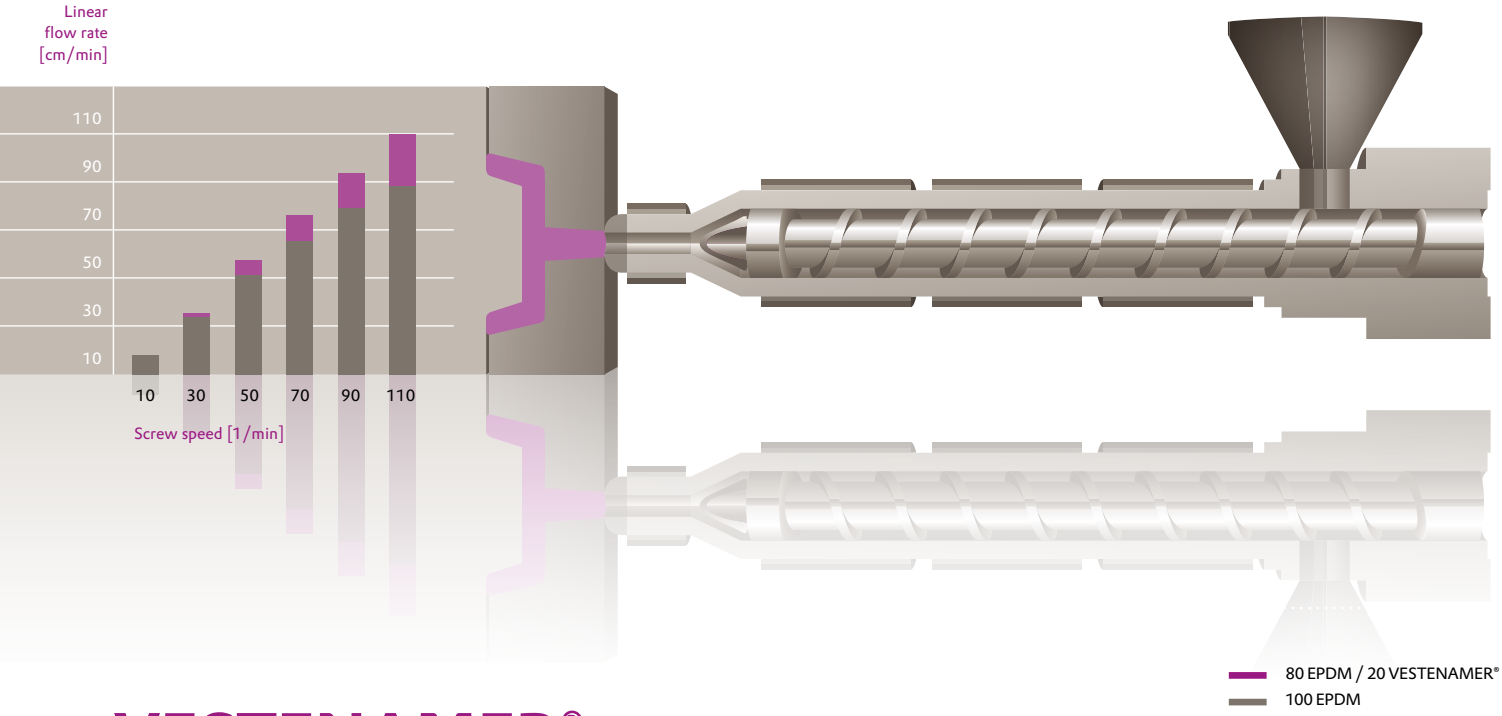
PROFILE EXTRUSION

VESTENAMER®

EVONIK
POWER TO CREATE



VESTENAMER®
Use in profile extrusion

In many areas of profile production, the use of VESTENAMER® as a processing aid has become state of the art. The option of VESTENAMER® addition is already being extensively used to increase the stability of the raw profiles and to improve flowability, surface smooth-ness, and dimensional stability.

Use in extremely hard profiles (e.g., profile bases for clamping profiles) is a particularly time-tested application. Here, VESTENAMER® results not only in increased vulcani-zate hardness but also significantly improved processability.

Using VESTENAMER® in profile extrusion enables an increase in linear and mass flow rates together with reduced melt pressure in front of the die, leading to savings in specific energy consumption.

The tests were performed on a plasticizer-free compound for technical hoses based on EPDM rubber (BUNA AP 241, see formulation in Table 2) using a Brabender extruder. To achieve essentially the same ejection tempera-tures in all tests, the cylinder and die temperatures were adjusted for the different speeds (for additional data see Table 1, top right).

Table 1: **Technical Data**

Machine

Manufacturer	Brabender
Type	Plasti-Corder
Cylinder diameter	19mm
Type of heating	electrical
Screw	compression screw
L/D ratio	20

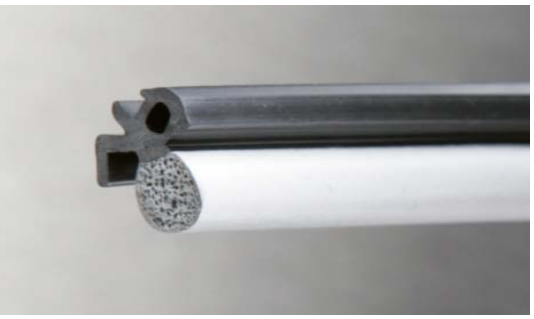
Extrusion die

Profile	Garvey profile
Dimension	ASTM D 2230-78

Tabelle 1:

Temperature comparsion

	Screw speed [min-1]	Temperature		
		Cylinder	**Die**	**Extrudate**
Compound A	20	90 °C	110 °C	97 °C
Compound B	20	83 °C	103 °C	94 °C
Compound A	50	82 °C	102 °C	96 °C
Compound B	50	83 °C	103 °C	92 °C
Compound A	80	75 °C	95 °C	87 °C
Compound B	80	80 °C	100 °C	94 °C
Compound A	110	75 °C	95 °C	87 °C
Compound B	110	79 °C	99 °C	94 °C



Profile

Tabelle 2:

Compound formulation

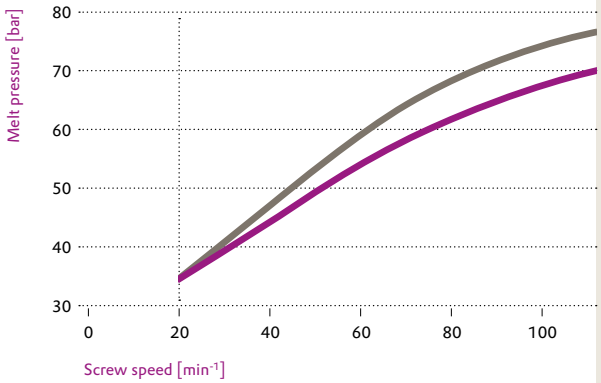
	Compound A	Compound B
BUNA AP 241	100	80
VESTENAMER® 8012	–	20
ZnO	3	3
Aflux 42	3	3
N 550	75	75
Perkadox BC 40	6.5	6.5
TRIM (activator)	1.0	0.5

Formulation of a BUNA AP 241-based plasticizer-free compound for technical hoses

VESTENAMER®

Processing data profile extrusion

1 Melt pressure



Compound A
Compound B VESTENAMER® based

ADVANTAGES OF VESTENAMER® 8012

The processing data from the sample compounds clearly show the beneficial effect of VESTENAMER® (Figs. 1 to 5). At extremely low screw speeds (approx. 20 min^{-1}), linear and mass flow rates and the melt pressure in front of the nozzle are almost the same for the two compounds, while the extrudate swell and specific energy consumption for the compound containing VESTENAMER® are lower.

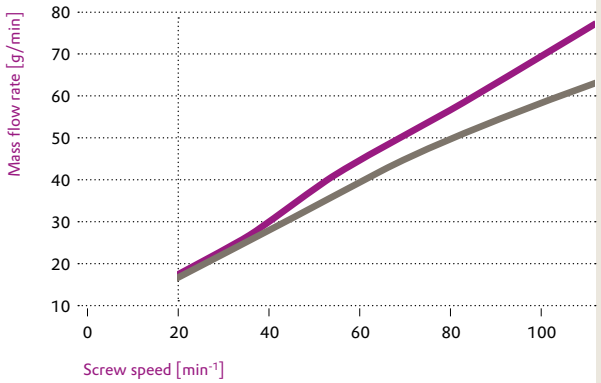
As screw speeds increase, the linear and mass flow rates of VESTENAMER®-based compounds (B) increase more sharply than for the pure EPDM compound (A).

Conversely, the melt pressure in front of the die and the specific energy consumption behave just the opposite: The higher the screw speed, the more significant the difference between compounds with (B) and without (A) VESTENAMER®. For the former, the values are consistently lower. The values for the extrudate swell develop more or less in parallel, though the values for compound A are substantially higher.

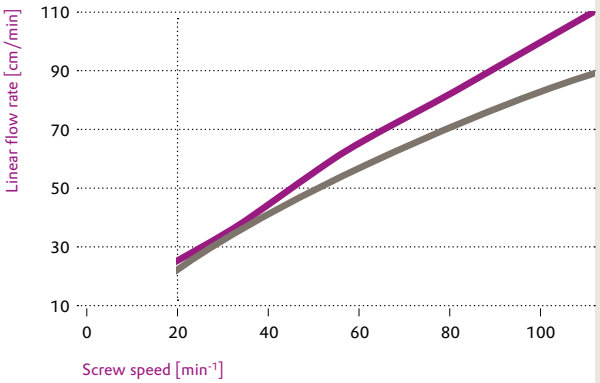
The advantages of using VESTENAMER® are therefore clear, particularly at higher screw speeds: Higher linear and mass throughputs are obtained (in specific cases, the difference is around 22 percent) with lower values of specific energy consumption, melt pressure, and extrudate swell.

An interesting observation is made when for a given machine setting a compound without VESTENAMER® is replaced by the corresponding compound with VESTENAMER®: The die swell is reduced significantly. By increasing the screw speed, the die swell (that is, the profile geometry) can be brought back to the original level but at much higher throughput. Depending on the conditions chosen in practice, this effect may well be higher than in the example presented here.

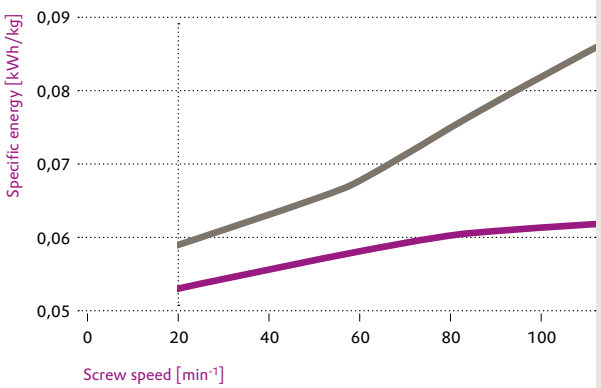
2 Mass flow rate



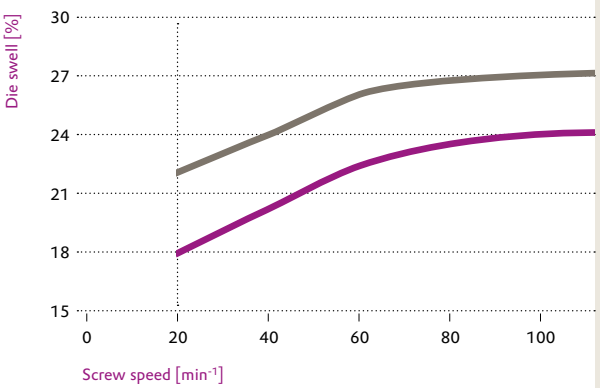
3 Linear flow rate



4 Specific energy



5 Die swell



Compound A
Compound B VESTENAMER® based

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