

# 2017 International Polyolefins Conference



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## Baeropol RST for Reduction of Phosphites in Polyolefins

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Technical Director, Special Additives North America  
February 28, 2017



# Outline

- Baerlocher Overview
- Background of Baeropol RST
- Baeropol RST Product Line
- Examples in Polyolefins
- Conclusions



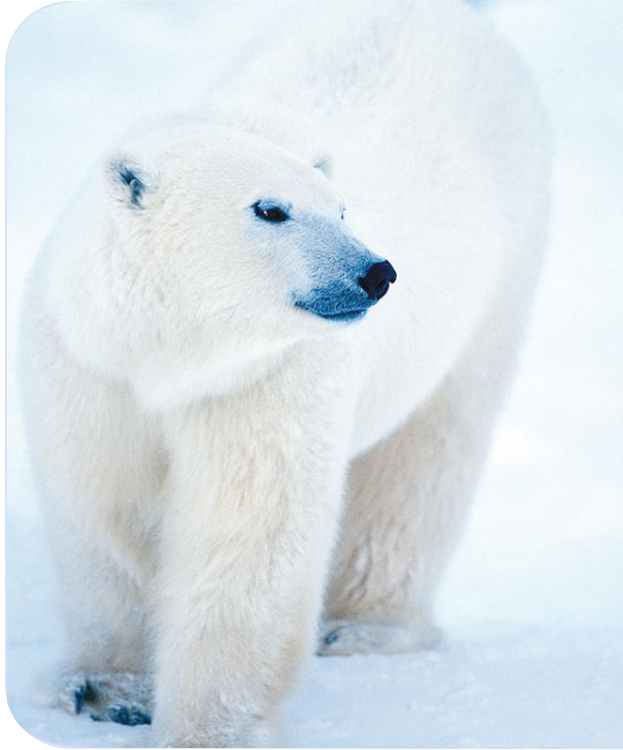


## Your global partner for additives

Baerlocher Group of Companies serves local customer needs with innovative / customer tailored solutions.

- Global leader in PVC additives: Leader in Ca-based solutions
- Global metal soaps specialist and trusted partner for BAEROPOL solutions
- About 1200 employees worldwide representing a trusted and reliable partner

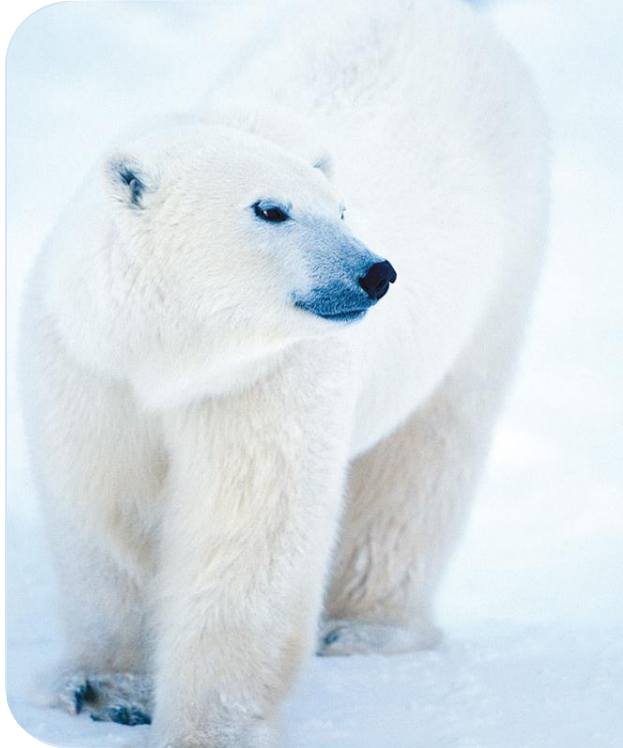




## Code of Ethics of the Baerlocher Group of Companies

Entrepreneurial progress and tradition characterize the history of the Baerlocher Group of Companies. More than 190 years of development of products and our companies mean 190 years of change, but also 190 years of experience.

Our Code of Ethics integrates our experience and serves as a guideline when dealing with present or future issues.



### **Code of Ethics of the Baerlocher Group of Companies**

New experiences may change the content of values or the balance between values. But there are values we consider vital due to our experience and which are unchangeable for us. These are:

- Respect
- Integrity
- Excellence

They form our value system and define the character of the Baerlocher Group of Companies.



# Products



# Products



**Lubricants**



**Stabilizers**



**Metal Soaps**

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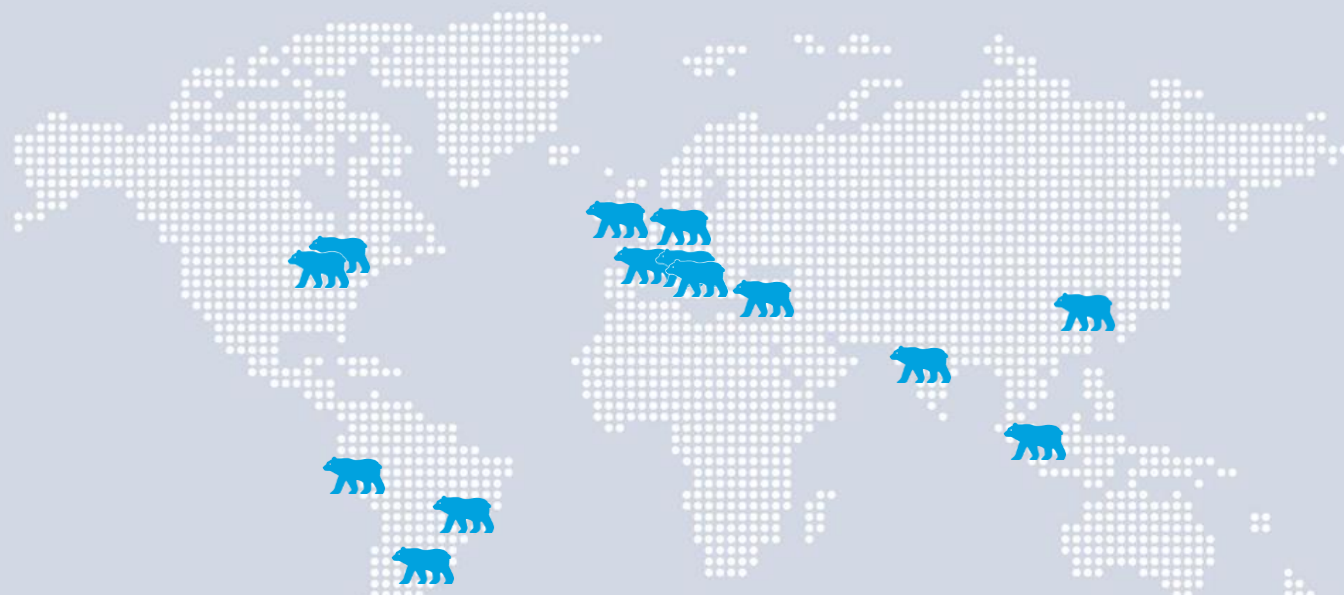




**Metal stearates**

**The metal stearates  
specialist – one solution,  
one quality, locally  
produced worldwide**

# Manufacturing Companies: Countries



Germany  
UK

Italy I  
Italy II

France  
Turkey

Brazil  
Peru

USA I  
USA II

Argentina  
China

India  
Malaysia

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# Baeropol RST Overview

# General Overview of RST

- Baeropol® RST = Resin Stabilization Technology
- RST ...is a family of customizable additive blends that work synergistically with antioxidants to stabilize polyolefin resins
- Made of materials currently used in polyolefins...put together differently...
- RST can:
  - be made from additives that are Generally Regarded As Safe and is suitable for food packaging CFR 178/179 ... A through H.
  - partially or fully replace phosphites in the resin formulation
  - fully replace antacids in the resin formulation
  - improve color of the resin
  - improve melt stability and processability of the polymer
  - increase long term stability and OIT



# RST Product Family

## Baeropol® RST

- Pure RST additive
- For direct formulation in resins

**(New Additive)**

## Baeropol® T-Blends

- For formulating unstabilized resin
- For boosting stabilization of recycle or prime/virgin resin
- Use as a one-pack solution

**(Simple Stabilizer Blend)**

## Baeropol® DRS

- Alternate to pure phosphites
- Formulated for processors that do not use additive blends

**(Commodity Phosphite Substitute)**

## RST Containing Baeropol®

- Custom blends that contain RST
- Use as one-pack or for delivery of specialty additives

**(Complex Stabilizer Blend)**



# RST Product Family List

| Product                        | Application                      |
|--------------------------------|----------------------------------|
| Baeropol RST 92D               | New Secondary Antioxidant        |
| Baeropol RST 33G               | New Secondary Antioxidant        |
|                                |                                  |
| Baeropol DRS 6812              | 1:1 Phosphite substitution       |
|                                |                                  |
| Baeropol T-Blend 1102 and 1111 | 1 to 1 Primary to Secondary AO   |
| Baeropol T-Blend 1214 and 1121 | 1 to 2 Primary to Secondary AO   |
| Baeropol T-Blend 6102 and 6111 | Primary to Secondary AO for film |
|                                |                                  |
| Baeropol Blend                 | Custom Blends                    |





# Ways to Use RST Products

- Stabilization of polyolefin resins during:
  - Production
  - Processing
  - Recycling
- Reduction/replacement of phosphite usage
- Replacement of antacids in formulation



# Examples

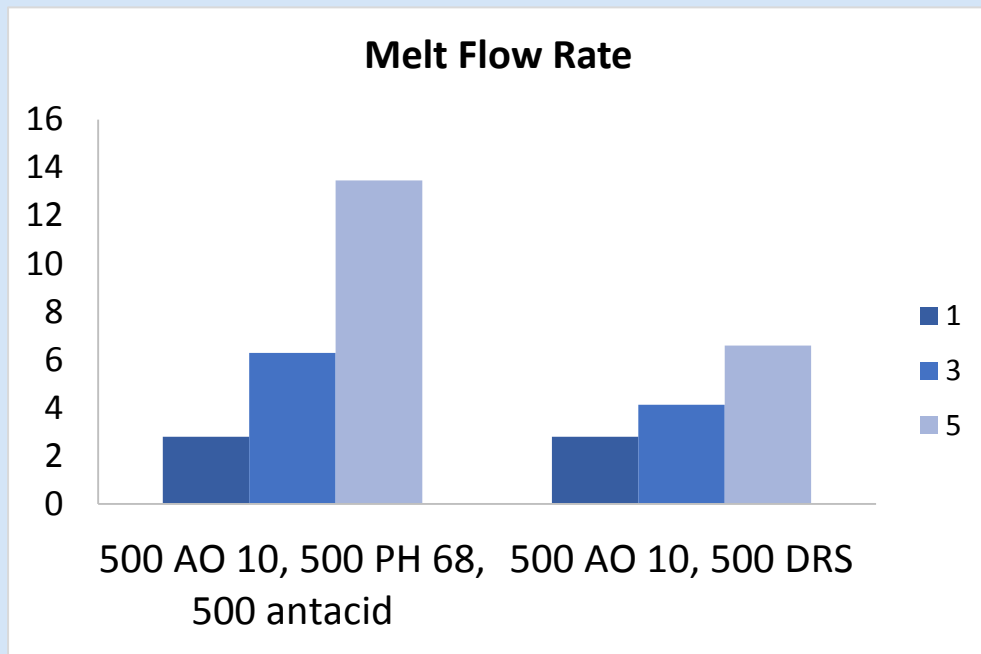
## Baeropol DRS as a Phosphite Replacement

- Baeropol DRS is a blend of RST and a commodity phosphite
- It is formulated to be a 1:1 replacement for standard phosphites
- It is formulated to give equal performance with better color
- DRS is formulated as a dust free pellet, prill, or pastille
- Since DRS contains RST it can also act as an antacid replacement



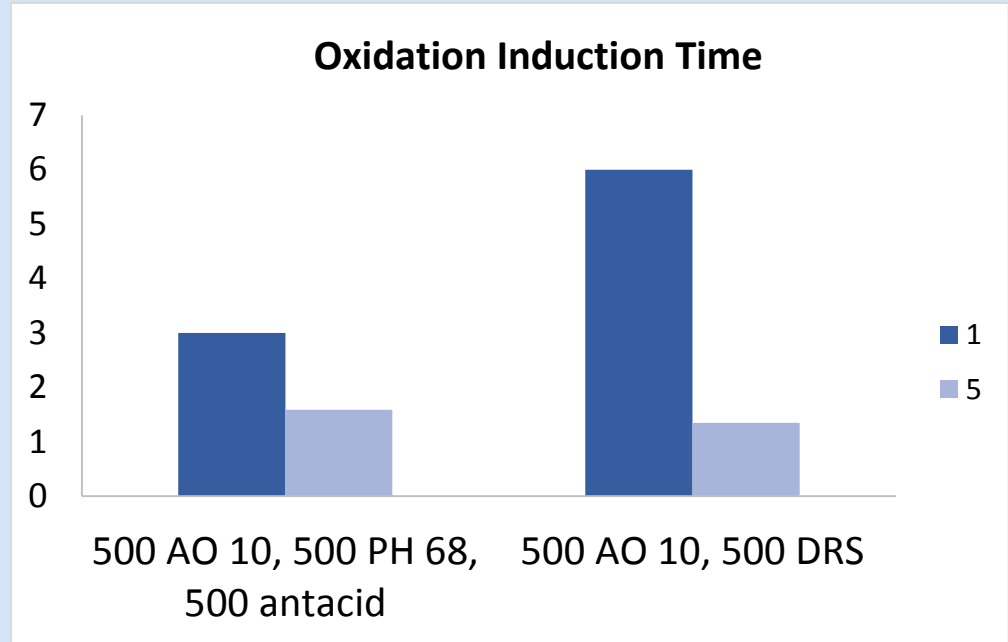
# Stabilizing Reactor Powder with Baeropol DRS (ZN PP)

- Baeropol DRS allowed for better melt stability compared to standard phosphite



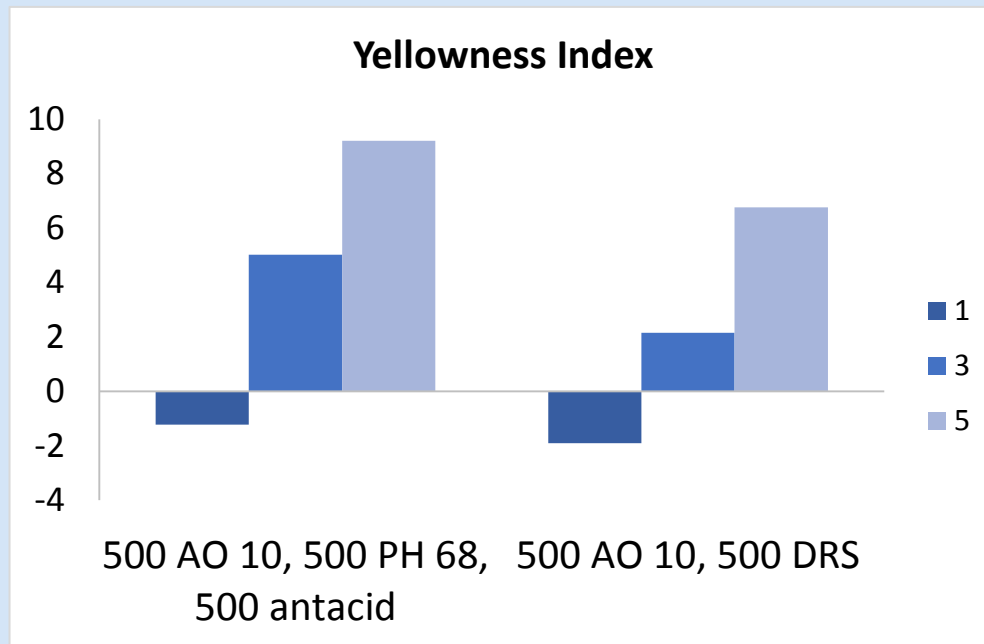
# Stabilizing Reactor Powder with Baeropol DRS (ZN PP)

- Baeropol DRS allowed for better oxidation induction time compared to standard phosphite



# Stabilizing Reactor Powder with Baeropol DRS (ZN PP)

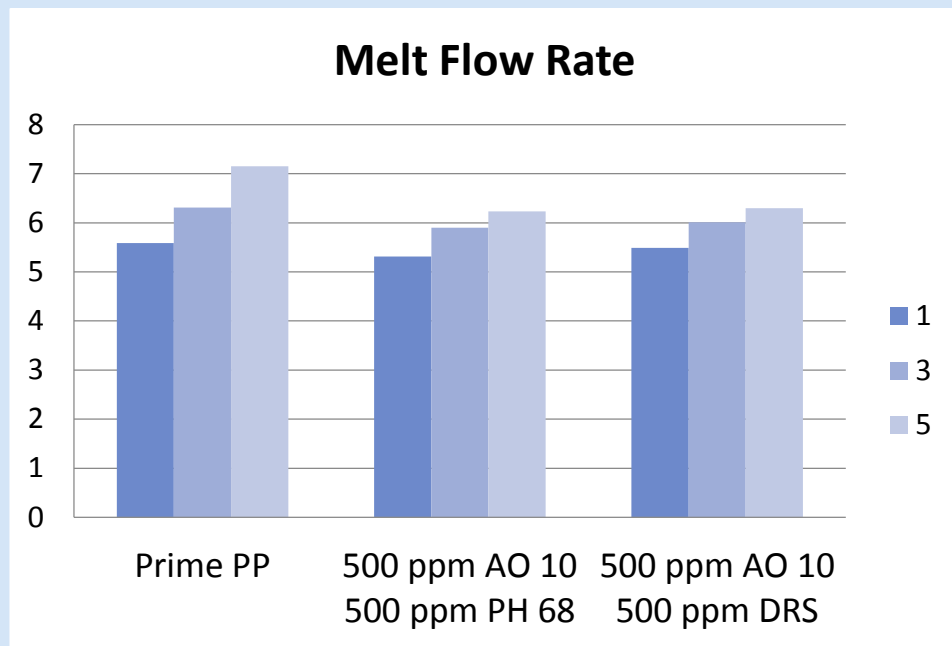
- Baeropol DRS improved color compared to standard phosphite





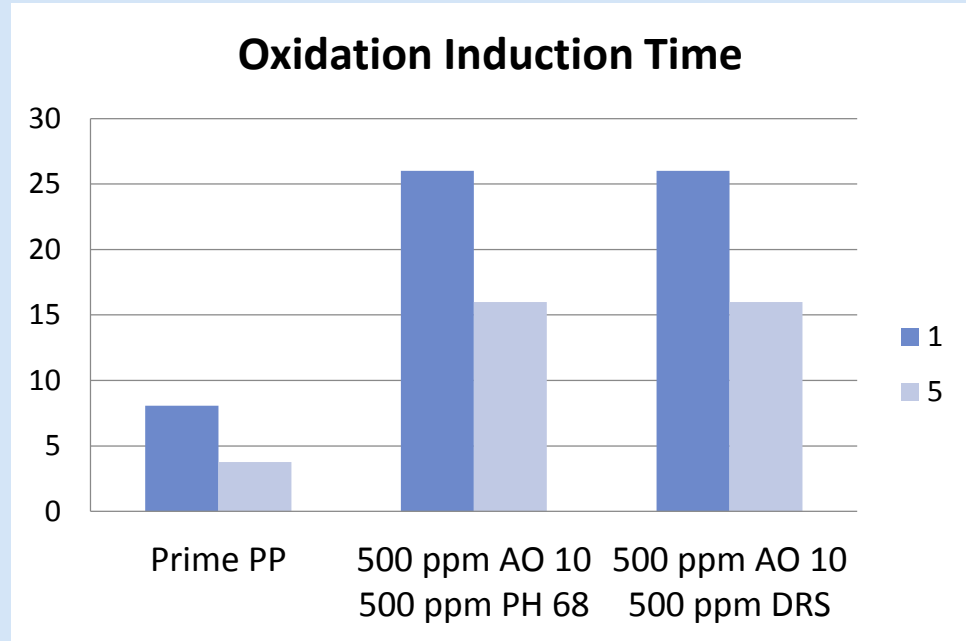
# Stabilizing Finished Pellets with Baeropol DRS

- Baeropol DRS gave identical melt performance compared to standard phosphite



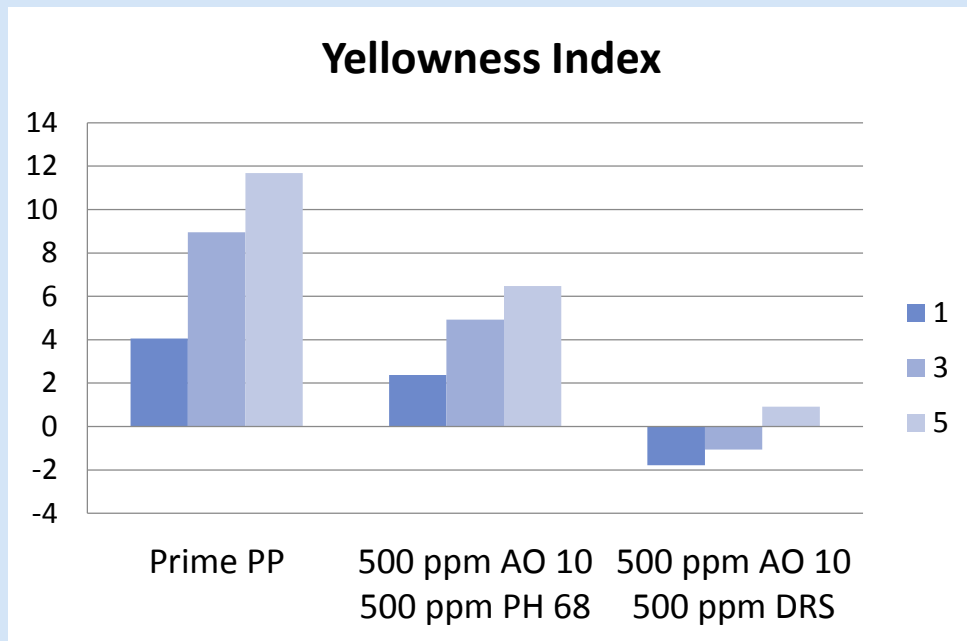
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# Stabilizing Finished Pellets with Baeropol DRS

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# Use of RST as a Partial Phosphite Replacement

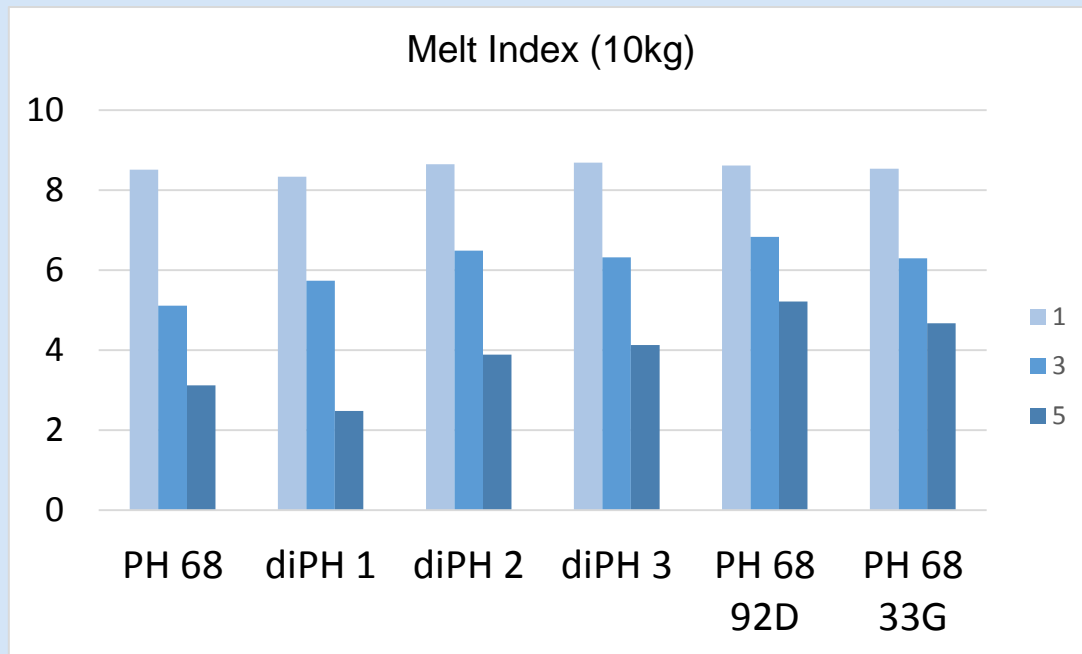
- RST can be used by polyolefin manufacturers and compounders as a phosphite reducer
- RST can be used to replace high end phosphites with commodity PH 68 type of products
- Propose: replace high end phosphite 1:1 with PH 68 and replace antacid with RST

■ Example:

|                     |               |
|---------------------|---------------|
| AO 10 500 ppm       | AO 10 500 ppm |
| diphosphite 500 ppm | PH 68 500 ppm |
| CaSt 500 ppm        | RST 500 ppm   |

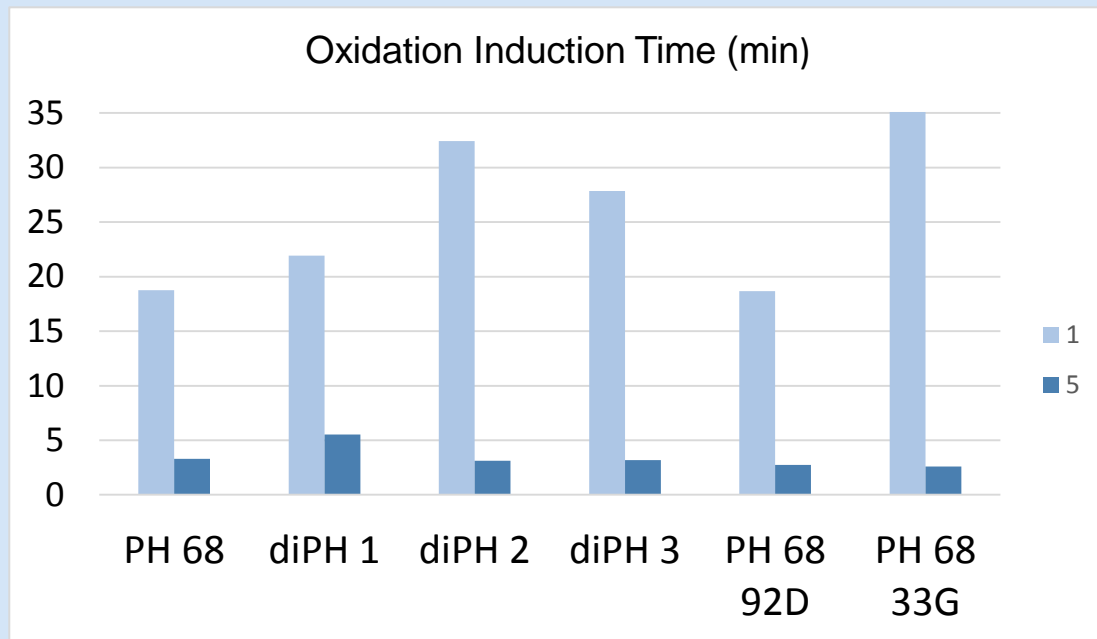
# Use of RST as a Partial Phosphite Replacement (CrHDPE)

- RST containing samples gave comparable control of melt stability compared to most high end phosphites



# Use of RST as a Partial Phosphite Replacement (CrHDPE)

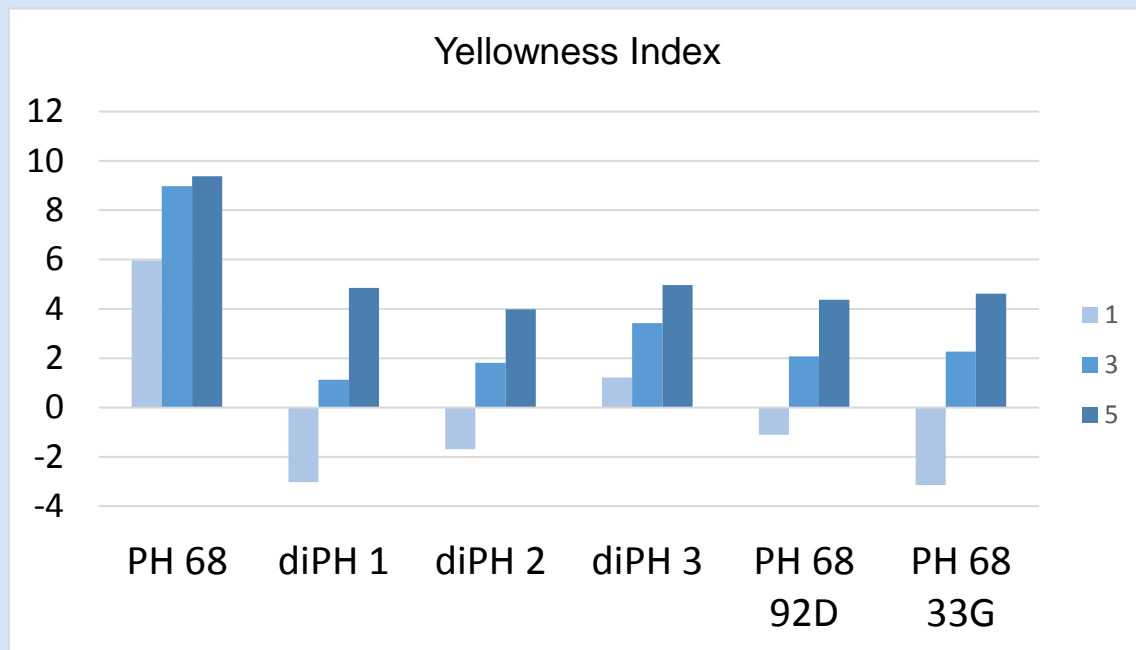
- RST gave comparable OIT compared to high end phosphites





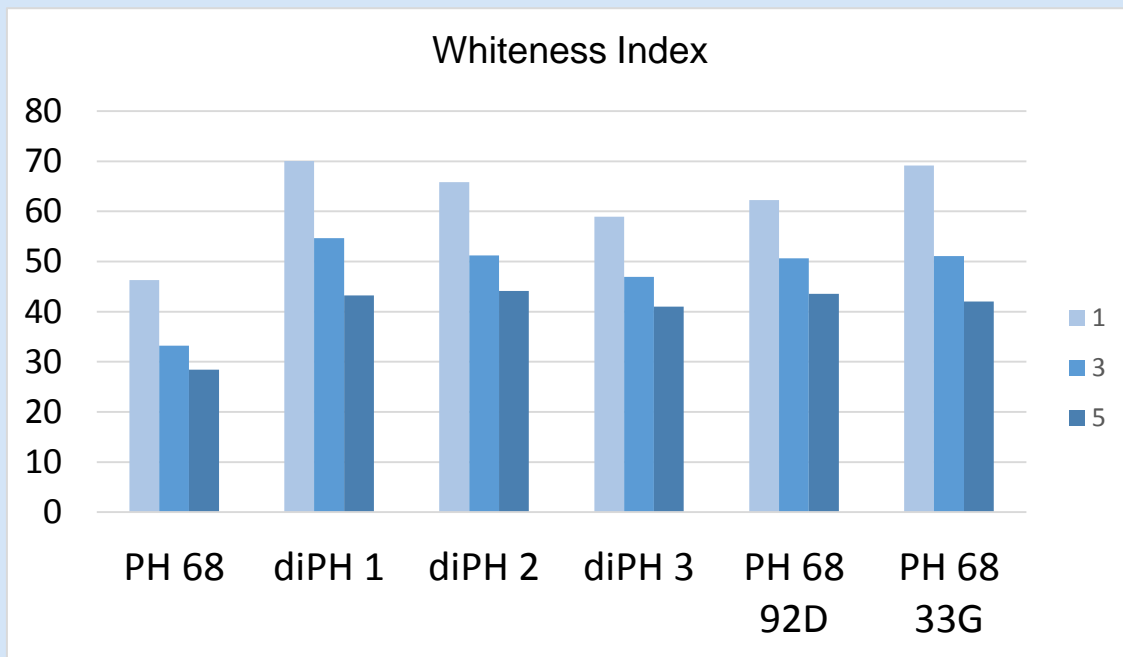
# Use of RST as a Partial Phosphite Replacement (CrHDPE)

- The diphosphite samples gave better color compared to PH 68 as expected
- RST gave color comparable to most high end phosphites compared to standard PH 68



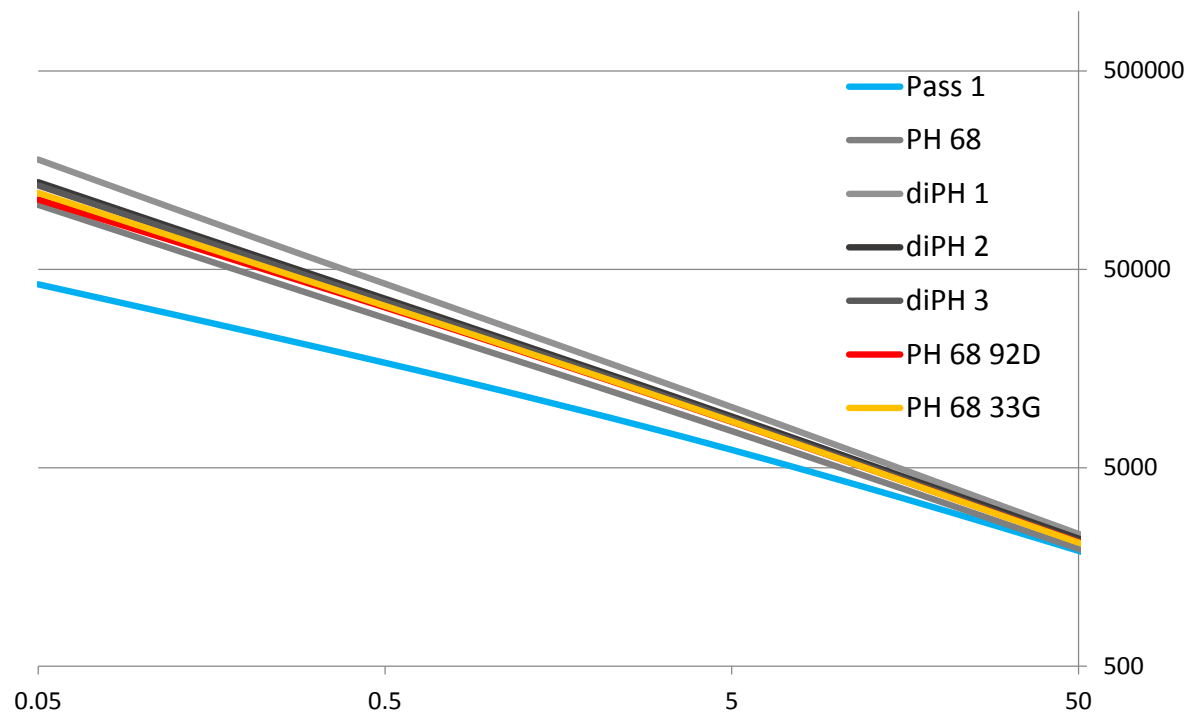
# Use of RST as a Partial Phosphite Replacement (CrHDPE)

- RST gave color comparable to most high end phosphites compared to standard PH 68



# Use of RST as a Partial Phosphite Replacement (CrHDPE)

- Complex rheology showed that RST gave excellent control of rheology at 5 passes



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all samples contain  
500 ppm AO 10  
500 ppm phosphite  
500 ppm antacid or RST

Extrusion Conditions: 240 °C

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## Use of RST as a TNPP Replacement

- RST can also be use to assist with switching away from the phosphite TNPP
- RST can allow for lower phosphite dosage
- With lower usage, PH 68 can be used for certain formulations
- Alternate liquid phosphites can also benefit from RST usage

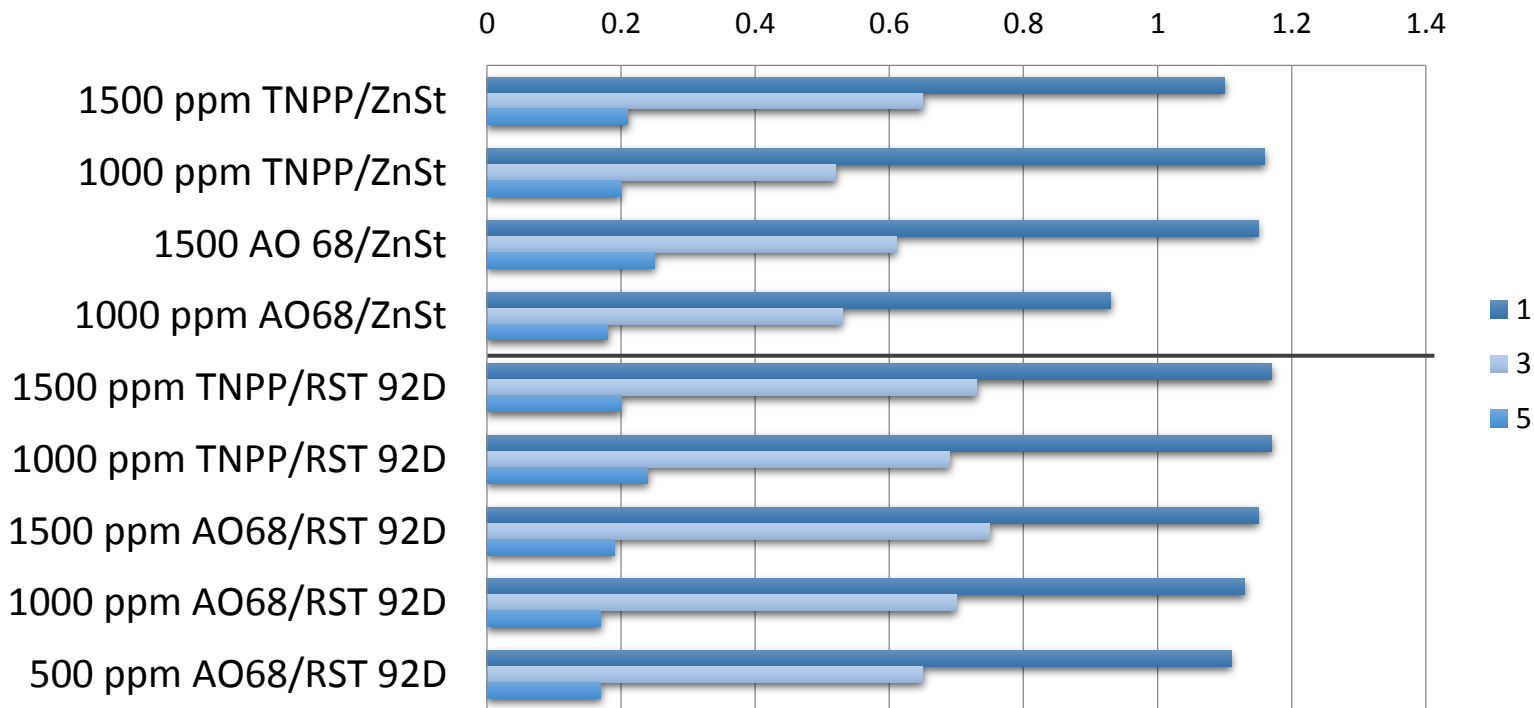
- Example:

|                 |               |
|-----------------|---------------|
| AO 76 500 ppm   | AO 76 500 ppm |
| TNPP 1500 ppm   | PH 68 800 ppm |
| Antacid 500 ppm | RST 500 ppm   |



# Use of RST as a TNPP Replacement (ZN LLDPE)

Melt Index (2.16 kg)



Extrusion Conditions: 240 °C

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all samples contain  
500 ppm AO 76  
500 ppm antacid or RST

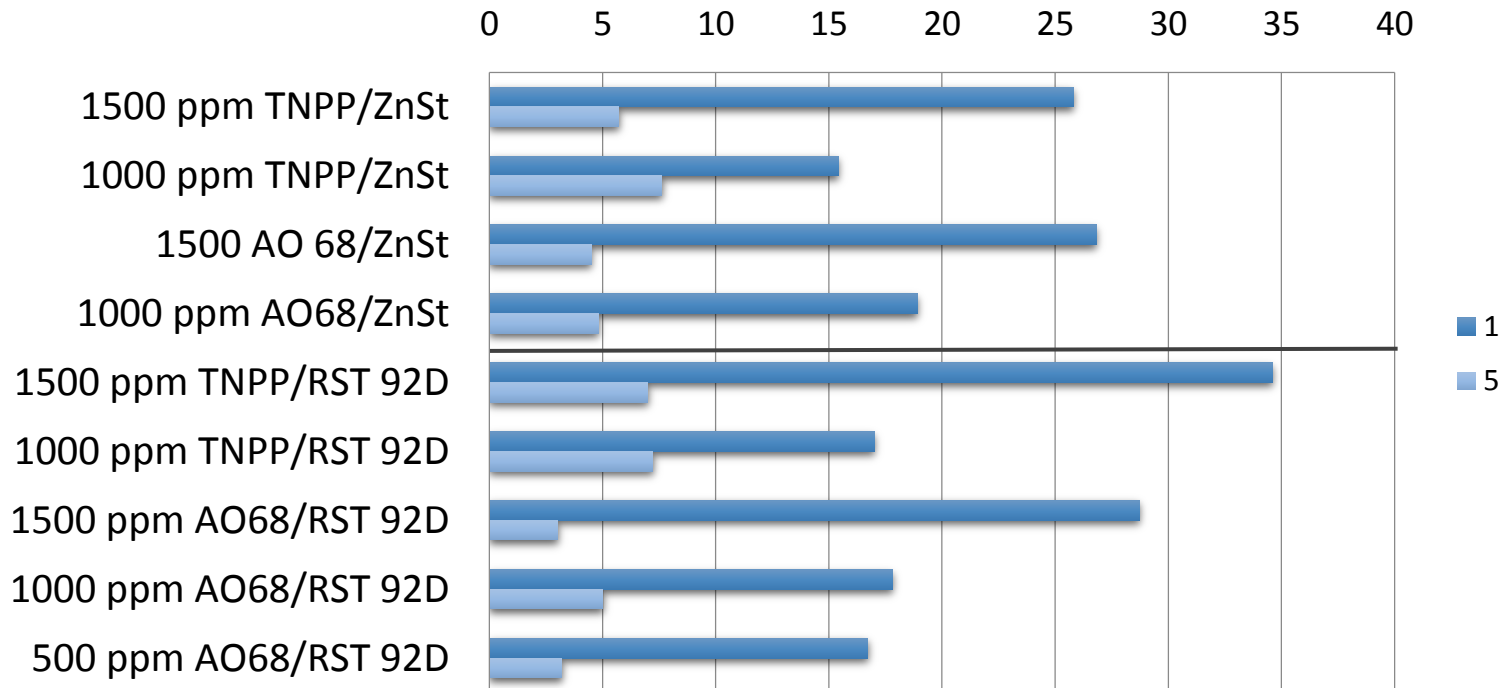
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# Use of RST as a TNPP Replacement (ZN LLDPE)

Oxidation Induction Time (min)



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all samples contain  
500 ppm AO 76  
500 ppm antacid or RST

Extrusion Conditions: 240 °C

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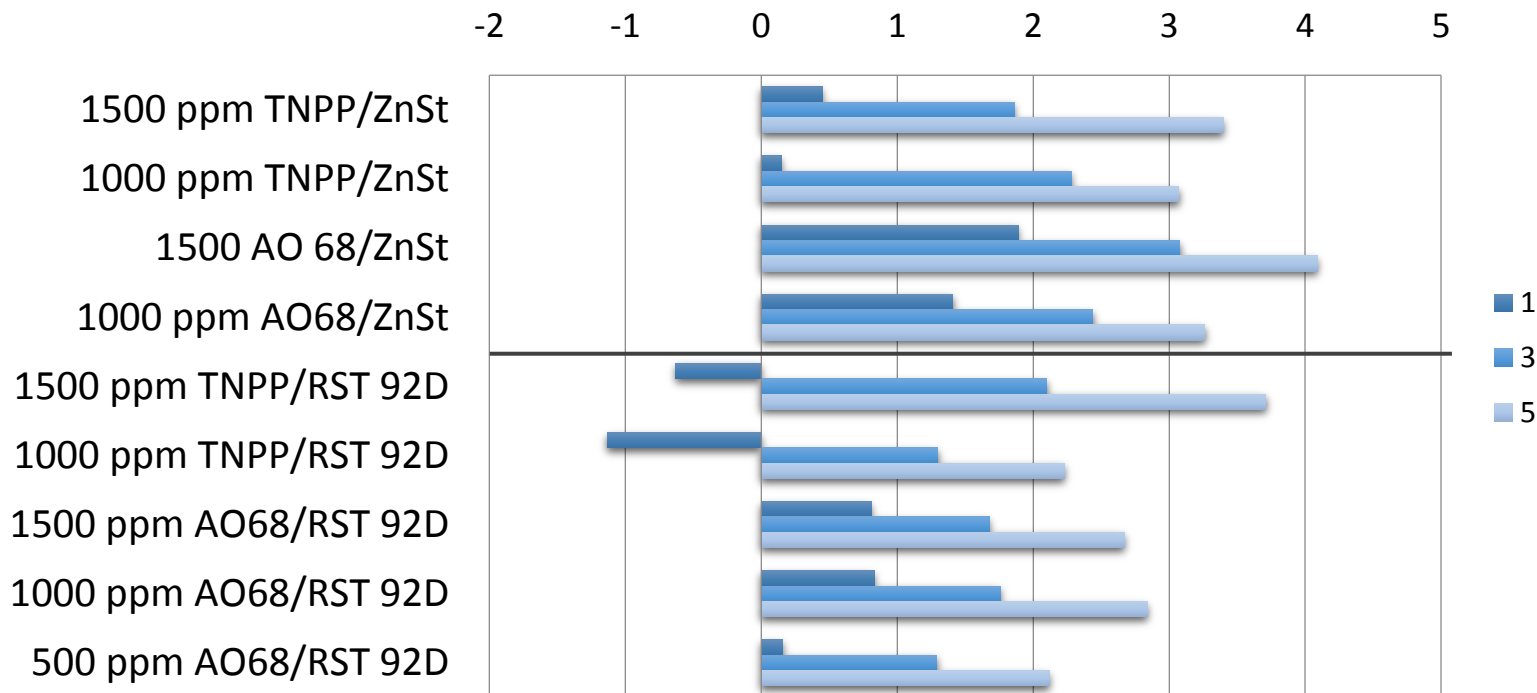
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# Use of RST as a TNPP Replacement (ZN LLDPE)

Yellowness Index



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all samples contain  
500 ppm AO 76  
500 ppm antacid or RST

Extrusion Conditions: 240 °C

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# Application of RST Products

- Stabilization of polyolefin resins during:
  - Production
  - Processing
  - Recycling
- Reduction/replacement of phosphite usage
- Replacement of antacids in formulation



# Conclusions

- RST allows for reduced phosphite usage
- RST allows switching from high end phosphites to commodity phosphites
- RST can aid in TNPP reformulation
- RST replaces antacid in polyolefin formulation
- Baerlocher USA is a trusted partner in additive reformulation





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