VOELPKER | biobased series

TECHNICAL STUDY

Enhanced flow improvement

Reduced ejection force

Faster part production

Improved dispersion

FLOW IMPROVER AND RELEASE AGENT –

WARADUR® E-R: A new effective processing agent for PA 6

Montan wax chemistry based on regrowing plant waxes.

PLANT BASED

INNOVATIVE AND RENEWABLE: WARADUR® E-R

WARADUR® E-R is an organic ester wax, based on renewable plant waxes. It perfectly mimics the chemistry of the classical montan wax WARADUR® E and optimally combines the characteristics of of a multipurpose montan wax based plastics additive with the appeal of biobased raw materials. It is therefore also perfectly suitable for thermoplastic polymers derived from renewable resources. In WARADUR® E-R natural long-chain fatty acids have been modified by innovative technology to create a biobased polymer additive that meets the highest standards in the polymer industry.

For more analytical details, see separate flyer: „SUSTAINABLE MONTAN WAX CHEMISTRY“

General Advantages

Highly effective in low concentrations:
WARADUR® E-R reveals a broad spectrum of effects: it is extremely versatile and suitable for a wide range of plastics applications as a multi-purpose additive, e.g. release agent, flow improver, dispersing agent and cycle time reducer.

46% reduced cycle time
15% enhanced flow improvement
46 – 49% reduced ejection force

Characteristics	Unit	Target value	Method
Acid value	mg KOH/g	12 – 25	ISO 2114
Drop point	°C	83 – 90	ASTM 3954
Biobased carbon content	%	95 – 100	ASTM D 6966-18 Method B
Colour	–	Pale yellow	AA 3.2.1.505

Table 1: Typical characteristics of WARADUR® E-R

Examples of Use

Thermoplastics: PA, TPU, PLA, PBT, PC, PVC, styrene. Thermosets: Epoxy resins, phenolic resins, polyurethane
Dispersing agent for colour master batches and filled plastics (mineral, glass fibre)

Technical Study: PA 6

Matrix	Nucleating agent	%	Wax additive
PA 6 Durethan® B 29 + Irgafos® 168 [0.2 wt.%]	None	– –	None: Blank 1
PA 6 Durethan® B 29 + Irgafos® 168 [0.2 wt.%]	Microtalc IT extra	0.2 –	None: Blank 2
PA 6 Durethan® B 29 + Irgafos® 168 [0.2 wt.%]	Microtalc IT extra	0.2 0.5	WARADUR® E-R
PA 6 Durethan® B 29 + Irgafos® 168 [0.2 wt.%]	Microtalc IT extra	0.2 0.5	WARADUR® E
PA 6 Durethan® B 29 + Irgafos® 168 [0.2 wt.%]	Microtalc IT extra	0.2 0.5	Amide wax (EBS)
PA 6 Durethan® B 29 + Irgafos® 168 [0.2 wt.%]	Microtalc IT extra	0.2 0.5	Calcium stearate

Table 2: Dosage of wax additives in PA 6 Durethan® B 29 (Lanxess)

1. Reduced Cycle Time and Enhanced Flow Improvement

The Cycle Time of the aforementioned PA 6 matrices was investigated in an extensive injection moulding study. Unmodified Durethan® B 29 (Lanxess) was stabilised with Irgafos® 168. Microtalc IT extra (Mondo) was added as a nucleating agent. Blank 1 (without nucleating agent) was tested for control. The effect of WARADUR® E-R was compared with WARADUR® E, amide wax and Ca-stearate.

In the applied experimental set-up, using standard tools and test specimens, the nucleating agent alone reduced the cycle time by 7%.

The resulting 56% reduced cycle time compared to Blank 1 for WARADUR® E-R is attributed to the known dispersing effect of the wax, which leads to a much better distribution and efficiency of the nucleating agent.

WARADUR® E-R produces a similar cycle time reduction of 46% and significantly outperformed amide wax and Ca-stearate.

The Spiral Flow Number (SFN) was determined by injecting the molten resin into a long, spiral channel testing mould. The SFN is defined as the flow length of the resin. It was demonstrated, as expected, that the flow ability can be significantly increased by using wax additives.

The best flow result was achieved with WARADUR® E-R. The flow spirals are longer than the reference by >15%. The extension in the equipment set-up used with WARADUR® E is about 8%. Calcium stearate and amide wax: ca. 5 – 5.5%.

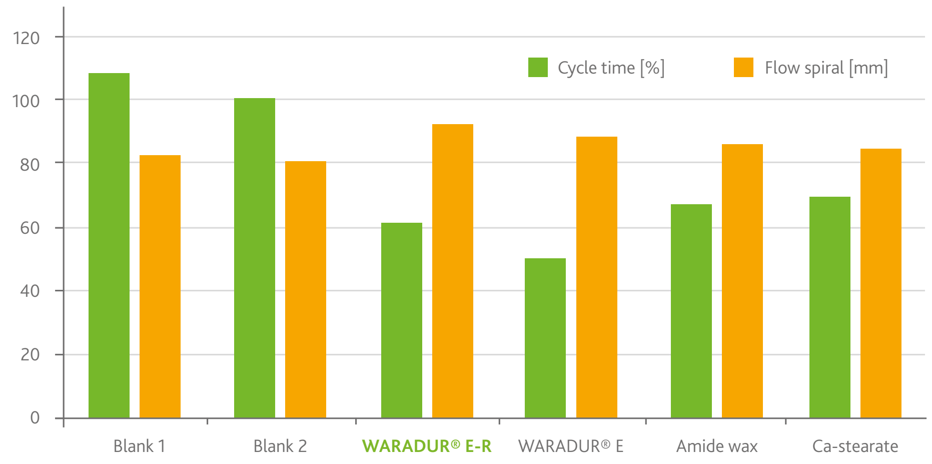

Figure 1: Cycle time reduction and flow improvement

2. Improved Mould Release by Reduced Ejection Force

The present studies also analysed the effect of WARADUR® E-R on the demoulding properties as an additive in PA 6. The ejection force was analysed in particular. The ejection force (or demoulding force) is defined as the force required to strip the moulded parts from the mould cores. It was demonstrated that the ejection force can be significantly reduced using WARADUR® E-R: 45.9% compared to Blank 2 and 49% compared to Blank 1.

Slightly better results were only received with WARADUR® E: the ejection force reduction was 50.1% and 53.1% respectively.

The ejection force reduction for amide wax and calcium stearate was between 21% and 31%.

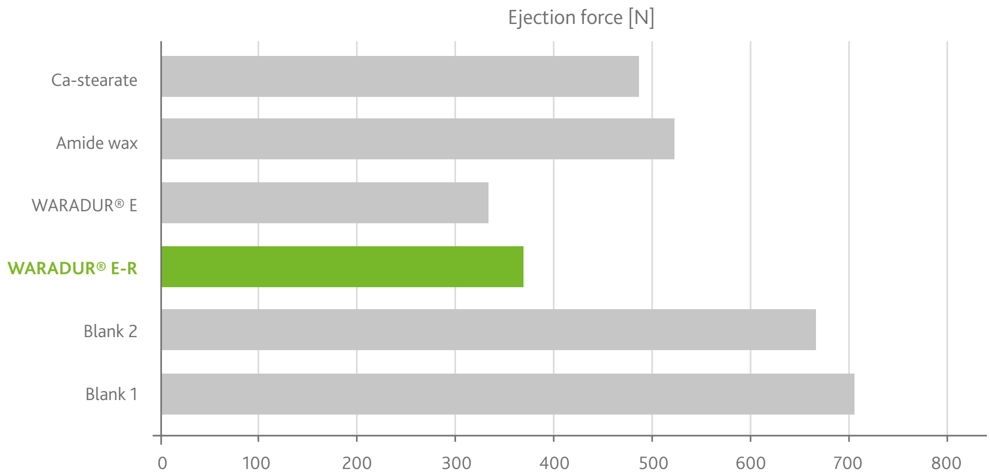

Figure 2: Ejection force reduction

3. Low Volatility (TGA) and Good Colour Stability

TGA (Thermogravimetric Analysis) measures the weight change of a material, either as a function of increasing temperature, or isothermally as a function of time, in an atmosphere of nitrogen, helium, air, other gas, or in vacuum. The present study was performed under nitrogen with a temperature gradient of 10.00 K/min (25 – 800 °C).

WARADUR® E-R weight loss curve shows a very similar profile compared to that of the montan wax WARADUR® E, which is known to satisfy "extra-stringent requirements in terms of performance, compatibility, low volatility or thermal stability"[2].

[2] Peter W. Dufton: Functional Additives for the Plastics Industry: Trends in Use Smithers; Rapra Publishing, Shawbury, Shrewsbury, Shropshire SY4 4NR, UK, 1998, p. 96

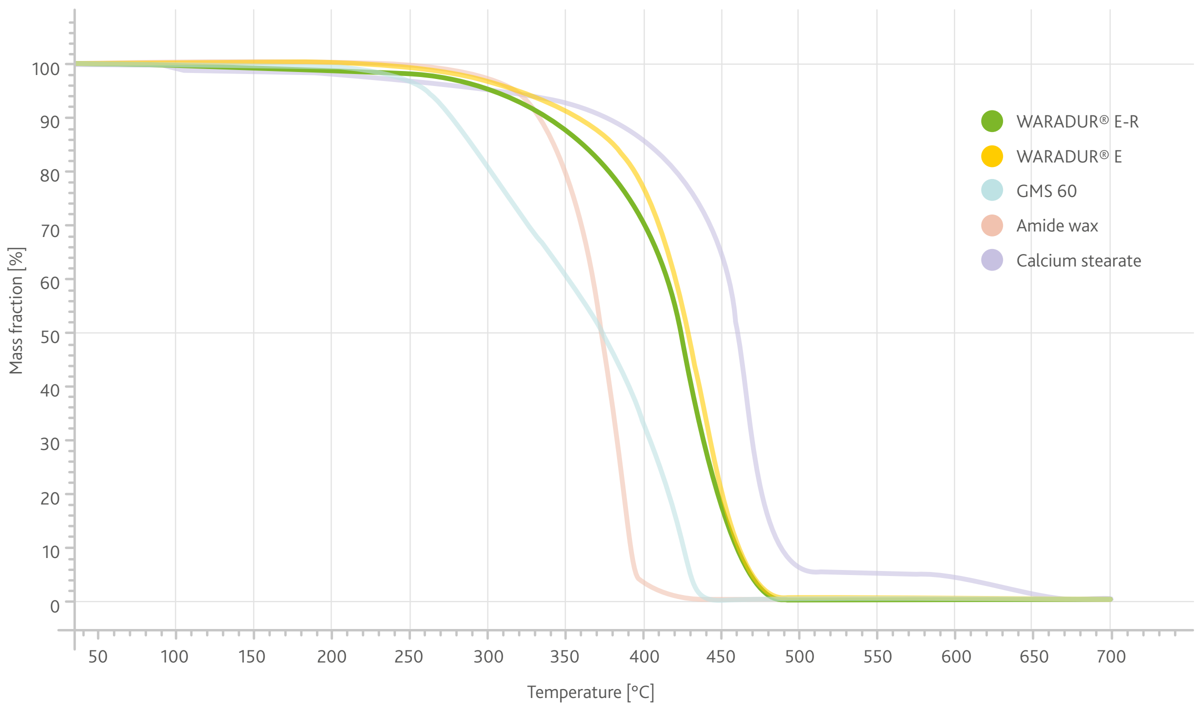

Figure 3: Thermogravimetric analysis (Fraunhofer-Institut WKI, Braunschweig)

This low volatility is combined with good colour stability (Figure 4), especially in comparison to amide wax and Ca-stearate.

Figure 4: Colour stability under thermal stress (Laboratory Air Circulation Oven Heraeus UT 6120: 250 °C/30 min; Ca-stearate: 10 min)

VOELPKER | biobased series

Völpker Spezialprodukte GmbH
Fabrikstraße 1 | 39393 Völpke | Germany
Tel. +49 (0) 39402 962-0
Fax +49 (0) 39402 215
application@voelpker.com
www.voelpker.com

Design: www.artfaktor.de

ipt

VOELPKER

This flyer is printed on certified recycled paper.

CORPORATE SOCIAL RESPONSIBILITY

EcoVadis has awarded VOELPKER's Corporate Social Responsability system „Silver“ status.

SYSTEM CERTIFICATION ISO 9001 SGS

Relaunch 1st Edition | 14/09/2023