Spezial reprint from
Kunststoffe international 4/2014

Recyclates with Immaculate Film Quality

Melt Filtration. The crucial step in the reclamation of highly contaminated plastic materials into film-grade recyclate is the ultrafine filtration of the melt. The new Erema Laserfilter significantly increases the purification efficiency and the separation capacity.

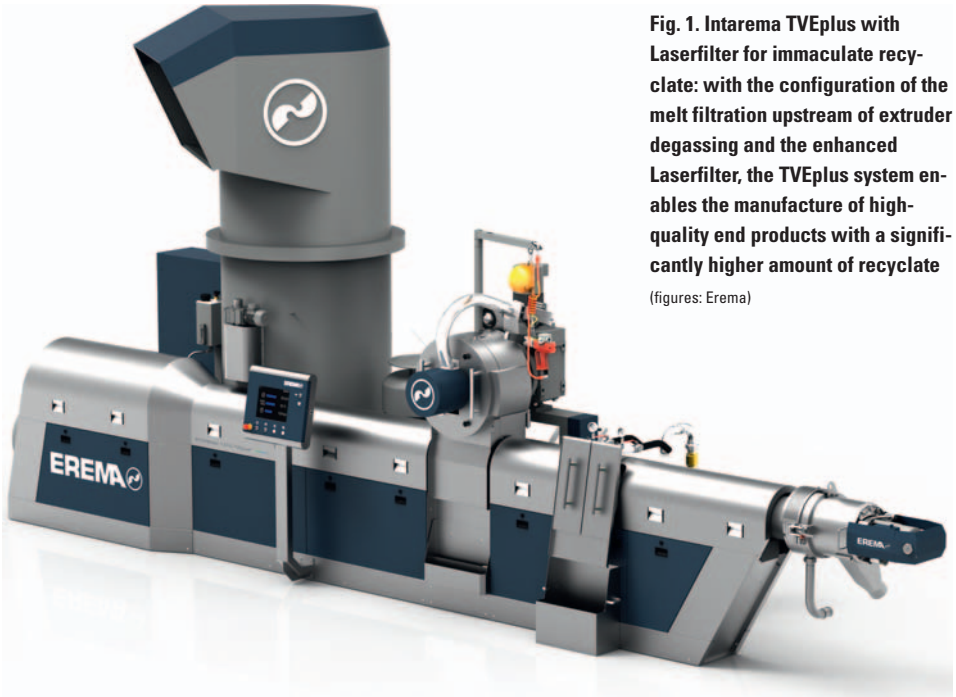

Fig. 1. Intarema TVEplus with Laserfilter for immaculate recyclate: with the configuration of the melt filtration upstream of extruder degassing and the enhanced Laserfilter, the TVEplus system enables the manufacture of high-quality end products with a significantly higher amount of recyclate
(figures: Erema)

MICHAEL HEITZINGER

With the patented configuration of the melt filtration upstream of extruder degassing, plus the efficient Laserfilter, the TVEplus system from Erema GmbH of Ansfelden, Austria, enables the manufacture of high-quality end products with a significantly higher amount of recyclate **(Fig. 1)**. The unique configuration ensures high degassing performance as only thoroughly melted, filtered and homogenized material can pass the degassing zone of the extruder. Additionally, the melting procedure takes place with minimum shearing effect. This prevents any contaminants from being further reduced in size prior to filtration. Filtration efficiency is improved as a result. Erema presented an innovation in plastic recycling systems last year with the patented Counter Current system, the central core technology of the new Intarema plant generation. This also represented a boost in efficiency for the TVEplus system. Thanks to improved material intake, it has been possible to increase not only output but also flexibility in selecting the optimum operating point **(see *Kunststoffe* international 103 (2013) 12, p. 62)**.

The Laserfilter is ideal for the processing of materials with a high degree of contaminants such as wood, paper, aluminum or copper. It fulfills requirements which conventional melt filters cannot meet, especially in the production of recycled film-grade recyclates. The technology of this high-capacity Laserfilter has now also been enhanced **(Fig. 2)**. The result is immaculate recyclates with top film quality.

Innovative Scraper Technology

The two significant innovations here are the new design of the scraper geometry and the new discharge system which removes the filtered contaminants more quickly and more thoroughly than in the past **(Fig. 3)**. Cleaning efficiency, discharge capacity and thickening thus reach a new level. The contaminated plastic melt is pressed through two laser-bored screen discs in a parallel configuration. A scraper disc rotates between these screen discs. It removes the filtered contaminants from the screen immediately and conveys them

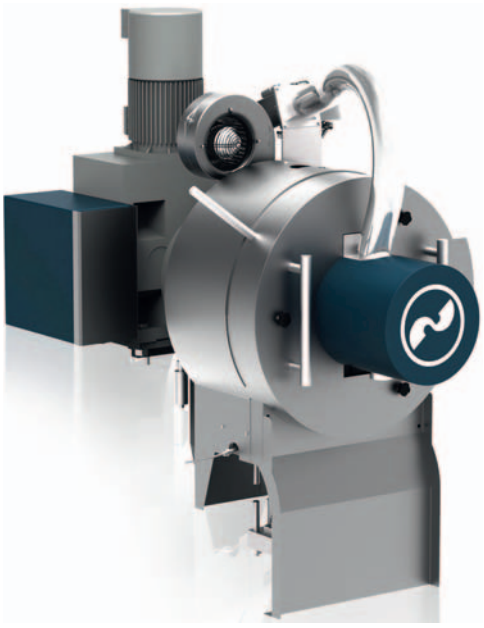

Fig. 2. The Laserfilter fulfills requirements which conventional melt filters cannot meet, especially in the production of recycled film-grade recyclates

Translated from Kunststoffe 4/2014, pp. 21–24
Article as PDF-File at www.kunststoffe-international.com; Document Number: PE111645

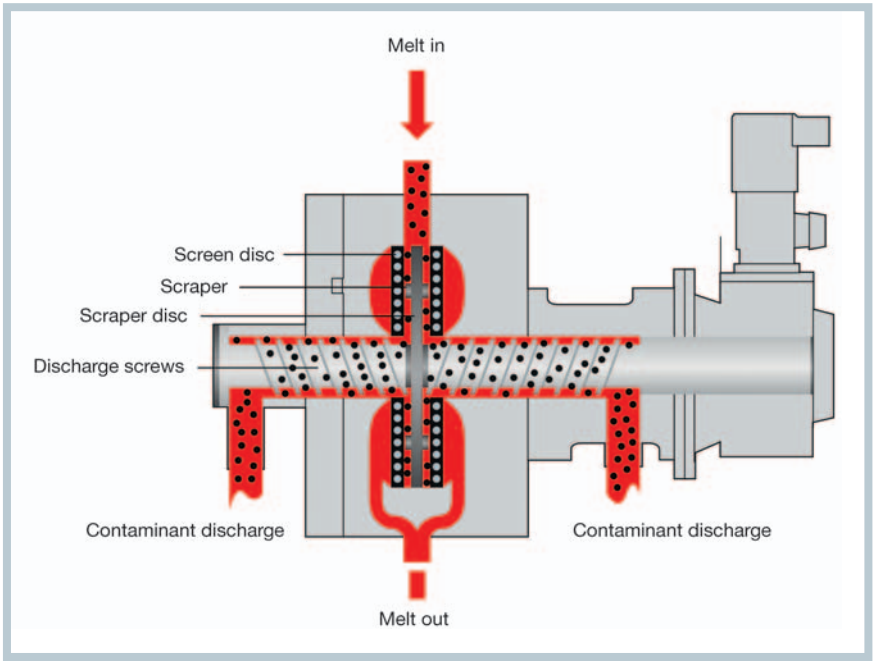

Fig. 3. The new discharge system transports the filtered contaminants more quickly and more thoroughly than before. Cleaning efficiency, discharge capacity and thickening increase as a result

without delay to the discharge system **(Fig. 4)**. This conveying process is continuous, thorough and fast. The efficiency of the system is increased considerably as a result. The contaminants are then removed under control and with a minimum of melt via the likewise optimized discharge system. The scraper and discharge screw speeds depend on the pressure and can be controlled fully automatically ("constant pressure operation").

Unlike many conventional filters the Laserfilter has a rotating scraper rather than a rotating screen. Furthermore, the static screen is perfectly sealed and prevents any items which are filtered out from getting into the plastic melt. Another unique characteristic of the Laserfilters is the upstream distributor ring which acts as a preliminary filter and protects the core components screen, scraper star and discharge system. This new filter system increases filtration reliability and, at the same time, extends the service life of the screen discs **(Fig. 5)**. The new Laserfil-

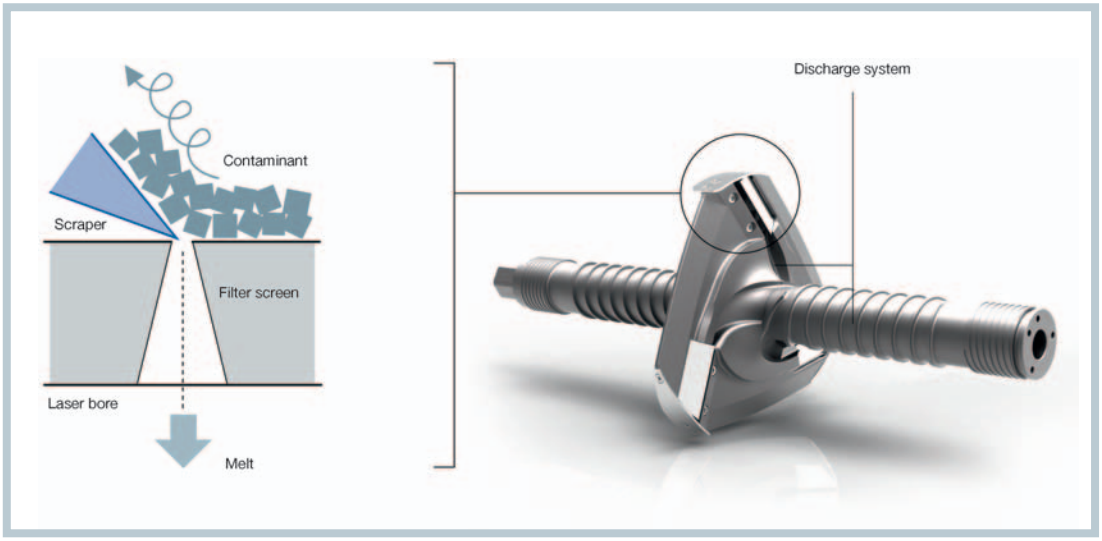

Fig. 4. With the new scraper geometry any contaminants are lifted off the screen immediately and forwarded directly to the discharge system

Fig. 5. Left: Conical holes are put into the filter screen using laser technology. Right: Hardened Laserfilter screen

Fig. 6. The LF 4/350 achieves a thickening of 41 % in the filtration of washed PE shreds from the post-consumer collection system

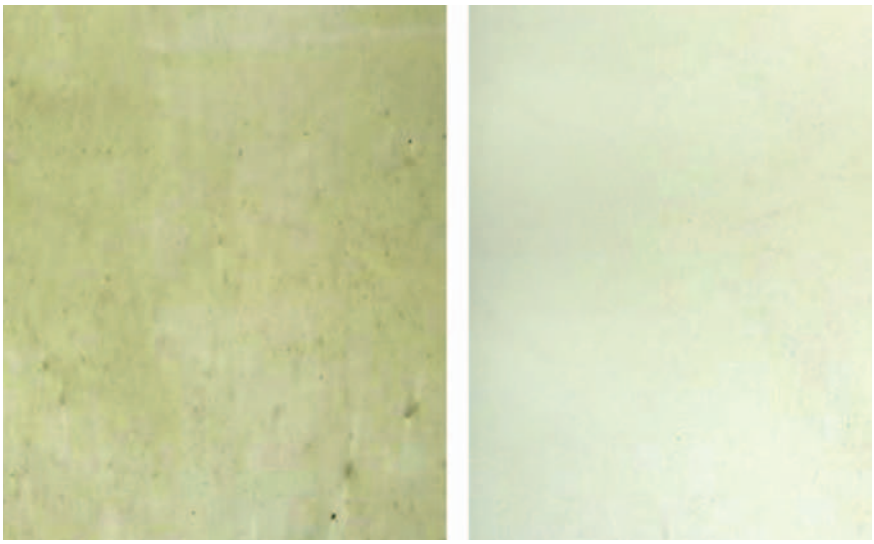

Fig. 7. These film patterns were produced on an OCS measuring extruder ME25/25D.V3 from a recyclate of washed PE shreds. Left: Recyclate produced using conventional, commercially available filter technology. Right: Recyclate produced with Laserfilter and new scraper technology

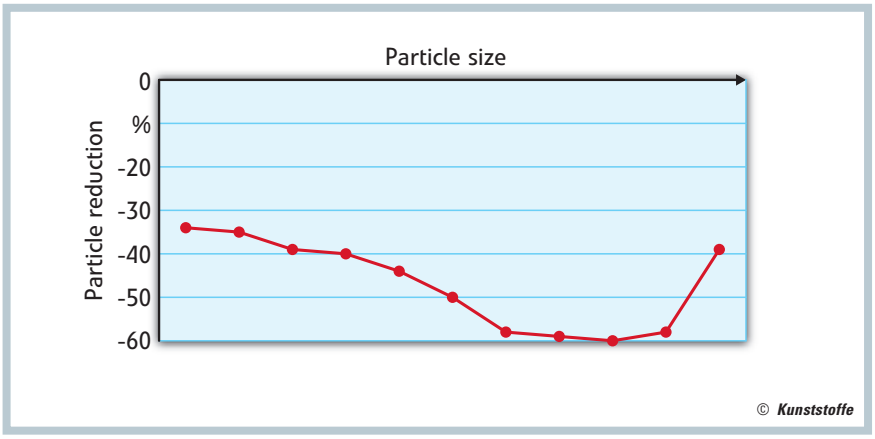

Fig. 8. The cleaning efficiency was measured by means of optical particle analysis on the films produced from the recyclates of the old and new systems. The diagram compares particle reduction using the new Laserfilter technology in comparison with the old system. A significant reduction of the particles remaining in the end product can be observed across the entire range of the particle sizes detected

ters are available with capacities of 350 to 3,500 kg/h and filtration fineness of 90 to 800 µm and beyond. Recyclers who already work with Erema Laserfilters can retrofit the new system to existing plants.

Centerpiece Filter Screen

The centerpiece of the Laserfilter is the filter screen. It features very fine boreholes which are drilled into the hardened special steel of the screen discs using laser technology. The conical shape of the holes causes a self-cleaning effect. The number of holes on the filter screen of the enhanced Laserfilter is approx. 15 % higher, thus improving filtration performance. The screen discs are made by 3S GmbH in Roitham, Austria. The Erema subsidiary worked together with the University of Erlangen, Germany, to develop the laser technology required to produce these screens **(see box)**.

41 % Thickening with Washed PE Shreds

Around 46 million tonnes of plastic are consumed in Europe, thereof some 8 million tonnes of LDPE and LLDPE. These materials are used primarily in the packaging sector and as agricultural films. When recycling the washed post-consumer film flakes, not only the moisture content but also the high degree of contamination is a challenge. Special contaminants in soft materials such as aluminum, paper, wood or copper place very high demands on the filtering technology used in the recycling process. The demand for LDPE and LLDPE recyclates processed in high quality, however, is quite high and they generate good prices. With the newly developed filter technology, heavily contaminated recovered material can be reprocessed to make high-quality PE recyclate – a much sought-after raw material in the plastic film industry.

In the filtration of washed PE shreds from post-consumer collections with 2 to 3 % residual contamination through PET, aluminum, paper and wood, a thickening of 41 % is achieved on an Intarema 2021 TVEplus with Laserfilter LF 4/350 in a parallel configuration (filtration fineness 130 µm) at a throughput of 2,300 kg/h **(Fig. 6)**. The output material is PE recyclate in film quality. The film samples in **Figure 7** from a wide variety of recyclates document the increase in quality through the new Laserfilter.

This result is due to the fact that with the new Laserfilter technology, contaminants are lifted off the screen immediately and passed on to the discharge system. This process has two additional benefits. Firstly, the active screen area lasts longer as the boreholes in the laser screen cannot be clogged by contaminant plating (e.g. aluminum). Secondly, the service life of the screen is also longer as friction is reduced. As a result the entire active screen area is available over a longer period. Clemens Kitzberger, Process Engineer at Erema, describes the concrete result of this

application from the post-consumer sector: "The service life of the screens has doubled, to be exact, and the scrapers need replacing only half as often."

Particle Reduction in LDPE Films from Trade and Industry

Processing LDPE stretch films from trade and industry which have adhesive labels to make film-grade recyclates previously represented a major challenge for recyclers. Particles of paper and adhesive stuck to the film cause problems especially in the area of filtration. Trials in the course of developing the new Laserfilter system led to remarkable results here.

The previous filter system and the new Laserfilter system with the new scraper star were compared in the trials on an Intarema 1514 TVEplus. The input material was recycled under the same conditions at a throughput of 1,300 kg/h for test purposes. The Laserfilter LF 2/350 with a filter fineness of 110 to 130 µm was used for the filtration. The thickening with the new system was 42 %. The cleaning efficiency was measured by means of optical particle analysis using the films produced from the recyclates of the old and new systems. **Figure 8** compares the particle distribution measures and shows the particle reduction using the new Laserfilter technology in comparison with the old system. A significant reduction of the particles remaining in the end product can be observed across the entire range of the particle sizes detected. Between 30 and 60 % more particles were removed from the material compared to the previous model.

! 3S GmbH

3S GmbH of Roitham, Austria, specializes in the manufacture of core parts for the extrusion branch. These include screws, barrels and intake parts. 3S produces screws, screen changer blocks and pistons for Erema.

Working together with the University of Erlangen, Germany, 3S developed a new laser technology for the production of screens. In this process, 280,000 conical holes with a diameter of between 90 and 800 µm are made. The laser pulse is every 10 ms and the spaces are checked using special computer software. 3S has particularly high-performing machines for the production of Laserfilter screens which enable high quantities and maximum precision.

→ **www.3s-gmbh.at**

Conclusion

Thanks to the redesign of the scraper geometry and discharge system, the high-performance filtration system of the new Laserfilters can remove contaminants even more quickly and more thoroughly than before. The cleaning efficiency, discharge capacity and thickening are thus increased considerably. The result: recyclates with immaculate film quality. With the new system, the service life of both the screens and the scrapers is increased and servicing is also reduced. ■

THE AUTHOR

MICHAEL HEITZINGER, born in 1967, is Chief Technical Officer (CTO) at Erema GmbH, Ansfelden, Austria.