

DURASTRENGTH® 200

PLASTIC
ADDITIVES

ACRYLIC IMPACT MODIFIER

Improves PVC Mass and Suspension Resin Stability

Introduction

Mass and suspension methods for manufacturing PVC produce resins with slightly different processing and performance characteristics. Most crucial to the siding and profile industries, which use both types of resin, are the differences of faster fusion and reduced stability of mass PVC resin. These performance differences are an important consideration when interchanging mass with suspension resin in siding capstock or profile as the processing window is narrower and the color shifts towards the yellow range with PVC mass resin. Durastrength 200 is the impact modifier of choice to widen the processing window and minimize the color shift in mass resin formulations.

Test Descriptions

Stability, color hold and rheology were evaluated on a standard PVC siding capstock formulation. The test methods included the following:

Dynamic Stability: Brabender Torque Rheometer, 190°C, 65 grams, 75 rpm,

Color Hold: Brabender Torque Rheometer, 190°C, 65 grams, 75 rpm, Color chips were pulled at 2 minute intervals. Yellowness Index was evaluated.

The standard PVC siding capstock formulation used in this evaluation follows.

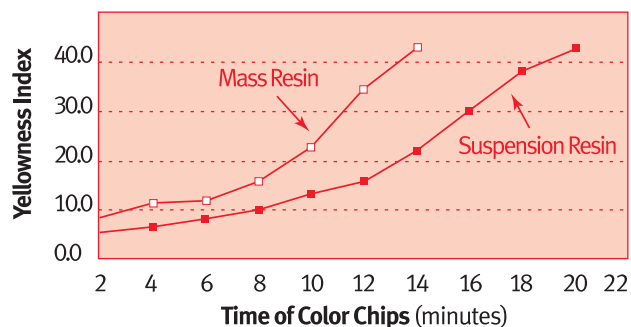
Ingredients	phr
PVC resin (Mass vs. Suspension), K-65	100.00
Thermolite® 380	0.45
Calcium Stearate	1.20
Paraffin Wax (165°F mp)	1.00
Plastistrength® 501	1.00
Impact Modifier	variable
Titanium Dioxide	10.00

Mass Resin Stability

Mass resin characteristically exhibits faster fusion and shorter stability times than suspension resin in PVC formulations. In the PVC siding capstock formulation, the color chips demonstrated a final difference in stability of 14 minutes for the mass resin formulation versus a significantly better 20 minutes for the suspension resin formulation.

Mass versus Suspension Resin Stability

Durastrength 200 at 4.0 phr in PVC Siding Capstock Compound



Formulators have the flexibility to minimize the stability and color differences in mass-resin-based compounds by choosing the additives which best enhance the performance of mass resin. Durastrength 200 effectively improves the stability and color hold as demonstrated in following graphs. This benefit was evident at 3.0, 4.0, and 5.0 phr loading levels.

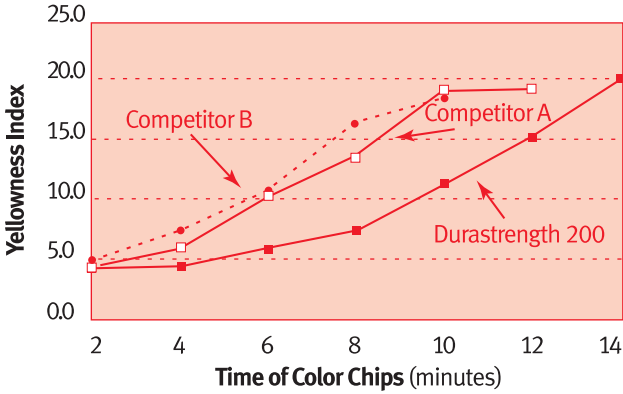
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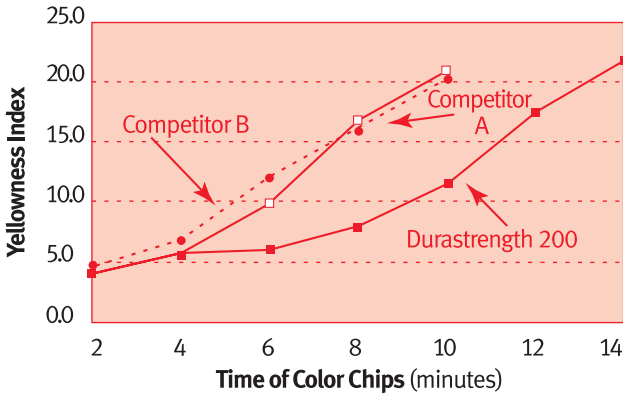
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Effect of Impact Modifier on Mass Resin Stability

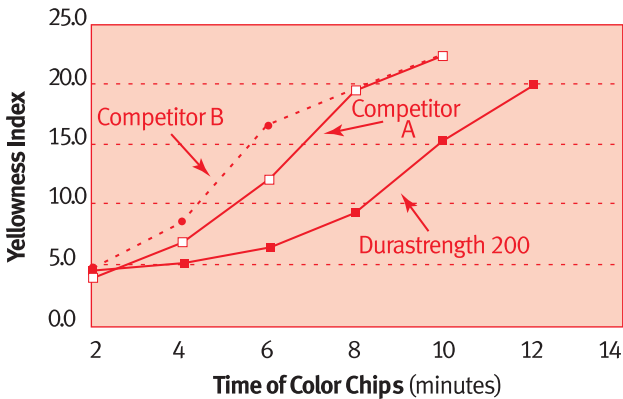
3.0 phr Impact Modifier



4.0 phr Impact Modifier



5.0 phr Impact Modifier

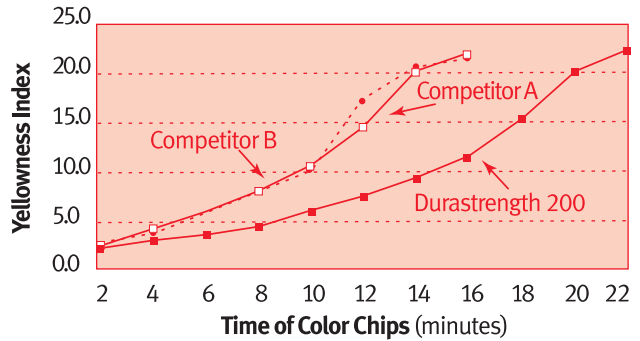


Effect of Impact Modifier on Suspension Resin Stability

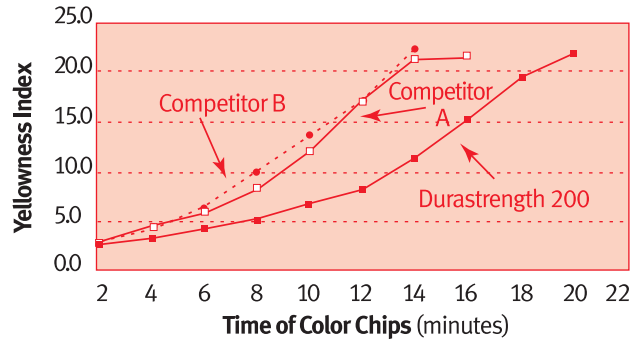
Suspension Resin Stability

Suspension resin inherently exhibits better stability and color hold than mass resin. Even so, the same benefit of significantly improved stability and color hold in suspension-resin-based compound was again evident with Durastrength 200 versus the competition.

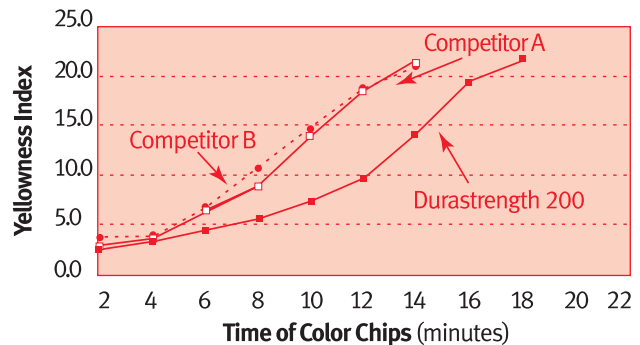
3.0 phr Impact Modifier



4.0 phr Impact Modifier



5.0 phr Impact Modifier



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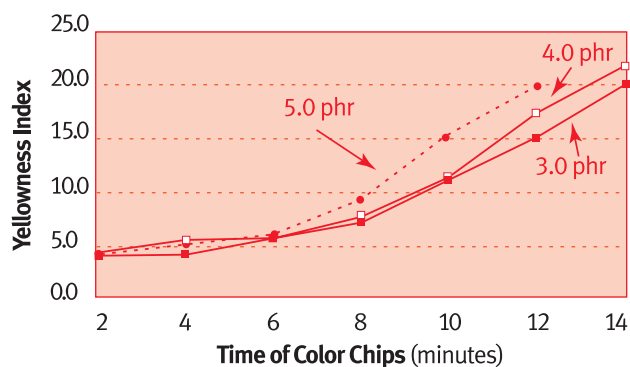
Improves PVC Mass and Suspension Resin Stability

Effect of Loading Level on Stability

Too much of a good thing detracts from the benefits offered by Durastrength 200. The loading level affected the stability of the PVC capstock compound as shown in the following graphs. This is a consideration for the formulator. While Durastrength 200 improves the color hold and stability of the compound, the effect is not additive but is superior as compared to competitive impact modifiers. This holds in both mass- and suspension-resin-based compounds.

Effect of Durastrength 200 on Mass Resin Stability

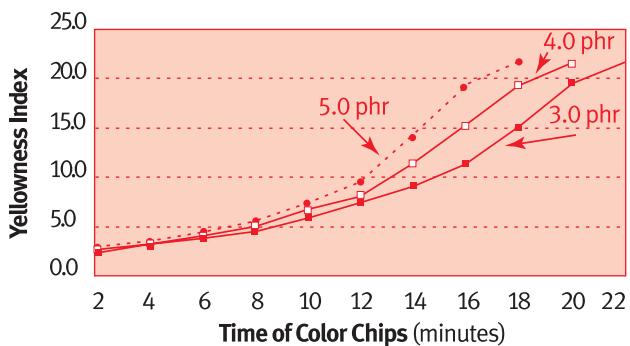
PVC Siding Capstock Compound



Brabender @ 190C, 65g, 75rpm

Effect of Durastrength 200 on Suspension Resin Stability

PVC Siding Capstock Compound



Brabender @ 190C, 65g, 75rpm

Rheology Results

As the following table indicates, mass-resin-based compounds exhibited shorter fusion times, shorter stability times, higher maximum torques, but slightly lower equilibrium torques in this evaluation. These differences in the mass-resin- versus suspension-resin-based compounds were minimized by formulating with Durastrength 200 versus competitive modifiers.

Mass Resin Compound

(Brabender Torque Rheometer; 190°C, 65g, 75 rpm)

	Fusion Time (minutes)	Stability Time (minutes)	Maximum Torque (mg)	Equilibrium Torque (mg)	Stock Temp. (°C)
3.0 phr					
Durastrength 200	00:50	10:14	3328	2360	205
Competitor A	00:50	07:14	3619	2366	203
Competitor B	00:42	07:14	3630	2360	203
4.0 phr					
Durastrength 200	00:50	09:52	3524	2470	204
Competitor A	00:40	06:38	3589	2406	205
Competitor B	00:40	06:40	3810	2418	204

5.0 phr

Durastrength 200	00:46	09:46	3657	2508	205
Competitor A	00:40	06:30	3769	2453	205
Competitor B	00:32	06:32	4003	2485	204

Suspension Resin Compound

(Brabender Torque Rheometer; 190°C, 65g, 75 rpm)

	Fusion Time (minutes)	Stability Time (minutes)	Maximum Torque (mg)	Equilibrium Torque (mg)	Stock Temp. (°C)
3.0 phr					
Durastrength 200	01:10	16:16	3459	2543	205
Competitor A	01:06	13:16	3590	2479	204
Competitor B	01:00	12:04	3483	2411	205

4.0 phr

Durastrength 200	01:00	15:42	3467	2551	206
Competitor A	01:00	11:20	3552	2517	205
Competitor B	01:02	12:02	3607	2459	205

5.0 phr

Durastrength 200	00:56	14:12	3500	2580	206
Competitor A	00:52	10:36	3756	2569	205
Competitor B	00:54	11:26	3728	2563	205

Conclusion

Durastrength 200, in comparison with competitive impact modifiers, offers formulators better flexibility when formulating PVC compounds based on mass resin by significantly improving the stability and color hold of the formulation and widening the processing window. These same benefits are found in PVC suspension-resin compounds containing Durastrength 200. With the results of this evaluation, formulators now have the necessary tools to formulate a mass-resin compound which will perform more similarly to a suspension-resin compound.

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More Technical Information Available

Ask your Arkema Account Manager for further information about other high quality Arkema additives for use in PVC resins, PVC alloys, and other polymer systems. Arkema produces a full line of heat stabilizers, impact modifiers, process aids and epoxidized vegetable oils.

Arkema offers complete technical service and assistance. Our laboratories and personnel are ready to assist you in any phase of your evaluation, from formulation development to end product testing.

Thermolite® Heat Stabilizers

Thermolite heat stabilizers are designed for use in the production of rigid, semi-rigid, foamed, and flexible PVC products. Arkema has developed PVC heat stabilizers specifically for extruded siding, profiles and pipe, injection molding, blow molded bottles, and calendered or extruded sheet. Arkema offers a full line of stabilizers that meet FDA requirements for food grade PVC packaging, and a full line of NSF approved stabilizers for PVC potable water pipe & fittings.

Clearstrength® & Durastrength® Impact Modifiers

Clearstrength and Durastrength impact modifiers are designed to meet a wide variety of processing requirements, from high clarity, crease resistant products for packaging applications to high efficiency modifiers for durable, exterior building products. Arkema's impact modifiers provide PVC processors with lot to lot consistency and cost effective performance.

Vikoflex® Epoxy Plasticizers

The Vikoflex line of epoxy plasticizers offers flexible PVC producers the highest quality, dual-function epoxidized vegetable oils available. Arkema has the ability to produce material with exacting specifications to meet varied customer requirements.

Plastistrength® Process Aids

Plastistrength process aids offer producers of rigid and flexible PVC greater product uniformity by improving compound fusion and flow during extrusion, injection molding and thermoforming. Variances in wall thickness and surging can be greatly minimized or eliminated with Plastistrength process aids.

For Technical Information Contact

Arkema Inc.
Additives Technical Service
900 First Avenue, King of Prussia, PA 19406
(610) 878-6658 (phone)
(610) 878-6260 (fax)
www.additives-arkema.com (website)
info.additives@arkemagroup.com (e-mail)

For Order Information Contact

Arkema Inc.
Additives Customer Service
2000 Market Street, Philadelphia, PA 19103-3222
(800) 446-2800 (phone)
(215) 419-7875 (fax)
arkema.usph-additives-cs@arkemagroup.com (e-mail)

Visit us at our Website

www.additives-arkema.com

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Note: The "Material Safety Data Sheet" on this product is available on request from the Safety and Environmental Services Department of Arkema Inc., 2000 Market Street, Philadelphia, PA 19103.



Arkema Inc.
2000 Market Street
Philadelphia, PA 19103
Customer Service 1.800.446.2800

www.additives-arkema.com