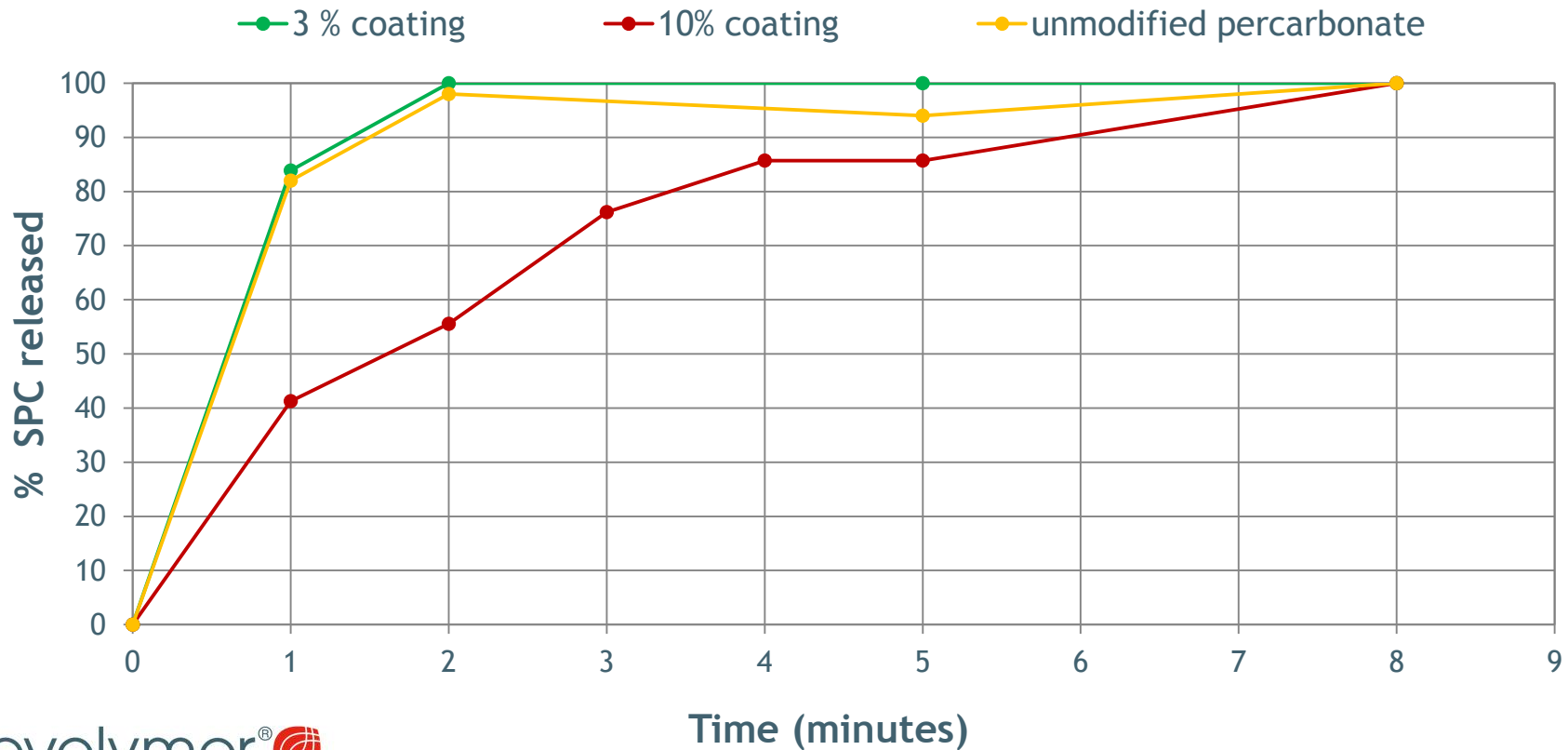


RELEASE PROFILE OF REVPEROX™ SPC PERFORMED AT LOW TEMPERATURE IN A TERGO

✓ All samples demonstrate >80% release after 4mins

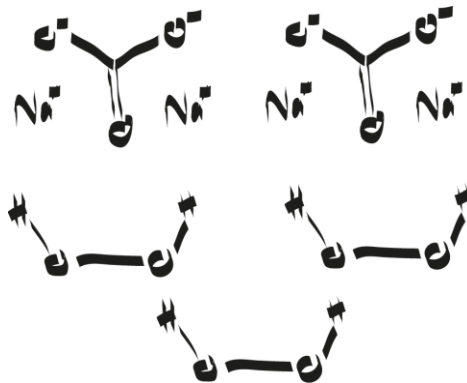


Peroxide release profile at 10°C into wash liquor
5g detergent/L



Oxygen Bleach for Bulk Laundry Powders

RevPerox[™] SPC - Responsive Polymer Coated Sodium
Percarbonate

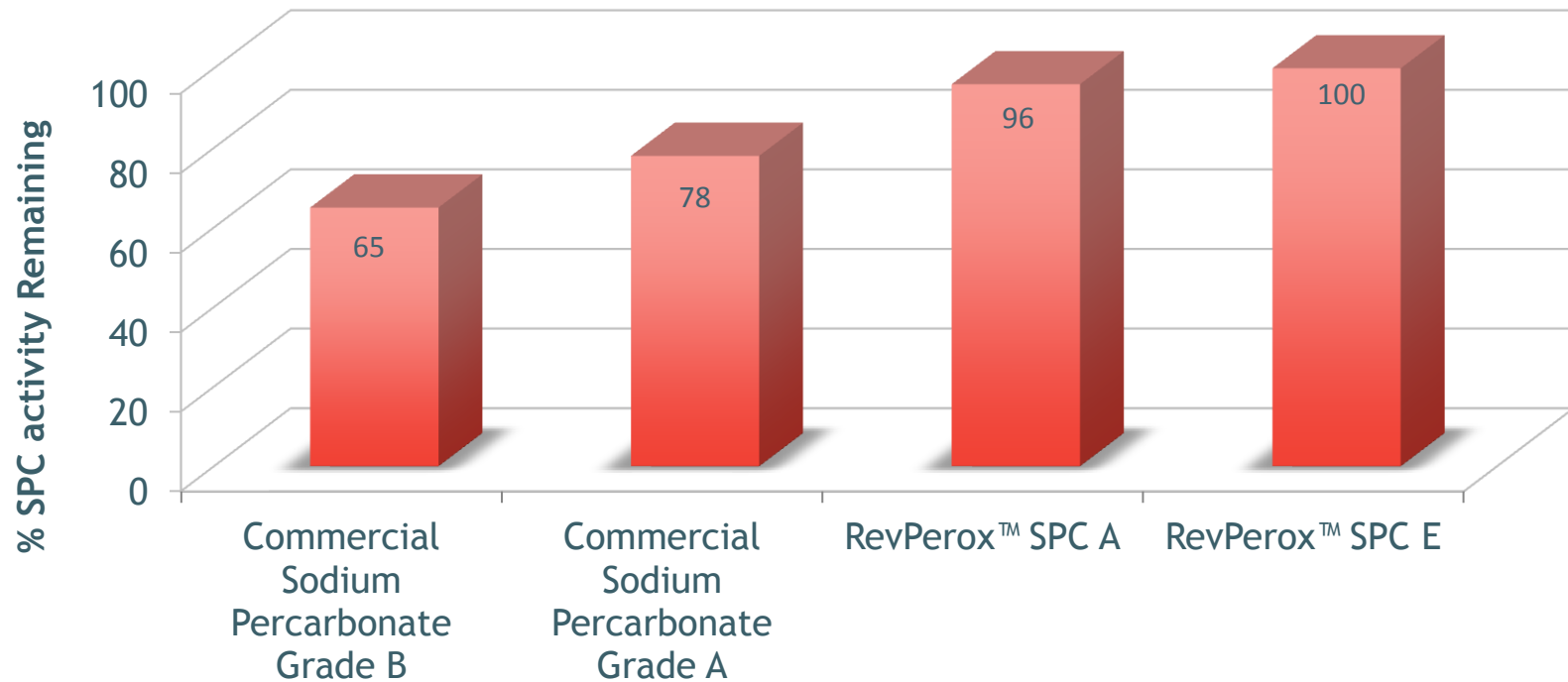


STABILITY OF REVPEROX™ SPC LAUNDRY POWDER



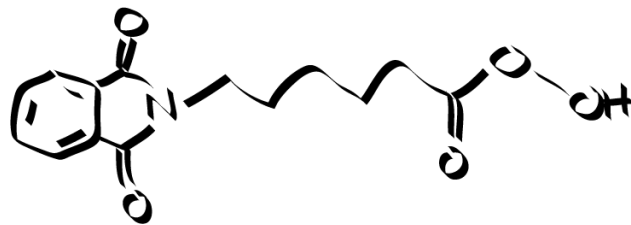
✓ Improved SPC stability for RevPerox™ SPC compared to commercial grades

SPC stability in standard laundry powder



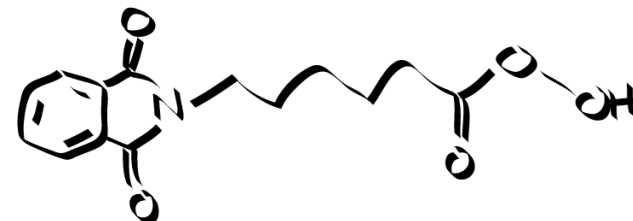
Oxygen Bleach for Multi-compartment Unit-dose Pods

Eureco[™] RP103 - A New Grade of Phthalimido-peroxy-
hexanoic acid (PAP) Bleaching Agent



PHTHALIMIDO-PEROXY-HEXANOIC ACID - PAP

BENEFITS VERSUS OTHER BLEACH SYSTEMS



- Pre-formed peracid
- Registered on European Biocides Regulation
- Superior bleach performance against hydrophobic stains
 - pH < 10 and T < 40°C
- Provides an improved performance even at a lower dose level compared to SPC-Activator



EURECO™ RP103* - PAP

SUCCESSFUL INNOVATION - STABILISED PAP GRANULE

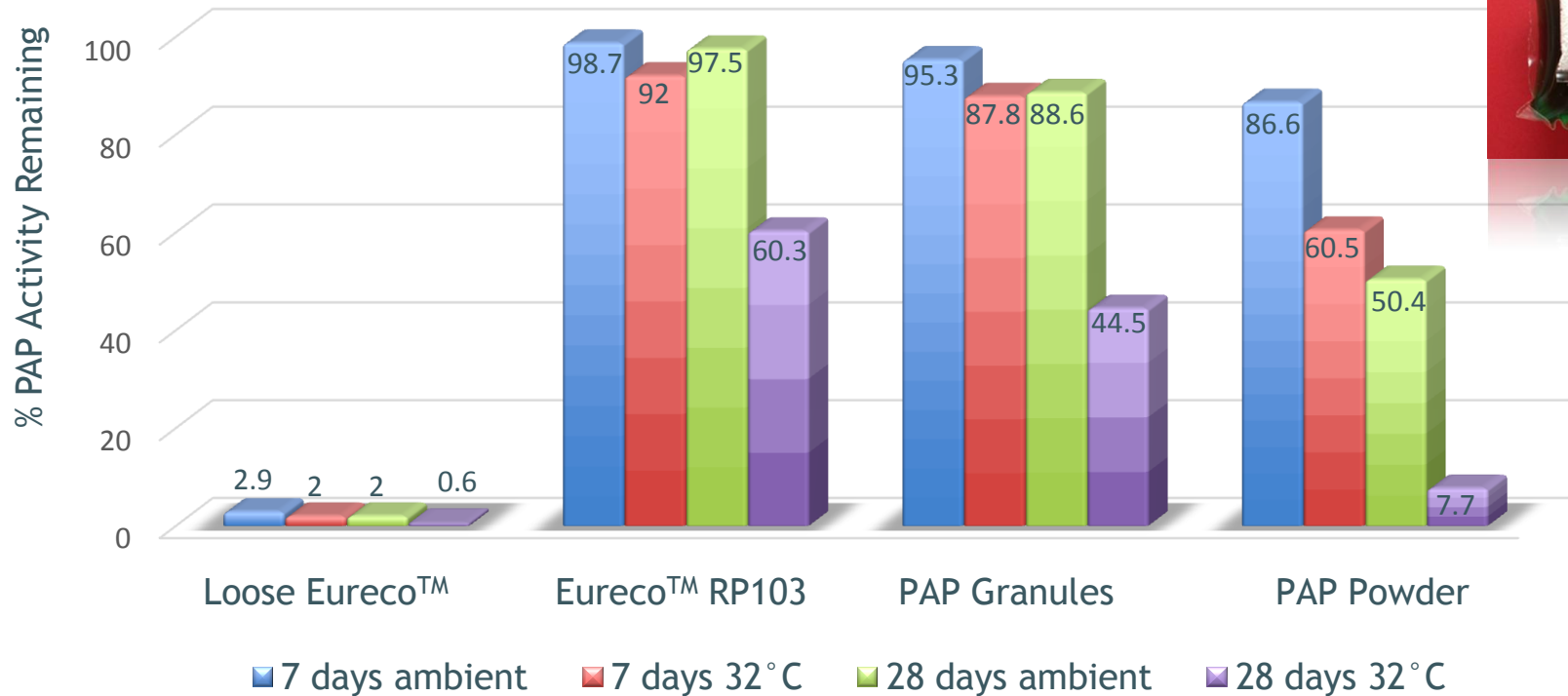
- Novel boron-free PAP composition (64% PAP)
- Dust free, mechanically stable, robust particles
- For use in domestic and professional formulations:
 - Laundry and ADW
 - powder and tablet
 - Unit dose liquid-solid dual compartment
- Excellent compatibility with PVOH film
- Very rapid dissolution at low temperature



STABILITY OF EURECO™ RP103 IN DUAL COMPARTMENT POD PAP IN PVOH POUCH IMMERSSED IN LIQUID POD FORMULATION

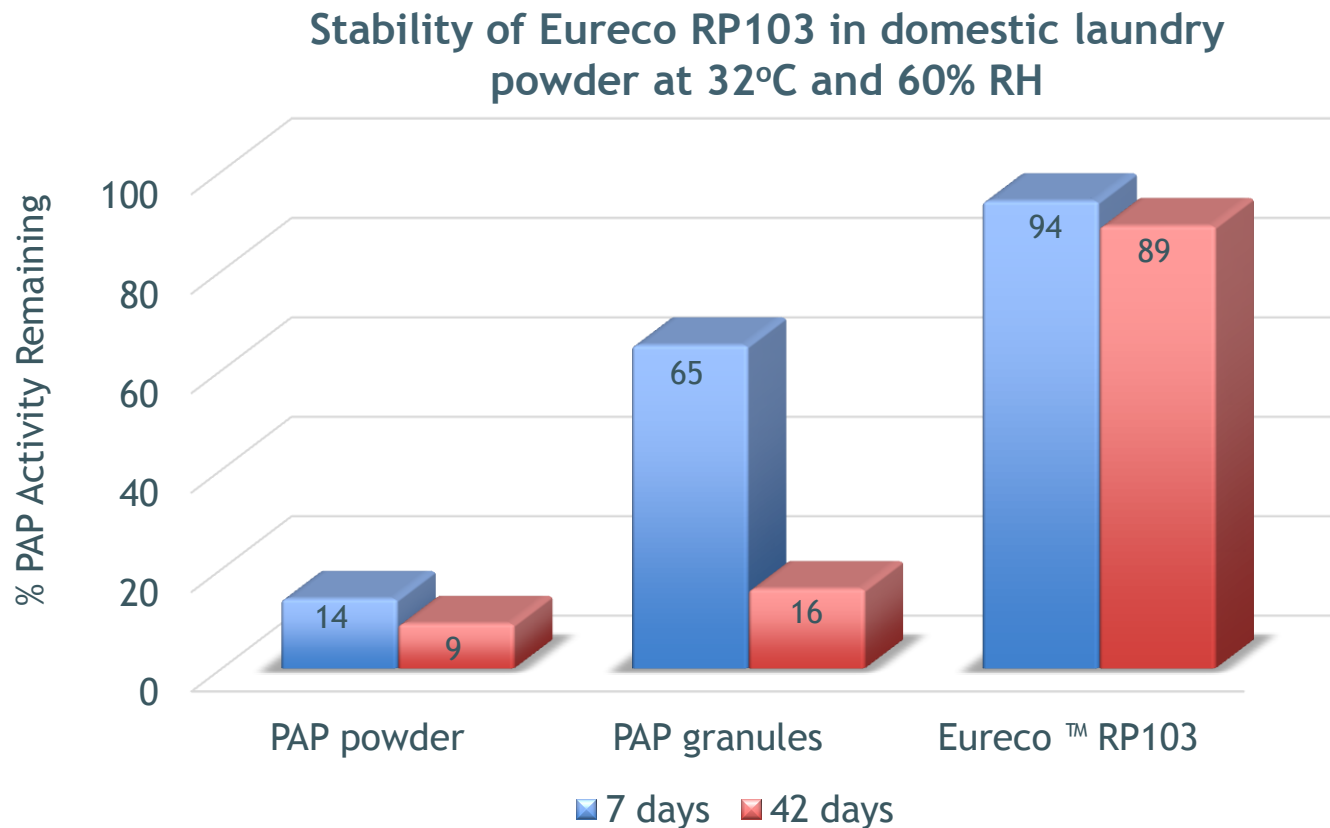
✓Eureco RP103 provides improved PAP stability

PAP stability following storage of PVOH pouch of PAP in commercial liquid pod formulation



STABILITY OF EURECO™ RP103 IN DOMESTIC LAUNDRY POWDER

✓Excellent PAP stability at elevated temperature and humidity for an extended period

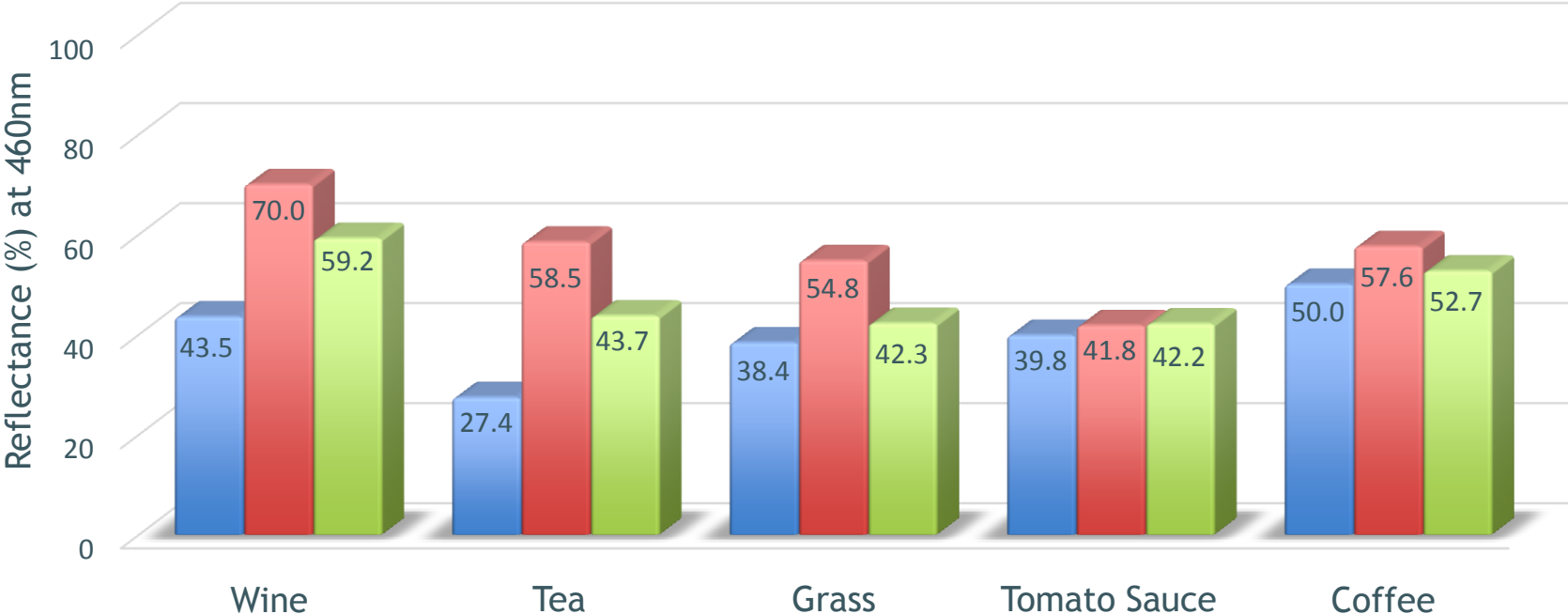


EURECO™ RP103 BLEACH PERFORMANCE AT LOW TEMPERATURE

TERGOTOMETER WASH TRIAL

✓Eureco RP103 out-performs the SPC-TAED bleach system at low temperature

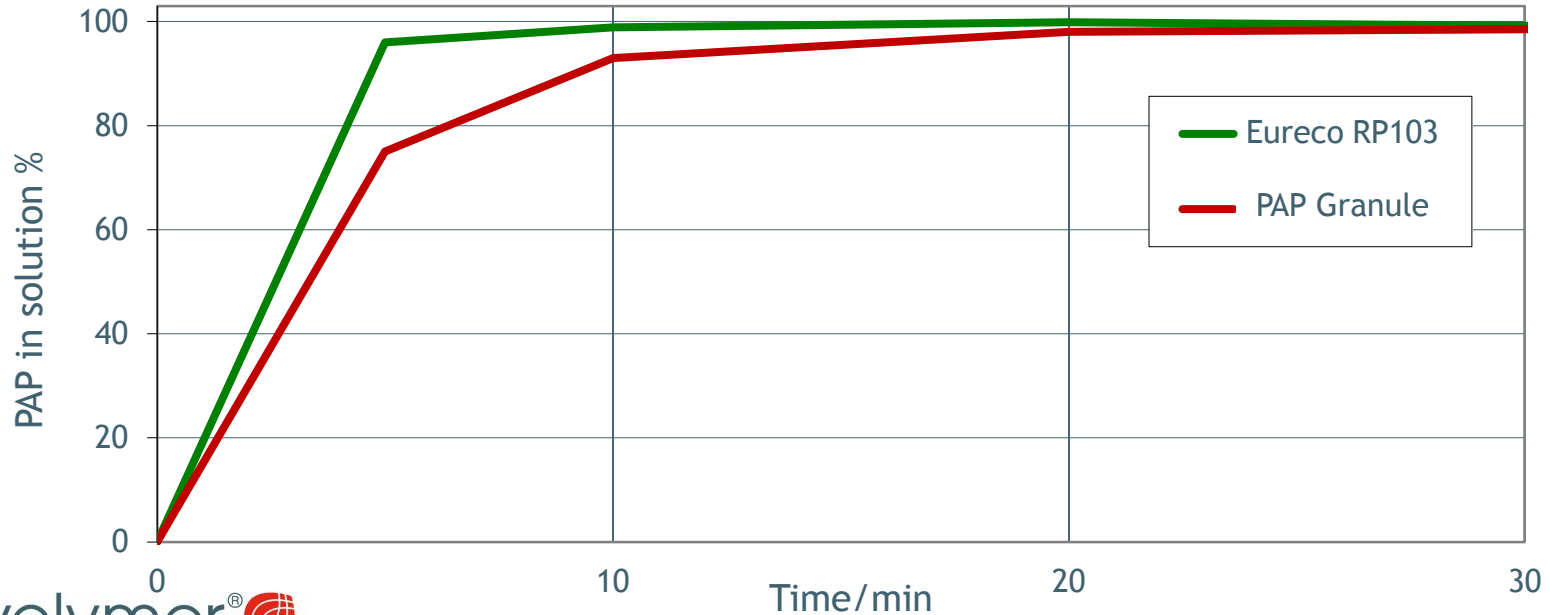
Bleach Performance following a 30 mins wash at 15°C using Persil Colour powder



■ Control Persil Colour powder only ■ Persil powder + Eureco™ RP103 ■ Persil powder + SPC&TAED

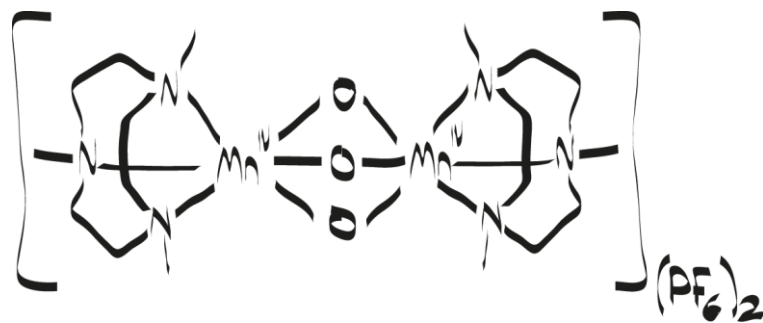
DISSOLUTION OF EURECO™ RP103 IN HARD WATER AT 30 °C

- ✓ Fast dissolution through measurement of PAP in solution at each time point
 - Dissolution testing conditions:
 - 30°C in hard water conditions (300ppm Na₂CO₃)
 - without surfactants or reducing substances



Manganese Catalyst for Unit-dose Tablets

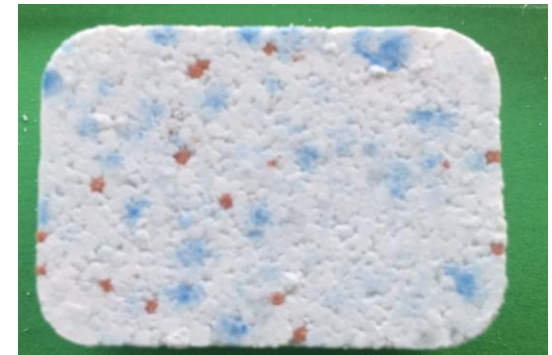
RevCap[™] MnTACN- A stable free-flowing catalyst particle



REVCAP™ MnTACN

SUCCESSFUL INNOVATION - STABILISED CATALYST GRANULE

- Dust free, mechanically stable, robust particles
 - ✓ For uniform dosage during manufacturing
- Excellent stability in ADW tablet formulations
- Excellent bleaching performance
- Rapid dissolution



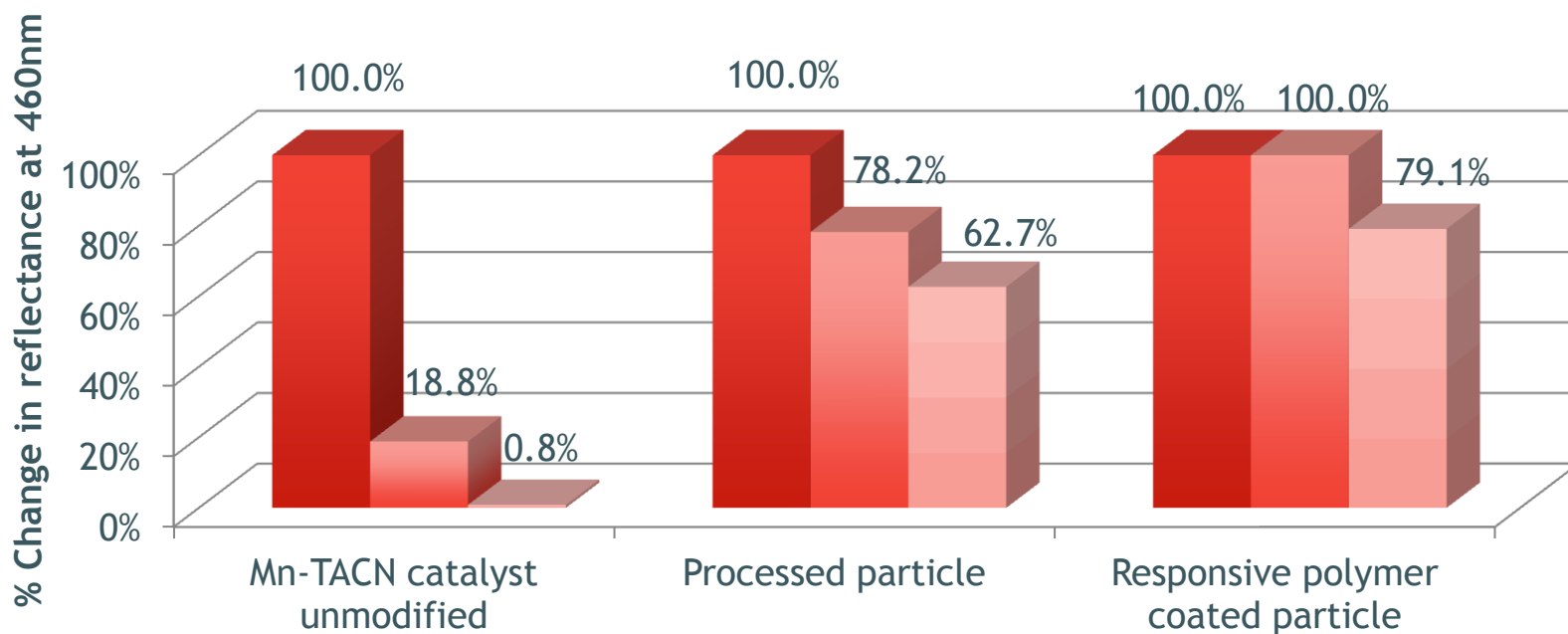
RevCap™MnTACN in ADW tablet after
7 Days at 30 °C 80% RH

REVCAP™ MnTACN BLEACH PERFORMANCE

ADW TABLET FORMULATION

- ✓ Catalyst stability is improved following encapsulation with responsive polymer following storage stability

Change in reflectance of tea stained cotton swatches before and after washing at 55°C, 1hr 20mins in European dishwasher



■ Time 0 ■ 7 Days at 30°C 80% RH ■ 14 Days at 30°C 80%RH

SUMMARY

5 KEY POINTS

1. The consumer wants convenient products without compromising performance
2. Important active benefit agents are currently unstable in liquid and powder formulations
3. RevPerox™ SPC enables the incorporation of Sodium Percarbonate into unit-dose liquid formulations to provide the bleach performance that the consumer expects
4. Eureco™ RP103 provides efficient bleaching in powders and can be incorporated into multi-compartment PVOH pods
5. RevCap™ MnTACN provides a stable catalyst for uniform dosing into ADW tablets with excellent bleach performance

Thank you for listening!

We are always happy to work with new partners to enhance product performance

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