



255 Fountain Street Akron, Ohio 44304-1991
 330-535-2100 ♦ 800-321-2260 ♦ Fax 330-535-8947

RUBBER CHEMICALS -RETARDERS-

RETARDER RSF

DESCRIPTION:

A non-staining and non-discoloring retarder for natural and synthetic rubber compounds. Use from 0.50 to 1.3 parts per 100 phr, depending on polymer and accelerator system used. Very effective with sulfenamide systems. Effective in thiazole systems as well as low sulfur/thiuram cures. Also useful for replasticizing of slightly scorched stocks by cold mill mixing. Replaces Retarder SAFE in many applications at a lower cost. When Retarder RSF is used in natural rubber, reversion is minimized.

Does not bloom at recommended amounts and no odor occurs from the use of Retarder RSF. Does not significantly change the fully cured characteristics of the compound. State-of-cure is effected less than with most other retarders.

TYPICAL PROPERTIES:

Composition.....	Proprietary Blend
Appearance	Cream to Tan Powder
Odor	Slight, typical
Specific Gravity.....	1.31
Moisture	0.5% maximum
Melting Range.....	77°- 83°C*
Storage Stability.....	Stable

TOXICITY:

Not considered hazardous for normal industrial use. However, as with most rubber chemicals, avoid ingestion and wash with soap and water after use.

* tentative range

t-retrsf

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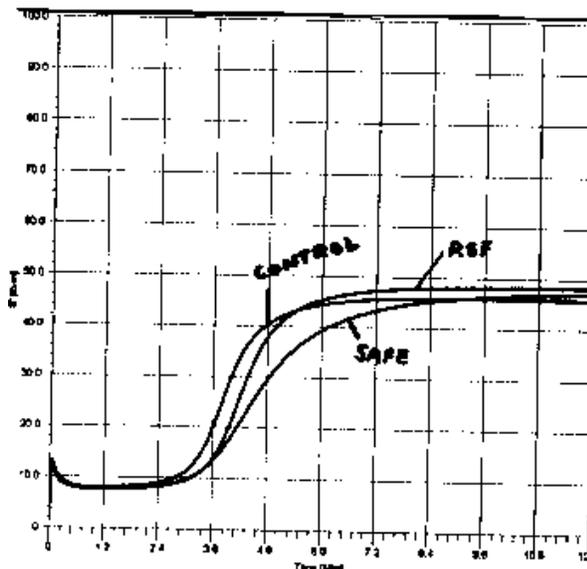
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RETARDER RSF vs. RETARDER SAFE

Due to the escalating price of Retarder SAFE, an effort was made to find a reasonable substitute at a lower cost. SAFE performs best in sulfenamide cures (CBTS, OBTS, BBTS). It is notable for the retention of the state-of-cure of the compound due to an activating effect. SAFE also reduces reversion in natural rubber. SAFE's ability as a scorch retarder is moderate overall. We feel Retarder RSF is a good replacement for Retarder SAFE in most cure systems. Here are a few test formulas and the results comparing Retarder SAFE with Retarder RSF.

Sulfenamide Cure in SBR

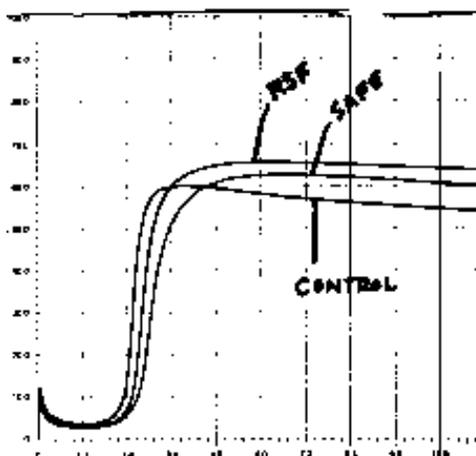
		Rheometer @ 340°F	RSF	SAFE	No Retarder
SBR 1805	212.5				
ZnO	5.0	T ₂	2.48	2.50	2.23
Stearic	1.0	T ₉₀	5.67	7.12	5.17
Sulfur	1.8	Max Torque	48.30	47.10	46.10
BBTS	1.5				
TMTD	0.3	Scorch @ 270°F	15.95	15.79	11.11
Retarder	<u>1.0</u>				
	223.1				



In SBR, SAFE tends to increase cure time (T₉₀). This will also be seen again in a thiazole-cured SBR. Scorch time and state-of-cure are comparable.

Sulfenamide Cure in Natural Rubber

<u>Material</u>	<u>PHR</u>	<u>Rheometer @ 340°F</u>	<u>RSF</u>	<u>SAFE</u>	<u>No Retarder</u>
SMR CV60	70.00	T ₂	2.07	2.10	1.88
SBR 1500	30.00	T ₉₀	3.55	4.03	2.92
N550	90.00	Max Torque	65.80	62.80	60.30
Aromatic Oil	32.00				
ZnO	5.00	Scorch @ 270°F	13.52	13.43	9.62
Stearic	1.50				
Sulfur	1.80				
CBTS	1.00				
TMTD	0.40				
Retarder	<u>1.00</u>				
	231.70				



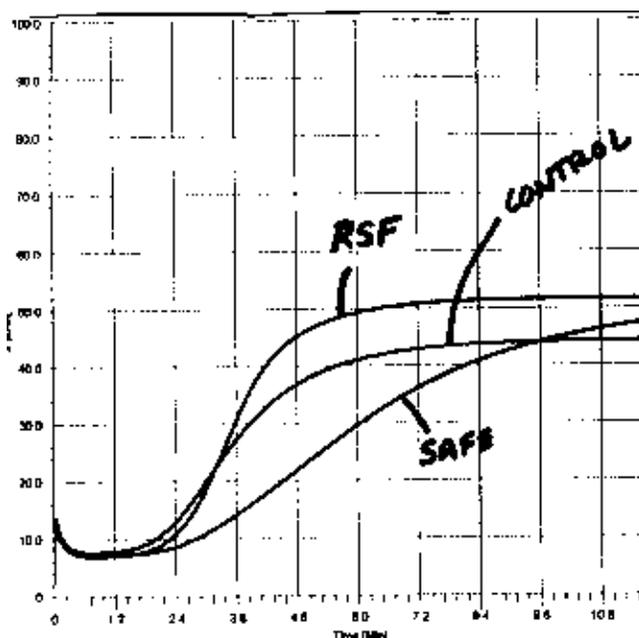
Again, scorch is equivalent to SAFE. Cure time is a little faster. Reversion is reduced by both retarders. Higher state-of-cure of the Retarder RSF resulted in a slight change in subsequent formulas to lower cured maximum torque.



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Thiazole Cure in SBR

Material	PHR	Rheometer @ 340°F	RSF	SAFE	No Retarder
SBR 1805	212.50	T ₂	1.82	2.03	1.53
ZnO	5.00	T ₉₀	5.22	9.47	5.77
Stearic	0.90	Max. Torque	51.73	47.92	44.27
Sulfur	1.50				
MBTS	1.50	Scorch @ 270°F	9.10	11.10	7.88
DPG	0.60				
Retarder	1.00				
	<u>223.00</u>				



Retarder RSF does not delay scorch as much as SAFE in this thiazole cure. However, most of the SAFE retarding is related to the slowing of the overall cure rate. T₉₀ is slowed significantly. This seems to be a function of the SBR, since a thiazole-cured natural rubber showed minimal loss of T₉₀. State-of-cure is raised slightly by the new retarder. Again, the formula has been adjusted to reduce these differences in torque.

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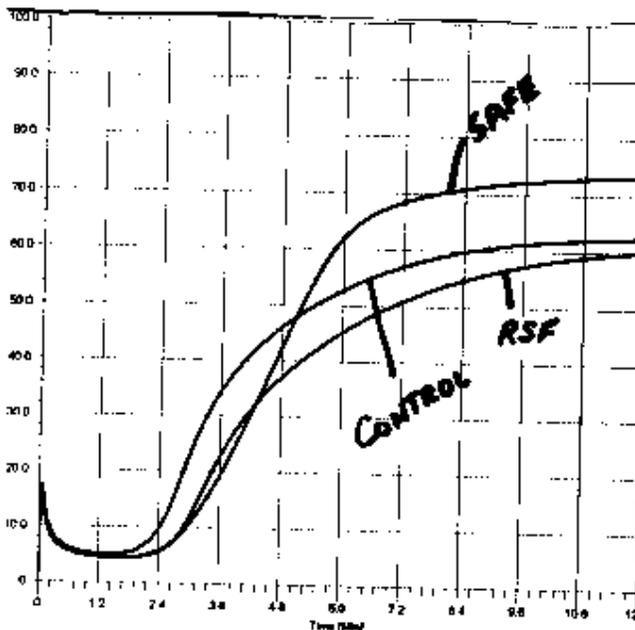
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Low sulfur/high thiuram cure in NBR

<u>Material</u>	<u>PHR</u>	<u>Rheometer @ 340°F</u>	<u>RSF</u>	<u>SAFE</u>	<u>No Retarder</u>
Krynac 34E35	100.00	T ₂	2.35	2.38	1.97
Q325 Whiting	40.00	T ₉₀	8.27	6.62	7.10
HC-75 Clay	20.00	Max Torque	60.14	73.40	62.62
ZnO	5.00				
Stearic	0.50	Scorch @ 270°F	13.72	11.51	10.39
MC-98 Sulfur	0.50				
TMTD	1.50				
TETD	1.50				
Retarder	<u>1.00</u>				
	170.00				



SAFE has been known to have unusual effects in NBR. It does activate the cure and raises the state-of-cure significantly. Retarder RSF has about the same state-of-cure as the control and retards better than SAFE. Unfortunately the SAFE and RSF differ from one another in this type of cure system. They would each have certain advantages and disadvantages here.

Retarder RSF may bloom if used in combination with Retarder CTP (PVI) due to similar (-imide) chemistry. No bloom should occur if RSF is used alone at less than 1.3 phr.

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