HOSE PRODUCTION

VESTENAMER®

EVONIK
POWER TO CREATE

VESTENAMER® 8012
Use in hose production

Three problems arise in hose production that VESTENAMER® 8012 can considerably help to resolve:

Green strength of hose tubes

To increase green strength or green hardness, respectively, it is often necessary to cool the unvulcanized hose tubes to well below zero degrees, which is time-consuming, energy-intensive, and therefore expensive. Because of its crystallinity, VESTENAMER® 8012 effects a noticeable increase in hardness and green strength in such compounds already at ambient temperature—an effect that continues during cooling. In many cases, this enables manufacturers to reduce or even completely avoid the hitherto essential cooling step in the manufacturing process.

The processing and extrusion properties of plasticizer-free compounds

Compounds that contain VESTENAMER® 8012 have significantly reduced viscosity and improved flowability, so production of hoses such as brake hoses is fully controllable. This substantially improves flow behavior on the machine.

Penetration of fabric

Due to improved flowability at higher temperatures (at which processing generally occurs), use of VESTENAMER® 8012 may result in improved layer adhesion and increased penetration of the fabric used for reinforcement.

Formulations

Examples of different formulations using VESTENAMER® 8012

1. Plasticizer-free EPDM compound
2. Normal EPDM hose compound
3. NBR-based hose compound

EPDM/NBR based compounds

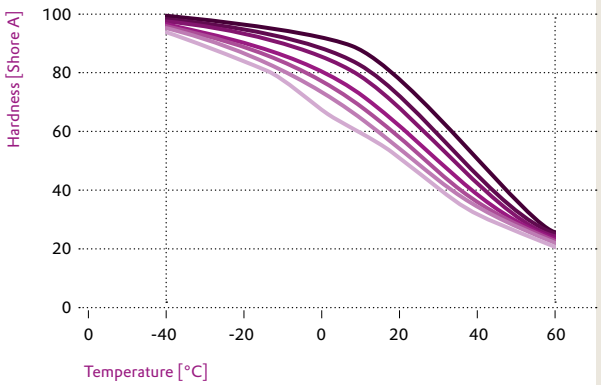
FORMULATION NUMBER	VE 473	VE 475	VE 476	VE 477	VE 478	VE 479	VE 480
EPDM*[1]	100	95	90	85	80	75	70
VESTENAMER® 8012	–	5	10	15	20	25	30
ZnO RS	3	3	3	3	3	3	3
Struktol WB 42	3	3	3	3	3	3	3
Corax N 550	70	70	70	70	70	70	70
TMQ	1.5	1.5	1.5	1.5	1.5	1.5	1.5
	VE 407	**VE 409**	**VE 410**	**VE 411**	**VE 412**	**VE 413**	**VE 414**
EPDM*[2]	100	95	90	85	80	75	70
VESTENAMER® 8012	–	5	10	15	20	25	30
ZnO RS	5	5	5	5	5	5	5
Stearic acid	1	1	1	1	1	1	1
Corax N 550	130	130	130	130	130	130	130
Tudalen 8013*[4]	80	80	80	80	80	80	80
SDPA	0.8	0.8	0.8	0.8	0.8	0.8	0.8
	VN 126	**VN 127**	**VN 128**	**VN 129**	**VN 130**	**VN 131**	**VN 132**
NBR*[3]	100	95	90	85	80	75	70
VESTENAMER® 8012	–	5	10	15	20	25	30
ZnO RS	5	5	5	5	5	5	5
Stearic acid	1.5	1.5	1.5	1.5	1.5	1.5	1.5
Corax N 550	50	50	50	50	50	50	50
Enerdex 81*[5]	10	10	10	10	10	10	10
TMQ	1.5	1.5	1.5	1.5	1.5	1.5	1.5

*[1] Unsaturation: 8 DB/1000C • Ethylene content: 50% • 100 °C ML (1 + 4): 45
*[2] Unsaturation: 8 DB/1000C • Ethylene content: 50% • 100 °C ML (1 + 4): 110
*[3] 100 °C ML (1 + 4): 45
*[4] paraff. oil
*[5] aromat. oil

VESTENAMER® 8012

Achieved improvements

1 EPDM
hose compounds



Effect of VESTENAMER® 8012 on the Shore hardness of unvulcanized hose compounds

Figure 1, 2 und 3

Using VESTENAMER® to increase the hardness of uncrosslinked compounds

As described earlier, this is due to the high degree of crystallinity below the melting range as well as the high recrystallization rate of VESTENAMER® 8012.

As Figs. 1, 2, and 3 show, addition of VESTENAMER® 8012 gives a substantial increase in compound hardness below its melting point (approx. 55°C) , depending on the dosing. This allows cooling energy to be reduced, or cooling to be dispensed with entirely, during the manufacturing process. For example, cooling down to -20°C is required to achieve a hardness of 84 Shore A with the EPDM-based compound. However, if 20 phr of the base polymer is replaced with VESTENAMER® 8012, this hardness is achieved even at 0°C.

Figure 4

Reduction of compound viscosity*

The effect of viscosity reduction is especially pronounced with a VESTENAMER® content of over 10 phr and in particular with an NBR based hose compound. In this case low VESTENAMER® content initially causes no appreciable reduction in viscosity; this is due to the fact that addition of VESTENAMER® leads initially to improved homogeneity—that is, improved distribution of fillers.

The reduction in viscosity, and the resulting improvement in flowability, of the compound when part of the base polymer is replaced by VESTENAMER® aids the processing of less easily handled compounds. Where fabric is used for reinforcement, the improved penetration leads to a much better overall result.

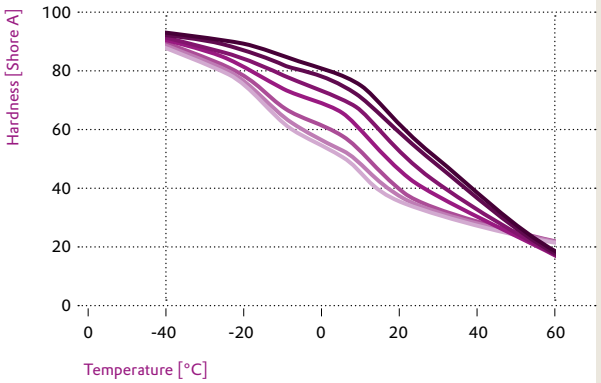
*measured at ML (1+4) at 100°C

Figure 5

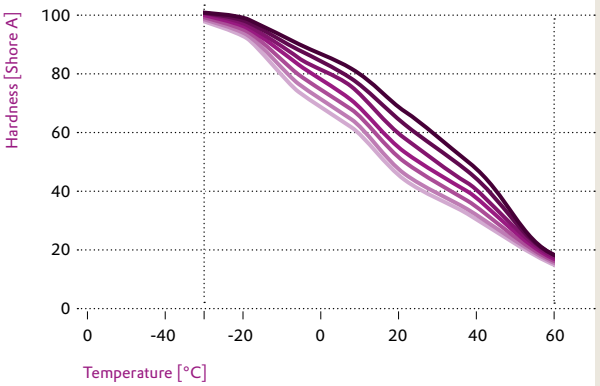
Increase in extrusion speed

As a result of the improved flowability, the extrusion speed can be increased significantly in some cases: The higher the VESTENAMER® content, the higher the linear flow rate, as Fig. 5 shows in second per meter. This effect is of particular interest for the processing of plasticizer-free compound.

2 EPDM hose mixtures

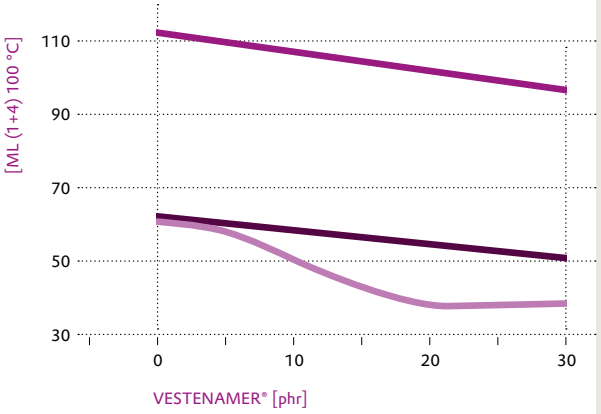


3 NBR hose mixtures

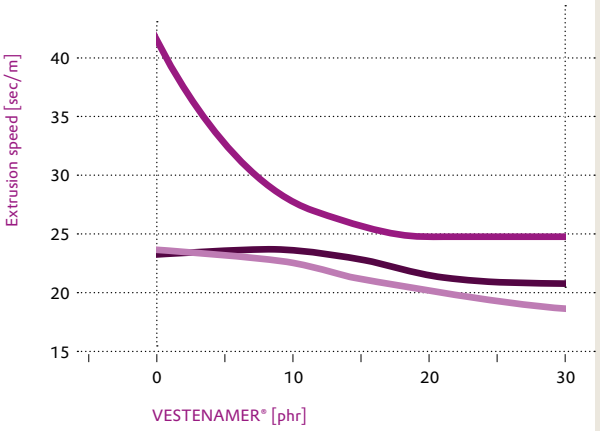


30 phr
25 phr
20 phr
15 phr
10 phr
5 phr
0 phr

4 Effect of VESTENAMER® on viscosity



5 Effect of VESTENAMER® on extrusion speed



Hose compounds

NBR • 100 °C ML (1 + 4): 45
EPDM • Unsaturation: 8 DB/1000C • Ethylene content: 50% • 100 °C ML (1 + 4): 45
EPDM • Unsaturation: 8 DB/1000C • Ethylene content: 50% • 100 °C ML (1 + 4): 110

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