

Counter Current Principle Improves Productivity



Intarema sets the new standard in production efficiency in plastics recycling (figures: Erema)

Recycling. Cutting, homogenizing, heating, drying, compacting, buffering and dosing in a single step – this is the performance range of the cutter/compactor as a preparatory stage for the extruder. Previously the material inside the cutter/compactor turned in the same direction as the extruder. An Austrian recycling specialist has now put this principle “into reverse” and changed the rotating direction of the plastic material inside the cutter/compactor so it is opposite to the extruder's flow direction. This means that the extruder is filled virtually pressure-free, never overfilled and thus better to control as a result.

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With the Intarema recycling system, Erema GmbH, Ansfelden, Austria, presents a system concept with a new core technology and further innovations (**Title figure**). The name “Intarema” comes from the principle of the process: INverse + TAngential + eREMA. The processing technology is based on the newly developed Counter Current technology (patented worldwide) from Erema.

The Counter Current System

This system shows its strengths in the transition area between cutter/compactor and tangentially configured ex-

truder. Inside the cutter/compactor the rotation of the rotor disc which is equipped with tools forms a rotating spout so that the material is circulating the whole time. However, this material spout – unlike the previous principle – moves in the opposite direction to that of the extruder (**Fig. 1**). As a result, the relative speed of the material in the intake zone, i.e. when passing from the cutter/compactor to the extruder, increases to such an extent that the screw acts in the same way as a sharp cutting edge which now cuts the plastic. Thanks to this inverse tangential configuration the extruder handles more material in a shorter time. Besides this, it is also far more independent in terms of the level of material pre-compacting.

The new principle is thus a reverse of the technology used commonly in the past in which the material in the cutter/compactor moved in the direction

of the extruder. The centrifugal forces arising in the process were used for the feeding of the extruder and the treated, warm material was thus “packed” into the extruder screw. The inverse tangential configuration of the Counter Current system, on the other hand, now ensures that the extruder screw is filled virtually pressure-free with the preheated material. The screw takes what it needs; the extruder always has the ideal filling level and is never overfilled, which makes it much better to regulate.

Feeding is automatic: loose material such as film shreds or regrind material is fed in via a feed conveyor belt and film enters direct on rollers using a roller intake system. The cutter/compactor cuts and mixes the feed material with rotating tools. At the same time the feedstock is dried – solely by the frictional heat which is generated – and compacted ready for intake in the extruder.

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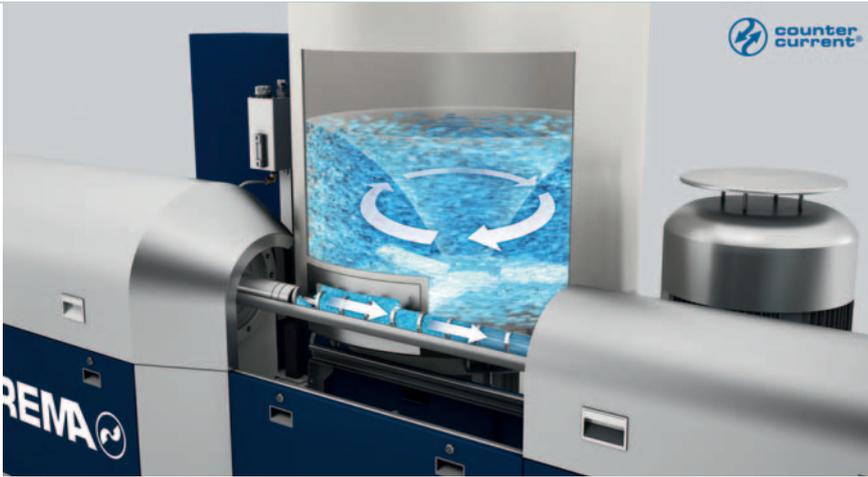


Fig. 1. Simple effect with a major impact – Counter Current, a groundbreaking innovation

Improved Material Intake – Over Extended Temperature Range

Inside the cutter/compactor the feed material is buffered and preconditioned for the extrusion process. It is cut, homogenized, warmed, dried and above all compacted to ensure constant extruder feeding. Here it is crucial that the temperature inside the cutter/compactor influences the degree of compacting of the material: the higher the temperature, the higher the degree of plastic compacting. With the Counter Current system the feeding of the extruder from the cutter/compactor, on the other hand, depends less on the compacting level of the plastic material, which in turn considerably broadens the range for optimum extruder feeding. This means that the recycling system is not only more flexible in the selection of the operation point, it is also much more reliable in operation (Fig. 2).

Besides extremely easy operation, a stable and sensitive recycling process is essential to be able to ensure recycling rates of 100 % high-quality recycle in virgin material grade, particularly when processing clean in-house waste from production.

In the system used previously there was the risk of material becoming stuck due to the pushing and pressure. Especially in the case of very light materials with low energy content such as fibers or thin packaging films, or materials with a very low softening point, this could result in reduced material intake. Thanks to Counter Current technology and the improved material intake, capacity is not only increased, it also stays at a constantly high level over a much broader temperature range. This in turn considerably extends the operation range for optimum system capacity. As a result, temperature changes in the cutter/compactor due to e.g. fluctuations in feeding have hardly any effect on system performance and the quality of the recycle. In addition to this there is greater flexibility in the selection of the optimum operation point. This is of particular advantage when processing very temperature-sensitive materials, for example.

Constant Output despite Input Fluctuations

Intarema technology also represents a quantum leap in the field of post-consumer recycling with its input material

and high fluctuations. It stands out here in particular through its high degree of flexibility and ensures that the throughput and quality of the recycled pellets produced remain at a constantly high level. The fluctuations in post-consumer recycling result not only from mixed fractions of varying compositions, moisture, viscosity, type and degree of contamination but also in particular from differently printed and laminated materials in the packaging sector.

The new system also handles e.g. washed agricultural films, washed post-consumer film flakes (LDPE, LLDPE, HDPE), films with solid content such as paper, wood or metals and also thick-walled regrind materials from waste automobile and electronic goods, PS cups and PE lids with no trouble at all.

The recycling of car batteries is an interesting application example. The Intarema T recycling system designed especially for this application offers the perfect technology for the processing of PP from car batteries which are recovered, washed and broken up into chips. The system consists of a single-screw extruder without degassing and cutter/compactor tools which are optimized especially for this application.

As these are thick-walled, moist particles, high residence times in the cutter/compactor are very important so the material is dried efficiently and warmed homogeneously. Once the particles have been optimally dried and completely and thoroughly warmed, they are forwarded to the extruder and the material is then melted carefully in the short extruder screw with minimum shearing strain.

Counter Current technology offers a further benefit here, which is crucial especially in terms of free-flowing materials such as regrind materials. Whereas the screw was previously susceptible to over-

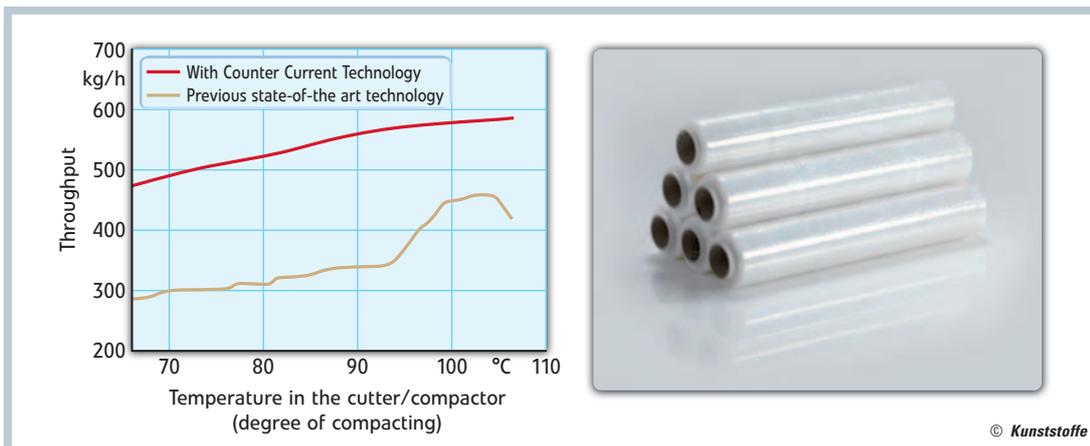


Fig. 2. Throughput as a function of processing temperature in the cutter/compactor – the impact of the improved material intake is considerable, as shown here with the example of an Intarema 1108 T with LLDPE blow/stretch films (thickness 30 µm)

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Input material:
PP polymers from collected,
washed and ground car batteries

Output:
High-quality, homogeneous
recycled pellets

End product made of
100% recycled pellets

Fig. 3. Efficient recycling with Intarema T and Counter Current technology

filling, thus resulting in increased shearing forces and signs of wear, the inverse tangential configuration now counteracts this problem. This is because the screw is filled virtually pressure-free and takes the exact amount which is required. Furthermore, the melting process with minimum shear stress increases the cleaning efficiency of the melt filter as the size of organic or mineral solid matter is not reduced. This in turn improves the quality of the recycled pellets. This means that new end products with a considerably higher share of recycled pellets can be produced, such as new battery packs made of up to 100 % recycled pellets (Fig. 3).

Easy Operation with Fully Automatic System

With the new, intelligent “Smart Start” concept, many central process steps run completely automatically. Staff can operate the system very easily by pressing just a few buttons – the same ones throughout the world, without having to think about the operating language. This is because the operating concept is based on just a few clear and easy to understand symbols. Intarema systems come with the intelligent Smart Start concept and ergonomic touch display as standard (Fig. 4).

Integrated recipe management is a particularly practical and time-saving feature. All settings and parameters of a special recycling application can be saved under a “recipe name” and called up again at any time at the press of a button. A single press on the “Extruder” symbol, for example, is enough to start the entire downstream equipment up to the extruder automatically and in the right sequence. Pressing the symbol “Cutter/compactor” next starts the cutter/compactor and automatic feeding. The system now starts up itself with the recipe set previously, goes into production with the highest degree of safety and works with constantly high quality.



Fig. 4. Enhanced automation with the “Smart Start” concept – a standard series feature of Intarema systems

Intarema also features a standby mode. If any input material is missing the system switches automatically to ‘warm’ and a lower operation point. It shows you at the same time that material is required. As soon as the system is refilled with input material it starts up automatically again. This function is executed fully automatically by the standby mode – without any operators and without having to press further buttons.

Another technical highlight of the new plant generation is the systematic development of EcoSave technology which is likewise a series feature. Thanks to this technology users benefit from up to 12 % less energy consumption, reduced CO₂ emissions and lower production costs. The overall package of design and process engineering measures includes – among others – efficient direct drive of the extruder screw with an up to 3 % higher degree of efficiency and an energy display which gives you a constant overview of energy consumption. Specific measures can also be taken to optimize consumption.

The Intarema systems are designed for capacities ranging from 50 to 3,000 kg/h. There is a choice of configurations depending on the application in question. The compact Intarema recycling system with short single-screw extruder is – in the T series – without degassing and ideal for non-printed edge trim, cutting

waste, rolls and loose leftover film or regrind materials. Featuring double degassing, the TE series is perfect for the processing of slightly printed production or industrial waste, fibers and technical plastics. The TVEplus series is designed for materials that are difficult to process such as heavily printed films and/or very moist materials. Melt filtration is located upstream of extruder degassing here so only thoroughly melted, filtered and homogenized material can pass the degassing zone of the extruder.

Conclusion

The new Intarema recycling system stands for higher productivity, flexibility and operational reliability. This is made possible by improved material intake over the extended temperature range thanks to new Counter Current technology which enables virtually pressure-free and constantly optimum filling of the extruder. Inside the extruder the material is then melted, homogenized and pelletized after passing through a fully automatic, self-cleaning filter. Finally, large amounts of the high-quality recyclate can be put back into production or used for new end products. ■

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