

مجل جديد لنظام فلكنة المطاط الطبيعي ومطاط الستايرين - بيوتاديين

(NH₂)₂CO

(SBR) - (NR)

/

()

(CBS) (SBR) (HMT) (NR)

MBT MBTS HMT CBS MBS

(CBS MBS)

(Q)

. Q

(CTP-100)

CBS Q

CBS

SBR

Q

Abstract:

In this research, using of Urea (NH₂)₂CO as an alternative accelerator in vulcanization system for both natural rubber (NR) and synthetic rubber (SBR) has been studied. The research has been carried out by the laboratories of Babylon Tiers Factory as a part of their employers' efforts to find other sources be cheap and available for rubber chemicals.

Mechanical and Rheometric properties for the new compositions have been measured and then compared with the standard compositions for both NR and SBR which contains HMT and CBS respectively as accelerators.

In addition to its cheaping and availability, it appears that new accelerator has great effects upon the mechanical and rheometric properties for NR with maintaining the same values of hardness and it has many desirable characters such as: suitable curing rate, upper resistance to combustion (scorch), upper damping properties and lower specific gravity.

When compared with other certain accelerators (MBS, CBS, HMT, MBT and MBTS) the new accelerator shows processability and elasticity surpasses the last three ones and has scorch time near from the types with delayed action, but with low crosslink density which means the needing to improve this property by changing the sulfur to accelerator ratio (Q), we notice that increasing the accelerator quantity both of curing rate, crosslink density and hardness have been increased, also unequal changing for same properties provide that ability to achieve certain properties by controlling the Q value.

By studying its behavior with changing the nature of vulcanization system (by adding CTP-100 as retarded), new accelerator shows the same behavior of accelerators in present of retarded in vulcanization systems and this behavior remains constant with varied values of Q.

In presence of retarders, new accelerator's behavior has been compared with CBS's behavior and showed less crosslink and curing rate, but the strange thing here is that the new accelerator surpasses CBS in scorch resistance which provides the ability to control its behavior by choosing the suitable vulcanization system.

With SBR, new accelerator shows limit ability to produce the crosslink and has little effect on rehometric properties in spite of changing Q ratio several times.

Keywords: Accelerator, Urea, Rubber

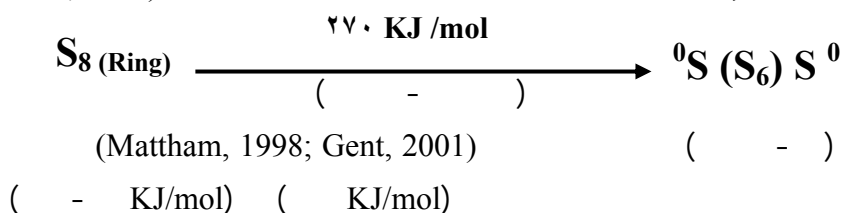
(James *et al.*, 2005)

(Hofmann, 1979)

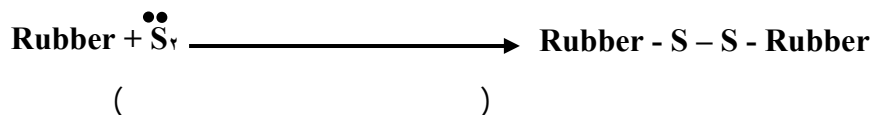
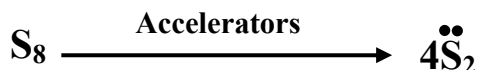
(James *et al.*, 2005)(Babbit ,1987)

.(James *et al.*, 2005)

:(Mattham, 1998) (KJ/mol)



: S₈



(Q)

.(;Morton 1987)

:()

(Mattham , 1998)

: ()

284°F (min)		
-		Thiocarbanilide
		Diphenylguanidine
		Thiazole , Sulfenamide
		Amines, Thiurams
		Dithiocarbamates, Xanthates

Sulfenamide Thiazole

(Delayed Action)

. (Gent, 2001)

Xanthates Dithiocarbamates Thiurams

Q

Thiurams

Dithiocarbamates

(-)

NR

(, - ,)

CBS

(Richard *et al.*, 1999) SBR

(Activators)

.(Gent, 2001)

(-)

()

:

(Mattham , 1998)

(Richard, 1999)

: (M_L) *

. (Mujed , 2006)

: (M_H) *

: (t_{s2}) *

(°C)

. (Mattham , 1998)

(°C - °C)

*(t₉₀):

$$V = 2.7 * M_L : (V) *$$

:

(46% min)

:(Constructive Innovation S.A., 2008)



(PH=8.5)



Thiurams

NR ()
SBR ()
()

Urea		NR ()	
Amount(pphr)	Amount(pphr)	Ingredients	No.
		NR	
		Reclaim	
		Zinc Oxide	
,	,	PCTP-50	
		N-660	
,	,	Phenolic Tack Resin	
		Process-Oil	
		Sulfur	
		HMT	
	--	Urea	

Urea		SBR	()
Amount(pphr)	Amount(pphr)	Ingredients	No.
		SBR	
		Reclaim	
	1	Satiric Acid	
,	,	Zinc Oxide	
		6PPD	
,	,	N-375	
		Micro Wax	
		Process-Oil	
,	,	Sulfur	
,	,	CBS	
,	,	TMQ	
	--	Urea	

()

ASTM D-1415	Wallace Dead Load Hardness Tester	3 mm mm	
ASTM D-1083	Monsanto-Densitorn	3 mm mm	
ASTM D-2084	Oscillating Disk Rheometer	, mm mm	(t _{s2} t ₉₀ M _L M _H)
ASTM D-412	Monsanto T10 Tensometer	, * * mm Dumbbell	()
ASTM D-1054	Wallace R2-Dunlop Tripsometer	mm mm °C 3 hr	

:

(NR)

:

Q=2 (HMT)

:A

)

()

()

(

(HMT)

()

(%)	()	(HMT)	
,	,	,	(m.m) t ₉₀
,	,	,	(m.m) t _s
,	,	,	(Lb-in) M _L
,	,	,	(Lb-in) M _H
,	,	,	
-----			(IRHD)
,	,	,	(MPa)
,	,	,	(%)
,		,	(MPa)
,		,	(%)

(% ,)

(% ,)

(% ,)

()

Q=2

: B

) MBTS MBT CBS MBS
Sulphenamide (Delayed Action)
: (Thiazole) DCBS

Q=2

()

MBS	MBT	MBTS	DCBS	CBS		
,	,	,	,	,	,	(m.m) t ₉₀
,	,	,		,	,	(m.m) t _s
,	,	,	,	,	,	(Lb-in) M _L
,	,	,	,	,	,	(Lb-in) M _H
,	,	,	,	,	,	
						(IRHD)
,	,	,	,	,	,	(MPa)
,			,	,	,	(%)
,	,	,	,			(MPa)
,	,	,	,	,		(%)

*

.HMT

CBS MBS

*

.HMT MBT MBTS

*

. MBT

*

()

*

HMT

*

:Q=5 CBS

(C

CBS

()

CBS

()

Q=5 Q=5 Q=2
11.4% 30% CBS

. Q

Q=5 CBS ()

(%)			
	CBS		
+ ,	,	,	(m.m) t ₉₀
+	,	,	(m.m) t _s
+ ,	,	,	(Lb-in) M _L
- ,	,		(Lb-in) M _H
- ,	,	,	
- ,			(IRHD)
- ,	,		(MPa)
+ ,	,		(%)
-		,	(MPa)
- ,			(%)

: Q (D

, , Q

: ()

) Q () *

. (

*

*

*

()

:

. Q

Q ()

Q					
20	10	5	3.3	2.5	
,	,	,	,	,	(m.m) t ₉₀
,	,	,	,	,	(m.m) t _s
,	,	,		,	(Lb-in) M _L
,	,		,	,	(Lb-in) M _H
			,		(IRHD)
	,	,		,	(MPa)
			,	,	(%)
,	,	,	,	,	(MPa)

: (E)

pphr , CTP-100

() , : Q

Q

.

M_H

M_L

Q ()

Q						
						(m.m) t ₉₀
						(m.m) t _s
						(Lb-in) M _L
						(Lb-in) M _H
						(MPa)
						(%)
						(MPa)

(F) : **Q=5 CBS**
 () CBS
 24.7% 63%
 4.7% 28% 13.7%

15% CBS
 .
 : (SBR) - :
 : **Q = 1.3 CBS** (A)
 % , CBS ()
 (% ,)
 82% 17.6%
 18.3% 16%
 (NR) SBR
 .NR SBR

Q=5 CBS ()

(%)			
	CBS		
+	,	,	(m.m) t_{90}
+	,	,	(m.m) t_s
+ ,	,	,	(Lb-in) M_L
- ,	,	,	(Lb-in) M_H
+ ,	,	,	(MPa)
+ ,			(%)
-	,	,	(MPa)

$Q =$, CBS ()

(%)			
	CBS		
+			(m.m) t_{90}
+			(m.m) t_s
+			(Lb-in) M_L
-			(Lb-in) M_H
+			
-			(IRHD)
-			(MPa)
+			(%)
-			(MPa)

: Q (B

(, ,) Q

.()

Q SBR ()

	Q				
					(Lb-in) M_L
					(Lb-in) M_H
-					(IRHD)
					(MPa)
					(%)
					(MPa)
					(m.m) t_{90}
					(m.m) t_s

References

- Babbitt, R. (1987). **"The Vanderbilt Rubber Hand Book"** Published by R. T. Vanderbilt Company Inc., Norwalk, pp: 6-7.
- "Constructive Innovation S.A."** 2008, International Trading/Procurement /Marketing / Consulting.
- Gent, N. (2001). **"Engineering with Rubber "**Hanser Publishers, second edition ,Munich ,p:20.
- Hofmann W (1979). **"Vulcanization and Vulcanizing Agents "** Palmerton Publishing Co. INC , pp: 5-6.
- James E., Burak E., Fredric R. (2005). **"Science and Technology of Rubber "** third edition, Elsevier Academic Press, PP: 257-260.
- Mattham, R. (1998). **"Rubber Engineering"** Tata McGraw-Hill Publishing Company Limited, Delhi ,pp:306-307.
- Morton, M. 1987 **" Rubber Technology "** Van Nostrand Reinhold, New York , p: 157.
- Mujed Al-Hatammi, 2006 **"Optimization Study of Rubber Blends and their Effects on Passenger Tire Tread Properties"**. University of Babylon, Ph. D Thesis, p:76.
- Richard A, Mark H, David W. 1999 **"The Use of Ash Filler in Rubber "** International Ash Utilization Symposium, University of Kentucky, www.flyash.info.
- Utah Fertilizer Guide **"Fertilizer Composition and Reactions in Solids"** 2008, AG 431, Utah State University.