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Plastics Recycling WORLD

4 News

News from the global plastics recycling industry, including: Ceflex conducts in-depth mixed waste study; Plans for Australian chemical recycling plant make progress; NextLooPP project launches

13 Responding to growing needs in melt filters

Technology groups are expanding their operations and the capabilities of their melt filtration systems to meet the demands of plastics recyclers. David Eldridge reports on new developments

27 Making a success of rPET

Processors and suppliers in the PET recycling sector are hitting new records. Peter Mapleston reviews new mechanical and chemical recycling technology and plant investments

39 The additive route to improved recycled plastics

The use of additives can both improve the plastics recycling process and the final quality of recyclates. Mark Holmes reports on additive and masterbatch suppliers active in the field

52 Diary

COMING NEXT ISSUE

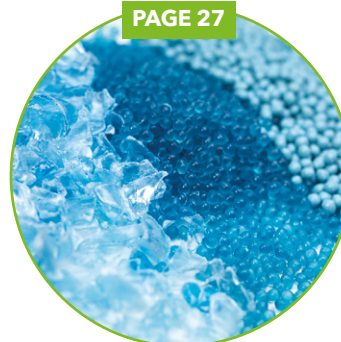
› Shredders › Compatibilisers › Post-Industrial Recycling



PAGE 4



PAGE 13



PAGE 27



PAGE 39

CONTACT US

AMI

Third Floor, One Brunswick Square,
Bristol, BS2 8PE, United Kingdom
Tel: +44 (0)117 924 9442
Fax: +44 (0)117 311 1534
www.ami.international
www.twitter.com/plasticsworld
Registered in England No: 2140318

EDITORIAL

Editor-in-Chief: Chris Smith
chris.smith@ami.international

Editor: David Eldridge
david.eldridge@ami.international

Technology editor: Peter Mapleston
editorial@plasticsrecyclingworld.com

Contributing editor (UK): Mark Holmes
editorial@plasticsrecyclingworld.com

ADVERTISING

Advertisement manager: Claire Bishop
claire.bishop@ami.international +44 (0)1732 682948

Sales & commercial manager: Levent Tounjer
levent.tounjer@ami.international +44 (0)117 924 9442

Sales manager (China): Jenny Zhou
jenny.zhou@ami.international +86 13651 985526

Events and magazines director: Andy Beevers
andy.beevers@ami.international

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Ceflex in-depth probe into mixed waste

The Ceflex consortium working on European projects to improve recycling of flexible packaging is conducting a detailed study with partners into waste streams. Initial results from the UK show a significant quantity of recyclable plastics remain unrecovered in mixed packaging waste streams.

The study is Europe's first in-depth analysis of its kind, analysing the amounts and types of post-consumer flexible and rigid plastic packaging in the two main waste streams in which it is collected. It involves researchers manually sorting, identifying and weighing samples, then attributing waste to nearly 200 categories. The team maps where packaging appears in the recyclables or residual waste streams and uses near-infrared (NIR) technology to identify polymer types.

The waste includes wrap, bags, pouches, bottles, trays and more. Fieldwork at two Suez sites in the UK took place in December 2020



Researchers are using NIR scanners to identify plastic materials

and work on samples of waste from France, Germany, Italy, Netherlands, Poland and Spain is scheduled to take place in the spring months this year.

In the first part of the UK research: 4,595 kg of material was manually sorted and categorised, of which 3,240 kg was residual waste and 1,355 kg was separately collected recyclables; more than 66.5% of flexible packaging found in the residual waste samples was categorised as recycle-ready mono-materi-

al - this includes mono-PE, mono-PP, mono-PET, mono-paper and mono-aluminium.

Ceflex says these initial results show that "currently there is a significant amount of ready-to-recycle flexible packaging appearing in residual waste samples, where it unlikely to be successfully returned to the economy and used again".

Partners in the study are PCEP, Petcore Europe, Styrenics Circular Solutions and MORE Recycling.

➤ <https://cefex.eu>

Corplex grows in recycling

Plastics extruder Corplex has further expanded into recycling by acquiring French recycler GeboPlast.

GeboPlast, formed in 1977, has two sites in Alsace in northern France, which process around 15,000 tonnes/year. It specialises in a number of recycling activities, including shredding, pelletising, densification and compounding. The company will now operate under the name Corplex Recycling.

"Through this acquisition, we confirm our vision to accelerate the transition to a circular economy for plastics," said Lucas van der Schalk, CEO of Corplex.

The acquisition means that Corplex now has eight sites. Both of the new Alsace sites are qualified for the recycling of plastics including PE, PP, polystyrene and polycarbonate, says the company.

➤ www.corplex.com

Multiple-choice compounds concept

Swedish compounder Polykemi and its subsidiary Rondo Plast have launched the Complus Concept which gives customers multiple choices of several materials, based on both virgin and recycled raw materials. The compounds all have similar properties but are adapted for different injection moulded parts within an assembled product, says Polykemi.

After making an initial material choice for a part, an injection moulder may find the conditions change during a project, it says. On these occasions, the customer is able to choose another material from the Complus Concept, without having to modify, change or even produce a new mould, which saves time and money.

Project Manager Johan Svenmo

says: "Our new concept gives the customers an incredible flexibility even far into a project, and the choice of materials can be adapted during the development work without the costs increasing dramatically."

The first uses of the Complus Concept will be with Polykemi's PP and then with PC/ABS and PA.

➤ www.polykemi.com

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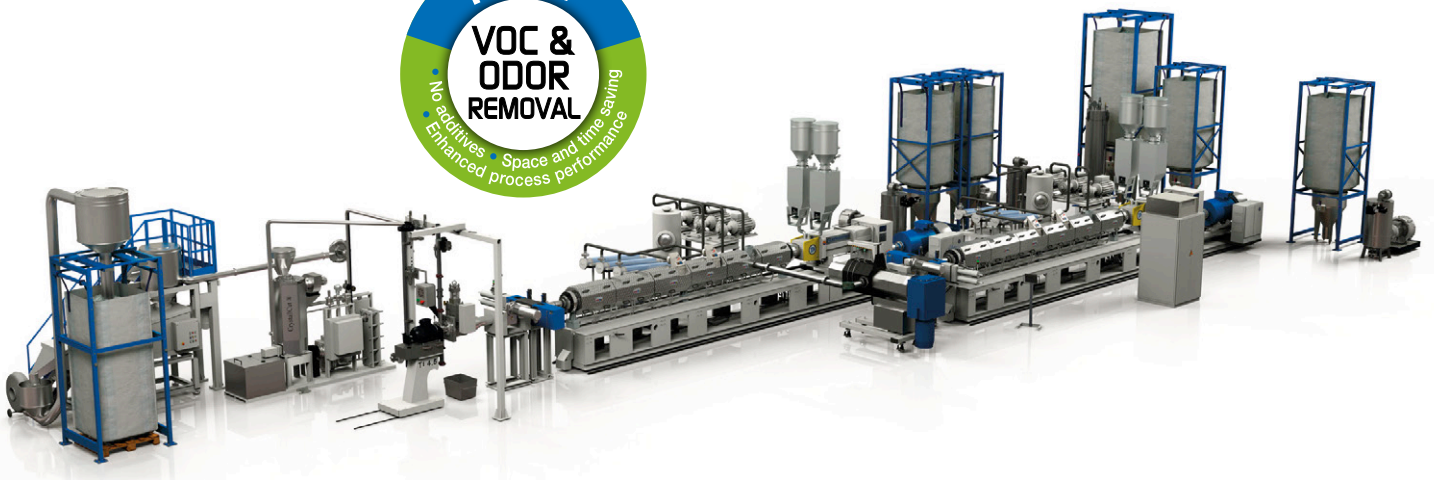
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Plans for chemical recycling plant in Australia make progress

Partners in a chemical recycling project are looking at potential sites in Victoria, Australia for a plastics recycling facility that would contribute to meeting the country's plan to use an average of 50% recycled content in packaging by 2025.

Partners in the project are technology developer Licella, recycler iQ Renew, supermarket chain Coles, polyolefins producer LyondellBasell and brand owner Nestlé. The proposed facility would use Licella's



Cat-HTR (Catalytic Hydro-thermal Reactor) technology which converts plastics packaging waste to an oil which can be used in the

feedstock for polymer production.

Nestlé has developed a wrap for KitKat chocolate snacks which it says is

Australia's first soft plastic food wrapper with recycled content. The packaging has 30% recycled polypropylene content (using a mass balance approach). Amcor and LyondellBasell were partners in the development.

The initiative to create the KitKat prototype wrap emerged from a trial on the Central Coast of New South Wales, where iQ Renew, CurbCycle and Nestlé started kerbside collection of flexible plastics.

➤ www.licella.com.au
➤ www.nestle.com.au

AST gets into HDPE recycling

Plastic containers, drums and bottles manufacturer AST is creating a new competence centre for HDPE recycling in Erndtebrück, Germany.

The aim of the project is to gather experience with the intention of introducing the use of recyclates in production. Ultimately, AST plans to produce recycled raw materials.

Lindner Group is AST's technology partner, supplying washing and sorting components from Lindner Washtech and shredders from Lindner Recyclingtech.

➤ <https://ast-kanister.de>
➤ www.lindner.com

PolyREC to verify circularity

Plastics industry trade associations Petcore Europe, PlasticsEurope, Plastics Recyclers Europe (PRE) and VinylPlus have formed a new organisation called PolyREC to monitor, verify and report their plastics recycling and uptake data in Europe using

a common data collection system, RecoTrace.

PRE president Ton Emans said: "Setting up mechanisms that evidence progress in driving plastic circularity in a transparent manner is a must if we are to meet the EU targets."

PolyREC, he added "is a significant step towards a credible and systemic approach to genuinely improve plastic production, collection and recycling." Other interested organisations are also invited to join.

➤ www.plasticsrecyclers.eu

Biffa expands rHDPE capacity in UK

Biffa is making a £13m investment to double HDPE recycling capacity at its plant in Washington, UK. The expansion takes total annual capacity at the plant to 39,000 tonnes, equivalent to 1.6bn bottles a year.

The company also operates plastics recycling facilities in Redcar and Seaham - the latter opened last year. In the last five years Biffa has invested over £54.5m in plastics recycling infrastructure and it has plans to quadruple its plastic recycling capacity by 2030.

The new investment will take Biffa's overall plastic recycling capacity to 155,000 tonnes per year.

➤ www.biffa.co.uk

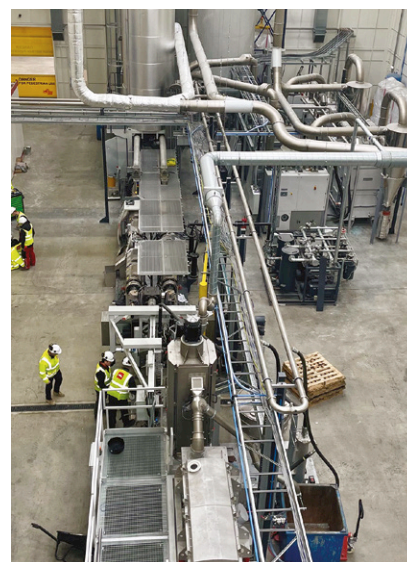
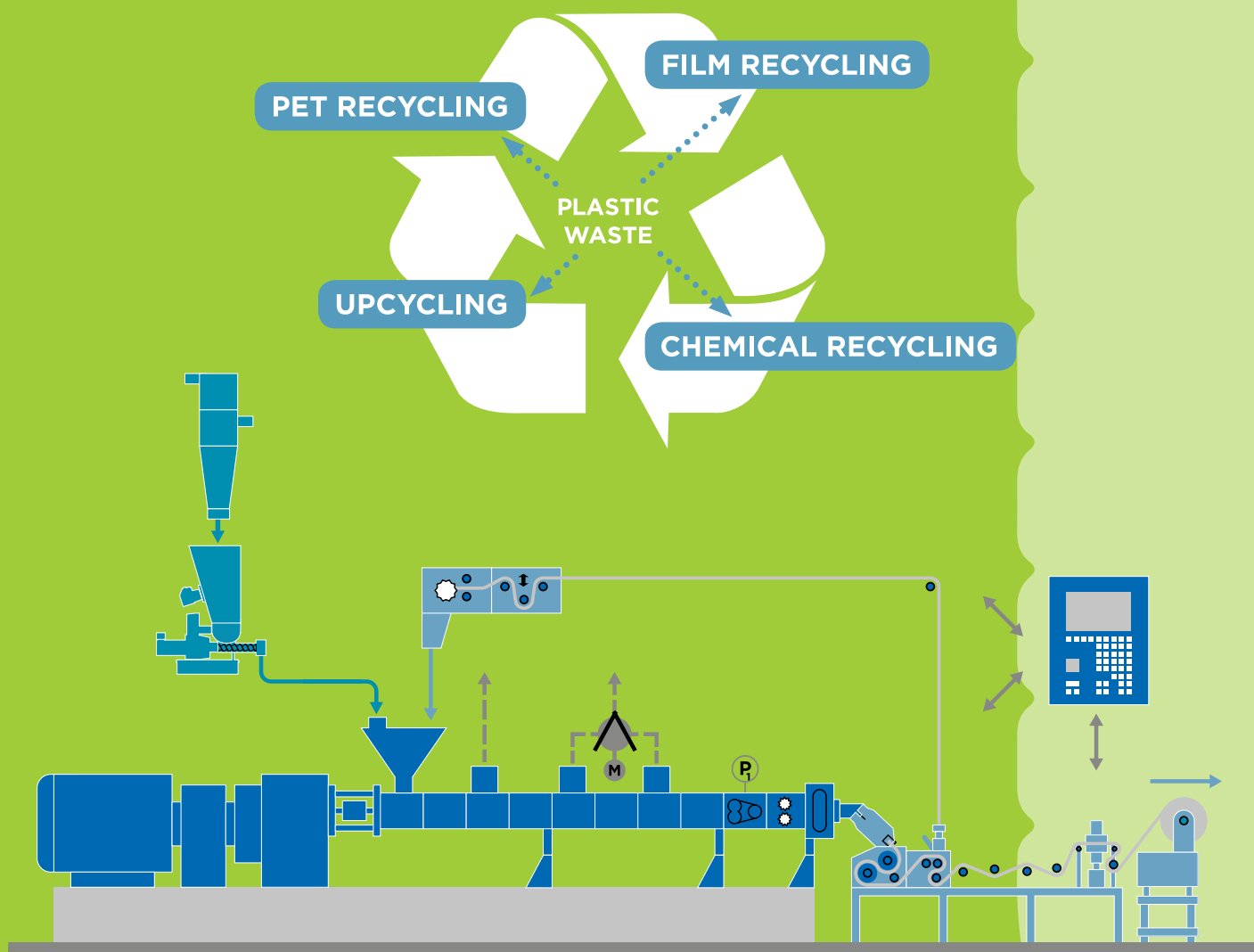


IMAGE: BIFFA

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Chemical recycling gathers pace

Mura Technology subsidiary ReNew ELP is to begin construction of a commercial-scale chemical recycling plant using Mura's Hydrothermal Plastic Recycling Solution (HydroPRS) technology at Teesside in the UK.

The project is intended to go onstream in 2022 and will process 80,000 tonnes/yr of plastic waste. The scheme is part-funded by the UK government, which awarded £4.42m in 2020 as part of its Industrial Strategy Challenge Fund's Smart Sustainable Plastic Packaging programme.

HydroPRS uses Cat-HTR technology from Licella, which employs supercritical steam to convert plastics back to original monomers. It said to be able to recycle all forms of plastic - even multi-layer, flexible plastics used in packaging - in as little as 25 minutes.

Mura said further rollout of the technology is planned in Germany, the US and Asia. It hopes to see 1m tonnes of polymer processed using HydroPRS by 2025.

Meanwhile, Netherlands-



IMAGE: SHUTTERSTOCK

Chemical recycling targets the most difficult-to-handle plastic waste

based recycling company Synova and Technip Energies have entered into a joint development and cooperation agreement to commercialise the former's thermochemical plastic waste-to-olefins technology in conjunction with the latter's steam cracking know-how.

The two will work together to improve the technology, which was invented by the TNO research organisation and which Synova has further developed, tested and piloted over the past 15 years. According to Synova,

it features a clean-up train that removes 99.9% of unwanted tars and uses the energy value to create a highly efficient process with a better CO₂ footprint.

Finally, in France, recycling firm Plastic Energy has reached agreement with ExxonMobil on a project to convert post-consumer plastic waste into raw materials for the manufacturing of virgin-quality polymers. Under this deal, Plastic Energy will build, own and operate an advanced recycling plant adjacent to ExxonMobil's Notre Dame de Gravenchon

petrochemical complex near Le Havre to convert waste into raw materials known as Tacoil.

It is expected to be one of the largest chemical recycling plants in Europe with an initial capacity of 25,000 tonnes/year and plans to scale up to 33,000 tonnes in the near future. A final investment decision is expected in mid-2021 with start-up anticipated in 2023. Plastic Energy already operates two commercial plants in Spain.

➤ www.muratechnology.com

➤ www.synovatech.com

➤ www.plasticenergy.com

Tide announces sustainability goals



P&G's major Tide laundry detergent brand in the US has set a goal to use 100% recyclable packaging for all its products by 2030. It also aims to reduce use of virgin plastic in packaging by half (versus a 2020 baseline), through light weighting, exploring innovative packaging solutions like its Eco-Box, and increasing use of post-consumer recycled content. Currently, Tide

bottles use at least 25% PCR content.

The packaging goals form part of Tide's 2030 Ambition sustainability strategy. Other actions focus on improving sustainability of washing. It has set a goal for three out of four loads of laundry in the US and Canada to be washed in cold instead of hot water by 2030, which it says has the potential to reduce GHG emissions by 4.25m tonnes.

➤ <https://us.pg.com>

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NextLooPP project targets food-grade PP packaging

A project to develop a circular approach for food-grade polypropylene packaging has been launched with 29 partners. The NextLooPP project is led by plastics recycling consultancy Nextek, based in the UK.

Edward Kosior, founder and CEO of Nextek, said that creating a circular economy for food-grade PP packaging waste fills a major gap in the packaging recycling sector.

He said: "It will allow brand owners to meet their recycling targets and significantly reduce the use of virgin plastics from petrochemicals. It will also

greatly reduce CO₂ emissions and divert waste from landfill and waste-to-energy."

The project aims for high quality food-grade rPP to be available in the UK by 2022.

Nextek says NextLooPP uses commercially proven technologies to separate food-grade PP using marker technologies. The approach includes decontamination stages to ensure compliance with food-grade standards in the EU and the US.

Partners in the project include Viridor, Klöckner Pentaplast and

Robinson Packaging.

Lubna Edwards, Group Sustainability and Marketing Director at Robinson Packaging, said: "Demand for this high-value recycled material will continue to rise as we shift away from using virgin material. Much of our UK business depends upon PP and this ground-breaking project gives us the opportunity to tap into cutting-edge technology, learn from industry partners and trial the material for sustainable use in our packaging."

➤ www.nextek.org

➤ www.nextloopp.com

Alpla expands recycling horizons with big budget

Plastics packaging major Alpla Group has said that from 2021, it will spend an average of €50m per year on plastics recycling.

The Austrian group already has a number of PET recycling operations (in Austria, Poland and soon in Italy) and it previously committed to spending a total of €50m to expand its recycling activities up to 2025. Its new commitment means that a €50m annual spend on recycling will be ring-fenced.

Sustained demand for recycled content from customers is leading the company's strategy. Günther Lehner, Chairman of the Alpla Advisory Board, said the company will focus on high-quality application areas in new regions: "Our aim is to establish a bottle-



Alpla has PET recycling operations in Austria and Poland

to-bottle cycle - including in regions in which the recycling of waste does not currently play a large part."

Georg Lässer, Head of Corporate Recycling, said: "This market [in Europe] is now highly competitive. We secured a strong market position early on in Western Europe with our own plants

and partnerships, and this is something we want to further consolidate."

Alpla recycles HDPE packaging as well as PET. A plant for HDPE recycling is being built in Toluca, Mexico, which is scheduled to go into production in autumn 2021.

➤ www.alpla.com

Maris moves in recycling

Italian twin screw compounding machinery maker Maris has stepped up its focus on the recycling market with the launch of two new brands – Evorec Plastic and Evorec Plastic Plus.

Maris has delivered a number of recycling lines over the past few years but this new move marks its "formal introduction" to the recycling solutions sector, according to a company spokesperson.

Evorec Plast products are targeted at applications that require only the supply of a twin screw compounder; Evorec Plast Plus systems combine the twin screw extruder with a single screw extruder and handling equipment.

➤ www.mariscorp.com

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IMAGE: FIMIC

Suppliers respond to growing needs in melt filters

Technology groups are expanding their operations and the capabilities of their melt filtration systems to meet the demands of plastics recyclers. David Eldridge reports on new developments

Melt filtration is a crucial stage in the plastics recycling process that can mean the difference between high and low yields for the recycling company. So it is not surprising that as the industry grows and recyclers improve product quality and quantity, demand for better melt filters is growing too. It's not just companies installing new recycling lines and new facilities that are behind the market growth, but also recyclers wanting to retrofit existing lines with new filtration systems. Melt filter manufacturers are responding to this trend with new technology that has higher throughput capacity, reduces melt losses and helps recyclers achieve a higher-quality product.

The blossoming market for melt filters is reflected in the growth of Italy-based plastics recycling technology specialist **Fimic**. The group is close to completing work on an expansion of its headquarters and manufacturing facility in Padua

which will increase its production capacity, support new product development and enable it to provide a faster service to its customers.

Fimic says this is a "new chapter" for the company after more than 20 years of operation and becoming widely known as a specialist in the production of automatic self-cleaning melt filters for heavily contaminated waste plastic materials.

Since its founding, Fimic has grown from five staff members to a team of 30 professionals in different areas, as well as sales agents located around the world. The company says: "With 95% of the products designed, manufactured and assembled internally [on our] premises, the continuous research for innovation, the tests carried out in the company's laboratory, and increasing market demand, the company is constantly growing."

Construction work started about a year ago on

Main image:
Fimic is increasing production capacity for its melt filtration systems due to rising demand

IMAGE: FIMIC



Above:
Fimic's new
headquarters
in Padua, Italy

the new Fimic headquarters and enlarged production halls. "After months of constant work, and with the clear vision of designing and producing new products and developing new and increasingly innovative technologies that allow more effective and productive recycling of materials, Fimic is preparing to inaugurate, in a couple of months, the new production halls," it says.

Once the expansion is completed, the renovated production hall will occupy 1,200 m² and the facility will be equipped with a new production line and "cutting-edge" technology. Fimic says its engineers and technicians can devote themselves to the development of new technologies and it expects to go beyond the current annual production of 70 machines, "significantly increasing its production capacity, [and] accelerating manufacturing times to offer an even faster service to its customers".

Also part of the project is a new two-storey building with 500 m² of space, which will hold offices, showrooms and conference rooms. Fimic says this building is designed "under the 'open space' concept and respecting the methodology of 'design thinking', where technique, innovation and creativity remain key words that distinguish Fimic, together with the latest insulation and energy-saving technologies to reduce the company's carbon footprint".

The company says: "This is an important investment, achieved through effort and hard work, which makes the Paduan company proud and satisfied with the goals accomplished in recent years."

At K2019, Fimic introduced its new GEM technology, the largest melt filter in the company's product portfolio. The model uses two 600mm diameter screens to provide 5,500 cm² of filter surface and is intended for use in high volume and highly contaminated recycling applications. The GEM filter can process up to 3,000 kg/h depending on the application. The new machine, which can be equipped with laser screens from 80-300 microns and mesh screens from 400 to 2,000 microns, combines twin filters with two scrapers and two independent discharge valves that function automatically. For maximum flexibility in operation,

the unit can be set to scrape and discharge at a predetermined pressure or, where high levels of contamination are being handled, to scrape continuously and discharge.

An increase in retrofitting melt filters by plastics recyclers is highlighted by **Gneuss**. The German manufacturer of filtration systems says it has seen a surge of interest among customers looking to retrofit their extrusion lines. "Against a background of government rules prescribing the proportion of recycled polymer, the plastics strategy of the EU and the commitment of many market leaders to responsible use of polymers, the conversion or modification of extrusion lines represents an important trend."

The company says the Gneuss RSFgenius back flushing filtration system is well suited for retrofitting to existing extrusion lines. It illustrates this in the context of recycling lines for PET bottle flakes. "The processing of PET bottle flakes presents particular challenges for melt filtration systems. On the one hand, the post-consumer material source typically has a relatively high contamination level, on the other hand, the quality requirements (fine filtration) are very high - especially when the material is to be put back into transparent bottles for beverages."

It continues: "In order that the filter elements do not need to be constantly changed by hand, the ideal melt filtration system should be self-cleaning. Typically, the principle of back flushing is used. A proportion of the melt flow is diverted so that it flows in the reverse direction across filter elements which are not in use in order to wash the contamination out. The cleaning efficiency of the back-flushing and the quantity of material needed for back flushing vary greatly between the different systems available on the market. With the Gneuss RSFgenius melt filtration system, the high-pressure sequential cleaning system ensures that the filter elements are completely cleaned with the absolute minimum of polymer."

Gneuss says PET recycler Nosoplas in Spain decided to retrofit the RSFgenius rotary filtration system due to its high efficiency and a fast return on investment which it offers. Nosoplas produces bottle grade pellets (or chips) from PET bottle flake. The chips are supplied to other companies, where they are injection moulded to pre-forms which are later blow moulded into high quality bottles for beverages.

Nosoplas needed to replace its existing, conventional filtration system due to problems with back flushing and high polymer losses. The system it opted for was a Gneuss RSFgenius 175 for a throughput of 1,500 kg/h and a filtration fineness of 56 µm. Gneuss says its customer is even able to

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operate with 30 µm for special products. The filtration system offers steady melt pressure, minimal losses due to back flushing and without any production variations, including during replacement of the filter elements.

"The expectations that Nosoplas placed on the retrofit with a Gneuss Rotary Filter have been completely fulfilled. Immediately after commissioning the units, a drastic reduction in material loss due to back flushing was observed and, at the same time, the quality of the rPET granulate produced was noticeably improved," says Gneuss.

Ettlinger, the melt filtration specialist owned by Maag, also highlights PET bottle flakes as a recycling activity that can benefit from using new filter technology. "Calculations of the expected ROI [return on investment] and extended production trials at a major packaging manufacturer have impressively confirmed the superior performance of Ettlinger's ECO melt filters in PET bottle-to-bottle

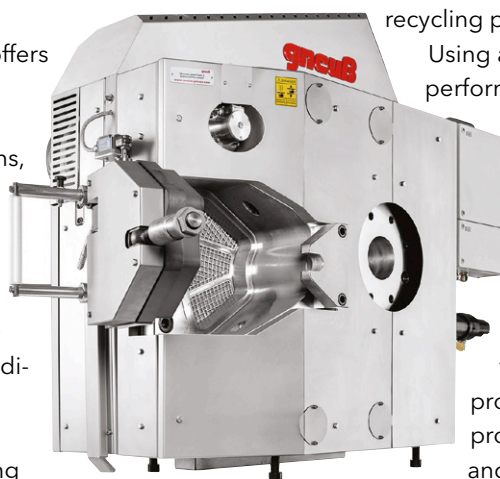


IMAGE: GNEUSS

recycling processes," it says.

Using a self-cleaning ECO high-performance melt filter with a filter fineness of 60 µm with 100% PET bottle flakes leads to particularly low residual content of contaminants, says Ettlinger. This makes the recycled material suitable for demanding rPET products, not just in new bottle production, but also in sheet and strapping as well as fibres.

The major food and beverage packaging manufacturer (Ettlinger did not name the company) put the reliability and economy of the ECO melt filter for the rPET bottle-to-bottle process to the test during pilot production. A calculation of the ROI based on a comparison with the backflush filtration system that it previously used influenced its decision to use the ECO.

Ettlinger says: "By optimisation of the upstream and downstream equipment of the extruder, including the ECO installation, replacing an

Left: The Gneuss RSFgenius back flushing filtration system is well suited for retrofitting to existing extrusion lines, says the company

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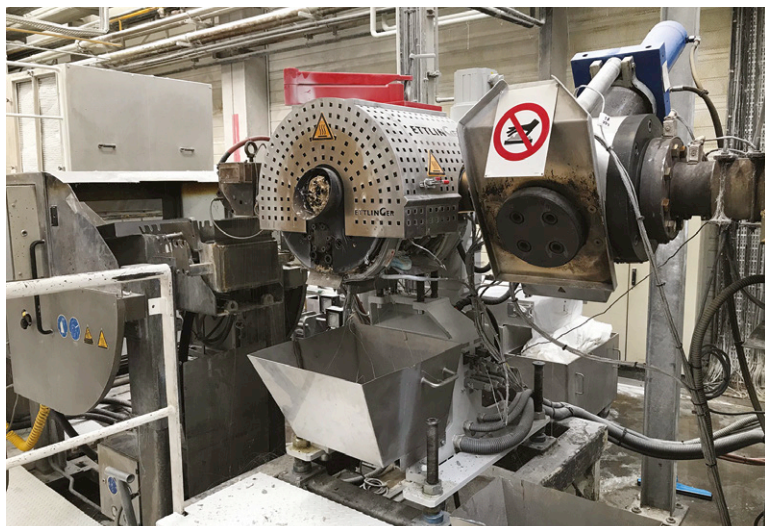
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IMAGE: MAAG



Above:
Ettringer's ECO
melt filters are
being used in
PET bottle-to-
bottle recycling

existing screen changer, the re-pelletising line is now capable of processing up to 1,000 kg/h. This was proven in an acceptance test. A higher cost efficiency also results from the reduced melt loss in the filter from formerly 1.5% down to 0.6%."

During the pilot runs, the system remained stable for more than eight weeks and there was a reduced level of operator assistance needed. Ettringer says: "Consistent quality acceptance of the converter, using the final pellets in bottle productions process, confirmed the ECO filtration efficiency. In comparable projects chemical analyses proved only slight degradation of the rPET well below the set limit values, as an advantage of the short residence times in the ECO melt filter."

The ECO melt filter has a rotating cylindrical steel screen with millions of laser-drilled conical holes through which the melt is forced from the outside to the inside. This leaves impurities on the

surface, from where they are continuously removed by a scraper.

Uwe Kellner, Managing Director at Ettringer, says: "In general, the PET world has much higher demands on the efficiency of melt filtration than other areas of plastics recycling. Where conventional screen changers and screens reach their limits, our self-cleaning ECO filter systems offer considerable reserves to meet even the toughest specifications. The breakthrough came with the recent market launch of a micro perforation with a previously unattained filter fineness of 60 µm. This means that we now also meet the particularly high requirements of PET recycling."

Conventional steel mesh filters are also available with a filter fineness of 60 µm, and even lower, but Ettringer says that during operation impurities such as aluminium foil or paper, along with black specks in the rPET bottle flakes, can find their way into the recycled material, causing yield losses.

Kellner says: "Compared to steel mesh screens, the rigid screens of the ECO melt filters with their laser-drilled micro perforation, in combination with permanently cleaning the surface, enable much better separation performance. At 60 µm filter fineness, the remaining impurities, smaller than 60 µm, are almost no longer visible to the human eye or will not be noticed - an important aspect in clear PET bottle production."

According to Ettringer, rPET produced in this way and used for fibre or tape applications is considerably less prone to breakage due to the significant reduction of black specks and other particles. This ultimately increases the efficiency of the line, which in turn leads to considerable cost

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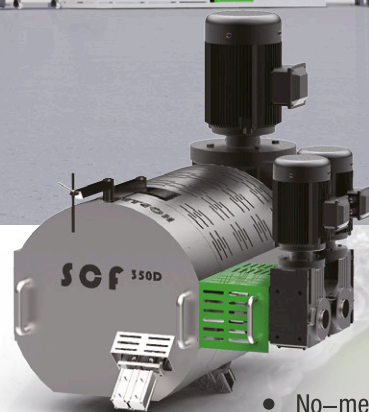


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and time savings, the company says.

Erema also manufactures a melt filter with laser-drilled holes: the Laserfilter. The latest development by Powerfil, Erema's melt filter business, concerns changing filters without stopping the line. With a shut-off slider option available initially with the Laserfilter Twin model, the machine continues in operation while one of the screens is changed. Using a gate valve, a Laserfilter unit can be taken out of the ongoing production process and, after the screen change, put back into operation again. In the meantime, production continues to run via the remaining filter units and without any interruption.

Erema says this option is particularly important for production processes with high throughputs, as well as for avoiding interruptions that would lead to a reduction in efficiency due to upstream or downstream processes (such as the washing plant beforehand, or the downstream process).

BritAS says recyclers are looking to produce at finer filtration levels in order to meet their customer requests. The company says it has the right answer for these needs with its Automatic Belt Melt Filter (ABMF) technology. Its most recent development in

the ABMF product family is the ABMF-TH (twin head) system.

"This twin head technology includes all the advantages from the very well-known ABMF technology and provides a much bigger filtration area at the same time," says Thomas Lehner, CSO of BritAS. "Without typical buffer cylinders from the ABMF series version, the twin head ensures continuous melt process and offers all the advantages of our ABMF idea, meaning highest filtration level even finer than 50 µm, lowest melt loss in the market and a reliable and solid technology with automatic operation."

The BritAS ABMF-TH combines two ABMF filter units with a manifold block, mounted almost vertically. The filtration area is up to 3,200 cm² (2 x 1,600 cm² filters), but the company says the ABMF-TH has a compact design and short melt channels.

Lehner says: "Especially the high value of processed plastic material does need a reasonable and effective technology which reduces the loss of plastic material to a minimum. Each lost kilogram is one too much."

The company expanded its technology offering with the launch at K2019 of piston screen changers

**RECYCLING OF
POST-CONSUMER
PLASTICS
INTO A**

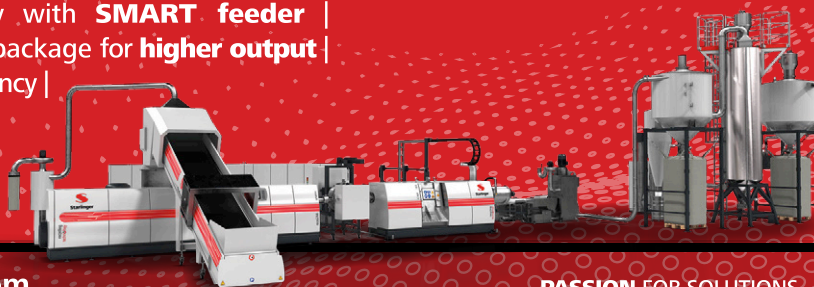


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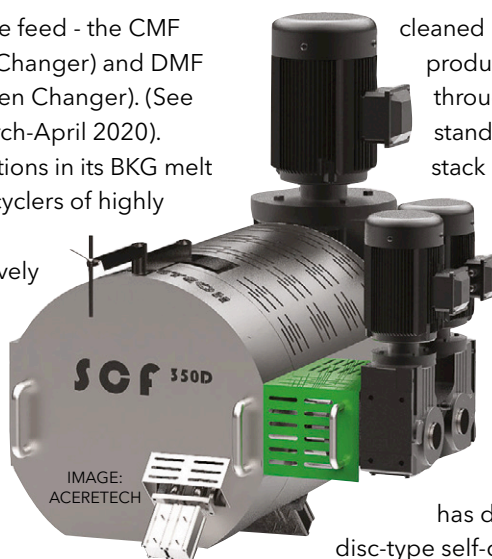
Right:
Aceretech's
SCF series
disc-type
self-cleaning
filtration
system

for less polluted plastic waste feed - the CMF (Continuous Bolster Screen Changer) and DMF (Discontinuous Bolster Screen Changer). (See *Plastics Recycling World* March-April 2020).

Nordson says that innovations in its BKG melt filtration products enable recyclers of highly contaminated materials to remove contaminants effectively while minimising melt loss. Its BKG HiCon R-Type 250 melt filtration system is designed for polyolefin and styrenic materials that have high impurities content - such as aluminum content above 15%.

PET recycling also requires effective removal of contaminants during melt filtration. Christian Schroeder, Global Product Manager for BKG melt filtration systems, says: "Nordson has enlarged the filtration area and decreased the melt loss during backflushing by developing FlexDisc, a multi-screen filter stack specifically for PET recycling. The greater filtration efficiency of the FlexDisc filter stack reduces the frequency of backflushing and the amount of backflush volume. In addition, it achieves finer filtration, higher throughputs, and longer filter service life. Due to the larger filtration area, it might be possible to use a smaller screen changer."

The FlexDisc filter stack can be retrofitted for use with screen changers that employ piston-actuated backflush technology, such as Nordson's BKG HiCon V-Type 3G screen changer. This system has four screen cavities, and each screen is automatically



cleaned by means of backflushing while production throughput continues through the other three. Replacing standard screens with the new filter stack in the screen cavities provides a much larger filtration area than with conventional round screens, the increase depending on the size of the cavities. Each filter stack consists of multiple FlexDisc cassettes, with two screen packs in each cassette.

Aceretech, based in China, has developed the SCF series disc-type self-cleaning filtration system. The technology can handle and remove up to 5% contaminants in the melt flow including paper, wood, aluminium, unmelted plastic and rubber. The system consists of a hardened steel screen plate, rotating unit, hydraulic section, contaminates removing blades and discharging screw. A large filtering area has up to 2.32 million micro-drilled holes, with filtering accuracy of 120µm. It is an easy operation to replace the disc screen in 30 minutes, says the company.

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Making a success of rPET

Processors and suppliers in the PET recycling sector are hitting new records. Peter Mapleston reviews new mechanical and chemical recycling technology and plant investments



IMAGE: STARLINGER

The use of post-consumer recycled PET continues to grow. It is now quite easy to find PET bottles containing 20% or 30% of mechanically recycled material, and several bottlers have already started using 50% and even 100% rPET. Chemical recycling is also on the rise. But many issues still remain unresolved. Legislation regarding use of rPET in food contact applications could be clearer, for example. Where is the best place for rPET – more bottles, or sheet and fibre applications? Can mechanical and chemical recycling sit happily side by side?

PET recycling technology group Starlinger says that since 2018 there has been a boom on the PET recycling market, and it looks like it will continue for some time. It says: "On the one hand, this is due to the stricter guidelines for plastic packaging and higher recycling rates set by law makers. Most EU states will have to raise their collection rates significantly over the next years. On the other hand, national and international brand companies are important driving forces, creating a market for recycled PET."

Starlinger says the outstanding performance of its super-cleaning processes for recycled plastics destined for food contact applications has been confirmed by several FDA letters of non-objection

in the US, more than 50 EFSA positive opinions from customers all over the world, as well as by country-specific food contact approvals of multinational food and drink brand owners. These processes are said to guarantee thorough decontamination using a combination of temperature, vacuum, or overpressure, as well as required residence times.

"Particularly in the field of PET recycling we have experienced significant growth since 2018," says Paul Niedl, Head of Sales at **Starlinger Recycling Technology**. This growth has been fuelled by plastic packaging legislation and higher recycling rates initiated at EU level and by individual countries, along with the trend for brand owners to set their own plastics recycling goals.

To cater for the increased demand for recycling lines, Austria-based Starlinger last year opened a new manufacturing location at a factory (operated by UniROTA Maplan Schwerin, a company affiliated with the Starlinger Group) in Schwerin, Germany for assembly of its largest RecoStar PET processing systems, which are capable of output rates of up to 3.6 tonnes per hour. Recycling systems with higher output capacities are also increasingly sought after and Starlinger has added a new machine size: the 215 mm screw-size model fits between units with

Main image:
Bottles and food trays are two applications that flourish in the PET recycling sector

**Right: Recycled
PET flakes and
rPET granulate**

screw diameters of 165 and 330 mm.

Viscotec, also part of the Starlinger group, specialises in PET sheet extrusion lines, making systems that incorporate rPET from bottles and packaging, as well as technology for increasing intrinsic viscosity (IV) in rPET. The company says it has passed the milestone of 2m tonnes of installed recycling capacity worldwide.

"Our solutions make it possible to recycle valuable raw materials. Our partners and customers share our conviction that PET can and must be recycled," says Angelika Huemer, Managing Director of Starlinger. "To recycle contains the word 'cycle'. Closing the loop is exactly what recyclers and packaging manufacturers do with Starlinger RecoStar and ViscoStar systems: they produce recycle which is safe for food contact. A beverage bottle can be turned into a beverage bottle again after recycling."

The trend towards bigger plants and higher quality recycle is confirmed by fellow Austrian plastics recycling technology specialist **Erema**. "Despite declining sales of beverages due to the Covid-19 pandemic and a tense situation in the recycling industry accounted for by the fall in the price of virgin material, interest in our PET recycling technologies remains high," says Christoph Wöss, Business Development Manager at Erema Group.

Erema estimates the total capacity of all PET recycling machines it has sold to date for various applications to be 2.6m tonnes per year. A recent trend points clearly towards customers favouring its larger systems processing upwards of 2,000 kg/h. The company cites a very large recycling system installed for a customer in Mexico last year. The line consists of two Vacurema Basic T machines, each with a capacity of 4,000 kg/h and incorporating solid state polycondensation (SSP).

"The customer is planning an annual production of up to 60,000 tonnes of food contact compliant rPET. These are the largest systems we have ever



IMAGE: STARLINGER

built, but our order books already have an order for an even larger one," says Wöss.

Erema is particularly satisfied with the market success of its innovative Vacunite technology, which combines vacuum and nitrogen technology, and which it claims "redefines the benchmark for performance in bottle-to-bottle." In just under two years, it has sold systems, developed in cooperation with SSP technology specialist Polymetrix, to 13 customers around the world.

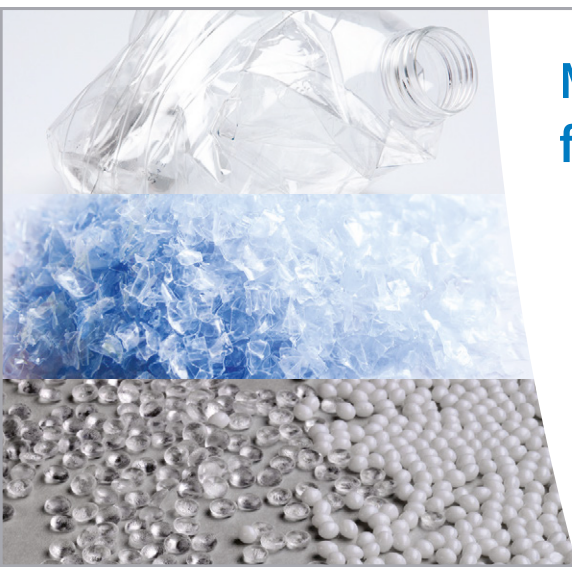
Growth is driven by more than the positive development of the bottle-to-bottle sector, Erema says. It highlights its Multi Purpose Reactor, which makes possible the processing of PET flakes directly, not only into preforms but also into film and sheet, and especially into recycled pellets for the textile industry.

"In total, Erema was able to deliver 42 plants with a total capacity of 643,000 tonnes per year within one year between October 2019 and October 2020. This is roughly equivalent to the total capacity of all PET recycling machines sold from 2011 to 2018," the company says.

Erema also highlights its involvement in the PET2PACK research project in Austria. Aimed at closing the loop for non-bottle PET rigid packaging, its focus is on sorting and recycling technology

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in order to generate food-grade and non-food-grade recyclate.

Another Austrian company, **NGR**, claims to be technology leader in liquid state polycondensation (LSP) technology, which it incorporates into its P:React recycling units. With LSP, the reaction speed in the PET melt is significantly higher than in SSP, the company says, adding that all impurities are removed from the PET melt to such an extent that the necessary requirements for food packaging, including water bottle grade, are achieved. The process produces EFSA- and FDA-compliant products.

NGR has just expanded its PET pilot plant with a second LSP line. Bottle-to-bottle trials and other applications can be tested.

NGR says that, compared to other systems, its process offers an energy-efficient and better melt cleaning process. IV is constantly measured and adjusted to the customer's target value via automated control of the vacuum unit. This makes it possible to finely tune the material quality to the customer's product specifications, including ultra-tight IV control, which is essential for downstream production. No addition of nitrogen or similar process aids are required for IV increase.

P:React units can be coupled directly with production processes such as film manufacture, spun yarn production, and the manufacture of preforms. "This eliminates a complete re-melting step and the associated IV degradation resulting from a downstream process," NGR notes. "The elimination of the pelletising process again significantly increases energy efficiency."

Amut has an eye on recycling PET food trays, use of which continues to grow, especially with lifestyle changes imposed by Covid-19, it says. The company has developed turn-key solutions suitable for this application, with lines including sorting and



Above: The recycling of production waste in the manufacture of BOPET biaxially oriented films is already common practice, but Erema says production becomes an extra challenge if PCR is also used. It worked with Lindauer Dornier to fulfil a customer's requirement by integrating components for the first time in a recycling line for a film manufacturer in Europe. The line combines an Erema Intarema 1512 TE recycling machine with a Lindauer Dornier melt filter for fine filtration

washing sections. The Amut Ecotech division, which specialises in sorting plants, provides the front end of the washing line. Amut says it can achieve outstanding yield both in sorting and washing, minimising the generation of PET fines. It says the washing lines remove the highest level of dirtiness and residual organics typical of this kind of packaging, normally much higher than post-consumer bottles.

Bandera's Revotech technology, which can also be used for sheet and film applications, combines innovative extrusion, converting, and recycling technologies. It also includes the pre- and post-treatment phases of the material. Revotech can be used for production of rigid film for thermoforming and industrial use, in food and non-food grades.

Patented microwave heating and drying technology makes it possible to process post-consumer (PCR) PET extremely quickly, the company says. "In this way it is possible to directly feed amorphous material that will be crystallised, dehumidified and dedusted in the same process," says Senior Sales & Product Manager Andrea Carraro. "In addition to having extremely low energy consumption, the process manages to reduce or even avoid the typical yellowing effect, even without the use of controlled oxygen-free atmospheres."

Revotech incorporates Bandera's PURE purification process, which can be incorpo-

Left: Liquid state polycondensation is incorporated into NGR's P:React unit



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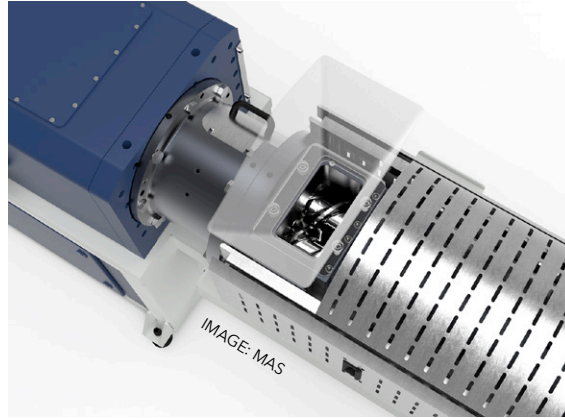
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rated with SSP. Further purification in the molten state occurs later in a Bandera twin-screw extruder. "The final result is a material with properties equal to virgin PET and free from contamination, FDA/EFSA approved," he says. "All this in shorter times and with energy expenditure greatly reduced, in some cases halved, compared to market standards."

Austrian equipment builder **MAS** has an unusual take on twin-screw extruder design, with its conical co-rotating system. Most of its units are used for plastics recycling, particularly PET recycling. A key point with this design, says Stefan Lehner, the company's General Sales Manager, is that they can accept large volumes at the input zone, which is ideal for regrind, especially flakes.

The units provide high throughput with low screw speed, and also a very low shear rate. Plus, the short processing unit of the MAS and hence the low dwell time of the melt inside the extruder are key features for achieving good colour and AA values, Lehner says.

MAS extruders are particularly energy-efficient, Lehner also notes. This is due to the low residence times and installed extruder heating power required



Left: MAS co-rotating conical twin-screw extruders have large intake openings

is also very low. "As a result, the MAS extruder requires significantly lower specific energy than parallel twin-screw extruders," he says. An energy saving of up to 20% is possible, says the company.

In order to be able to meet growing requirements for PET packaging sheet with high rPET content, many processors are confronted with high investment costs for equipment that can process recycled materials.

Gneuss says it has already proven to many customers worldwide that retrofitting is a good alternative for processing recycled materials. "For

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Above: CMG has developed a high-capacity PET preform granulation line

example, a company in South America has been using our Rotary Filtration Systems for several years now to produce PET thermoformed trays with a 70% recycled content," it says. Even with high degrees of contamination, the screens of the RSFgenius system can be reused up to 400 times, depending on the filter fineness, it says (see feature on Melt Filtration, page 13 in this issue).

Another manufacturer in South America has taken an MRS 130 (1,000 kg/h capacity) Multi-Rotation System (MRS) extruder together with a complete Gneuss Processing Unit, which includes an RSFgenius 150 melt filter as well as an Online Viscometer. The viscometer is also available separately and is ideal, says Gneuss, as a retrofit solution. It constantly provides the representative shear rate and dynamic viscosity. Depending on the values determined, the vacuum in the degassing zone of the MRS extruder is readjusted to keep the melt viscosity within the specified tolerances.

Bottle preforms are made of PET solidified in an amorphous state. While such a condition is advantageous for the process of grinding them, it

might become a problem when quantities to grind increase, says **CMG**, which specialises in size reduction technologies. It has recently developed a new high capacity preform recycling line, which it says safeguards all mechanical properties and physical characteristics of the polymer, "so that the regrind be reintroduced in the production process flawlessly, with no implications or negative quality impact".

CMG's solutions include granulators, shredders, integral conveyor belts, regrind evacuation and conveying systems, dedusting, dust management and air filtration. Systems range in capacity from 400 to 1,200 kg/h.

Indorama Ventures has a ticker on its web site, counting how many PET bottles it has recycled across its global operations since 2011. As of April 13, the figure was 61.35bn. In March 2020, when the figure reached 50bn, Yashovardhan Lohia, the company's Chief Recycling Officer, said the aim was to recycle 50bn bottles every year within five years. Last year the company acquired operations in France and Poland, and is set to have European capacity of 10bn bottles per year by 2023. It is also building capacity in the Philippines in collaboration with Coca-Cola; projected capacity is 30,000 tonnes per year, with output of 16,000 tonnes per year in the first phase. According to the company's 2020 Sustainability Report, last year it recycled 222,288 tonnes of PCR PET.

In January, plastic packaging and recycling specialist **Alpla Group** said it was investing more than €5m in an extrusion system for food-grade rPET made from used bottles at its site in Anagni, Italy, where it has one of its most important preform production plants. The plant processes around 50,000 tonnes of PET a year, of which only a very small proportion has been recycled material. The

Authorisations are a drag on progress in EU

In Europe, several industry bodies have written to the EU Directorate General for Health and Food Safety urging faster progress in authorisations for rPET in food contact. The heads of Petcore Europe, Plastics Recyclers Europe, Natural Mineral Waters Europe, and Unesda (Soft Drinks Europe), say that while many of their members want to go beyond existing EU targets on use of recycled content in beverage containers, regulatory inaction is impeding them.

They say EFSA, the European Food Safety Authority, has been requested to provide Scientific Opinions on the safety evaluation of the mechanical recycling process to produce recycled PET intended to be used for manufacture of materials and articles in contact with food - but authorisations have been pending for years. EFSA opinions have now become the established standard for most EU Member State's authorities.

"It is now up to the European

Commission to publish the authorisation of the positively evaluated processes," they say. The absence of authorisation is putting the PET industry at risk of not being able to reach its regulated targets for 2025 (25% recycled content in all beverage containers). "Closure of installations is also a threat," they say. "There are currently three processes awaiting EFSA opinions in France alone and many more throughout the rest of Europe."

new extrusion system, with a capacity of 15,000 tonnes per year of rPET, is scheduled to go into operation in the second half of 2021.

In a separate announcement in February, Alpla said it would invest up to €50m a year on average between now and 2025 in further expanding its global recycling activities. Over the past two years, the group has initiated bottle-to-bottle projects around the world, including in Asia, Europe, and Central America, says Georg Lässer, Head of Corporate Recycling at Alpla. "We nevertheless continue to see increasing demand on the part of our customers all over the world. This increasing global demand gives Alpla the opportunity to kick-start further investment projects."

Start-up PET recycler **Enviroo** has had its planning application approved for its first plastic recycling facility in the UK. It should be operational in Summer 2022 at Peel NRE's strategic energy and resource hub, Protos, near Ellesmere Port. It says it will use proven technology to sort and wash the waste, before creating rPET pellets suitable for new packaging products. The £165m Plastic Park at Protos will cluster together plastic recycling and recovery technologies.



IMAGE: ALPLA

Chemical recycling

Technologies for taking back used PET to its original monomers for reconversion into new PET – the terms chemical recycling, feedstock recycling, molecular recycling, and depolymerisation are all used – are making progress towards commercial use. In April, French company **Carbios**, which is developing an enzymatic process to solutions to hydrolyse PET, set out its schedule for building and operating a unit capable of handling 40,000 tonnes

Above:
Handling
incoming
material at
Alpla

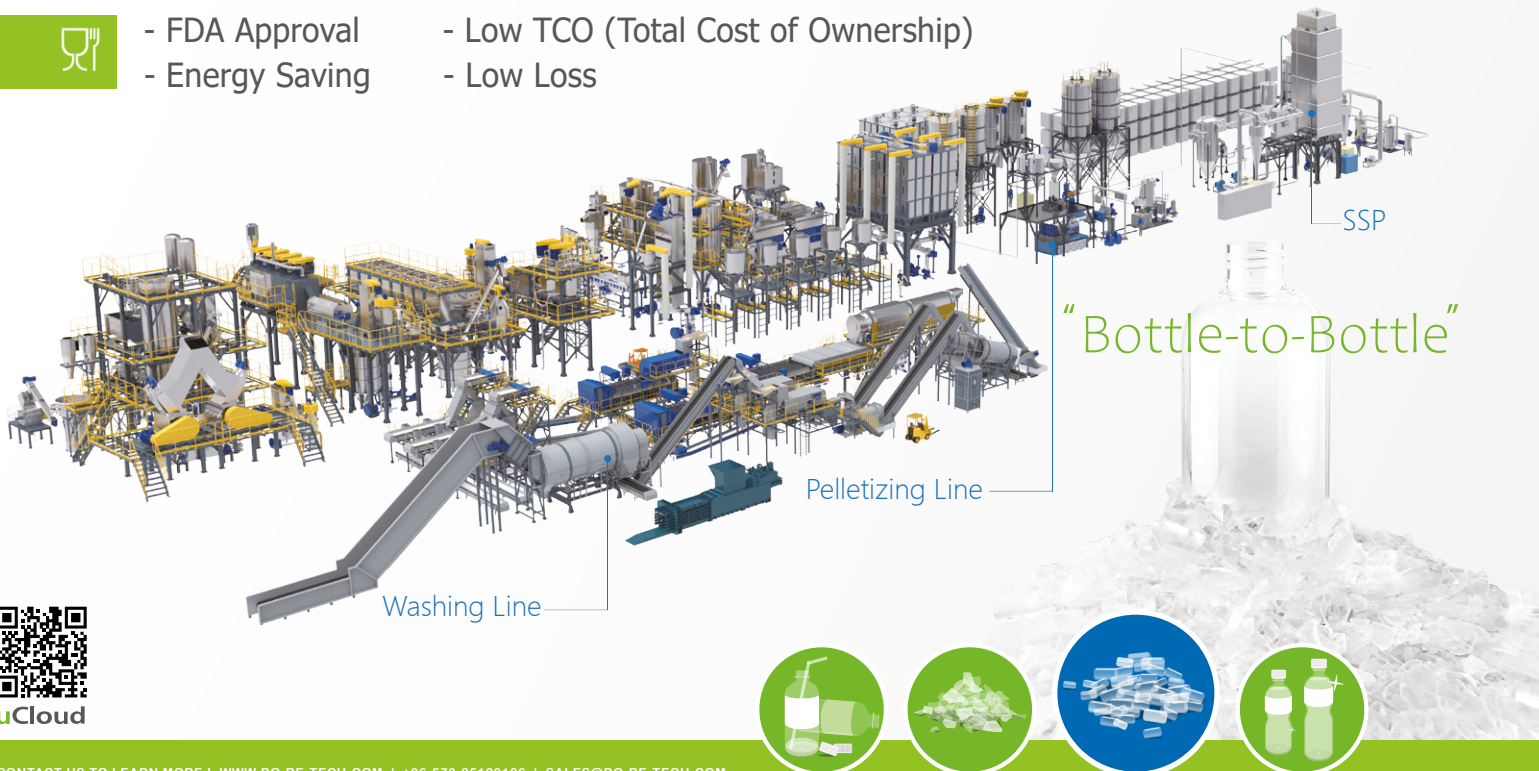
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- Low Loss



uCloud

IMAGE: EASTMAN



**Above:
Chemical
recycling is
good for
coloured
bottles**

per year of old PET bottles. It plans to have the plant operating around the end of 2024. In March, it signed an Expression of Intent agreement with PET producer Equipolymers, which could host the unit on its site in Schkopau, Germany.

In January, **Eastman Chemical Company** announced plans to build one of the world's largest plastic-to-plastic molecular recycling facilities at its site in Kingsport, Tennessee, US. Using methanolysis-based technology developed by Eastman, it will convert polyester waste. Eastman is already lining up supplies, including material from old polyester carpets.

The facility, which is expected to be mechanically complete by year-end 2022, will contribute to the company achieving its ambitious sustainability commitments for addressing the plastic waste crisis, which includes recycling more than 500m pounds of plastic waste annually by 2030 via molecular recycling technologies.

Switzerland headquartered start-up **Gr3n** said in December that it had raised funds from an initial investor that would help it towards its goal "to become the world leading supplier of recycled PET and polyester." The company says it has developed the first economically sustainable and industrially viable process for breaking down any type of PET

and polyester plastic into PTA and MEG monomers. A demonstration plant with an inlet capacity of 60 kg/h, located on the premises of NextChem in Chieti, Italy, is currently under construction. This is part of the EU-sponsored Demeto project (Demeto is an acronym for depolymerisation by microwave technology).

SABIC said in March that since the introduction of LNP Elcrin iQ materials in late 2019, it has helped divert more than 100 million single-use 16.9 oz. (50 cl) PET water bottles from landfills and incinerators, converting them in a chemical recycling process into polybutylene terephthalate (PBT) materials.

Huntsman also operates chemical recycling, but in its case, it is converting old PET bottles into polyurethane polyester polyols. It has two plants, one in Houston, Texas, US, (running since 2014, processing the equivalent of around 1bn 500-mL bottles per year to yield around 26,000 tonnes per year of polyols), and one in Taiwan (which opened last year, and which has a declared output of 22,000 tonnes per year).

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Exploring chemical recycling developments in the US



The Chemical Recycling USA Virtual Summit provided three days of high-level presentations and stimulating dialogue between chemical recycling companies, industry groups, brand owners, packaging producers, market specialists, NGOs and other stakeholders. The online event, which took place in early March, was organised by AMI, publisher of *Plastics Recycling World*.

The American Chemistry Council's Senior Director for Recycling and Recovery, Craig Cookson, delivered the opening keynote speech on "Policy drivers for advanced recycling". He brought attendees up to speed on the various plastics-related bills making their way through the US legislative process, including the RECOVER Act, RECYCLE Act, PLASTICS Act and Advanced Recycling Research & Development Act.

Cookson also led a high-level panel discussion

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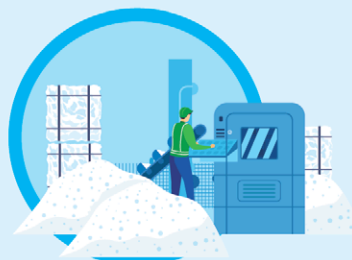
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of executives representing the viewpoints of polymer companies, packaging manufacturers and brand owners, who discussed ideas and plans for improving plastics recycling.

Rachel Goldstein, North America Policy Director for Sustainable in a Generation Plan, at Mars, said the confectionary brand owner launched its sustainability initiative in 2019. The group aims to reduce the use of virgin plastic in packaging and to include 30% post-consumer recycled (PCR) content by 2025. Goldstein said chemical recycling appeals to the group because of its ability to turn packaging waste back into food-contact approved materials.

Ronald Cotterman, Vice President of Innovation and Sustainability at Sealed Air, said that a large part of the group's business is food packaging which is highly regulated, so it is interested not just in new technologies but also recycling policy in the US. "We're looking for food-grade quality recyclates to put in our products, but we're also trying to ensure our products can be recycled. That means policies that enable or mandate the collection of materials such as thin flexible plastics that ultimately bring down greenhouse gas

emissions because they are so light, but we need the infrastructure to recycle them."

The panellists discussed the potential benefit to plastics recycling of mandatory targets, but were cautious about approaches such as Extended Producer Responsibility (EPR) schemes due to complexity. Zeina El-Azzi, Chief Development Officer and Co-Founder at US chemical recycler Brightmark, said there should be mandated goals for recycled content, but "it's all in the details of how, and what are the supports in place in order to do that."

Joel Heilman, Director of Global Public Policy, LyondellBasell, said: "My fear is if legislators just pull figures out of the air and don't do the homework and collaboration to land on the appropriate targets and objectives of recycled content."

■ AMI is planning a number of conferences in Europe and North America during 2021 covering chemical recycling and also mechanical recycling of plastics. Find out more about these events at <https://www.ami.international/events/upcoming>. AMI Consulting has published a series of in-depth market studies on plastics recycling and sustainability – find out more at <https://www.ami.international/cons/markets/RecyclingSustainability>

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The additive route to improved recycled plastics

The use of additives can both improve the plastics recycling process and the final quality of recyclates. Mark Holmes reports on additive and masterbatch suppliers active in the field

An increasing number of additives are being specifically developed for the plastics recycling market. These range from additives and masterbatches that can now be used to improve near infrared (NIR) sorting, in particular of black packaging materials, through to aids for other areas of the recycling process such as washing and separation. Additives are now also being introduced to upcycle plastics and improve their odour and properties to be re-used in a wider range of increasingly more demanding applications.

Demand is high for additives for the plastics recycling market, reports **Evonik**. "The recycling plastics market itself is very dynamic," says Ido Offenbach, Americas Segment Manager, Polymer Specialties. "We are observing high capacity of new recyclers all over the world, especially in Europe. As a result, the quantity of the recycled plastic is consistently increasing. Therefore, it is not surprising there is a need for additives to optimise the recycling process and to increase its speed. To achieve these targets, we have developed additives for the washing and floatation steps, as well as for the upcycling compounding steps."

However, there are specific problems that require new solutions. "The mechanical recycling process is far from perfect," says Offenbach. "Therefore, optimisation is needed. Currently, most developments are typically focused on improving efficiency and the cleaning process – the washing step – of mechanical recycling, as well as improving the sorting process to achieve more homogenised recycling resins without contamination, removing



IMAGE: GABRIEL-CHEMIE

malodour, and adjusting MFI/MFR of the recycled polymers. Currently, we are primarily developing solutions to improve the efficiency of the washing step and solutions for the odour absorber."

Evonik says its main area of focus is to optimise the mechanical recycling process, particularly in the wet stage and during the process, and in the upcycling plastics steps. "For the wet stage, we offer high efficiency additives that achieve better defoaming, wetting, de-inking, and delabelling performance than the market standard. These additives have global food contact status."

Tego Antifoam 4-94 is an example of an Evonik additive that is suitable for post-consumer (PCR) and post-industrial processes. The company has also developed a dewatering aid, Tego XP11022. This additive is used before the drying process, reducing the water content of plastics, which results in a shorter drying process. It also lowers the energy consumption of this process.

The company says: "In addition, our odour absorber series, Tego Sorb, reduces malodour during the recycling process and in upcycled plastics. This series includes 100% active odour

Main image:
Gabriel-Chemie
has achieved
COTREP
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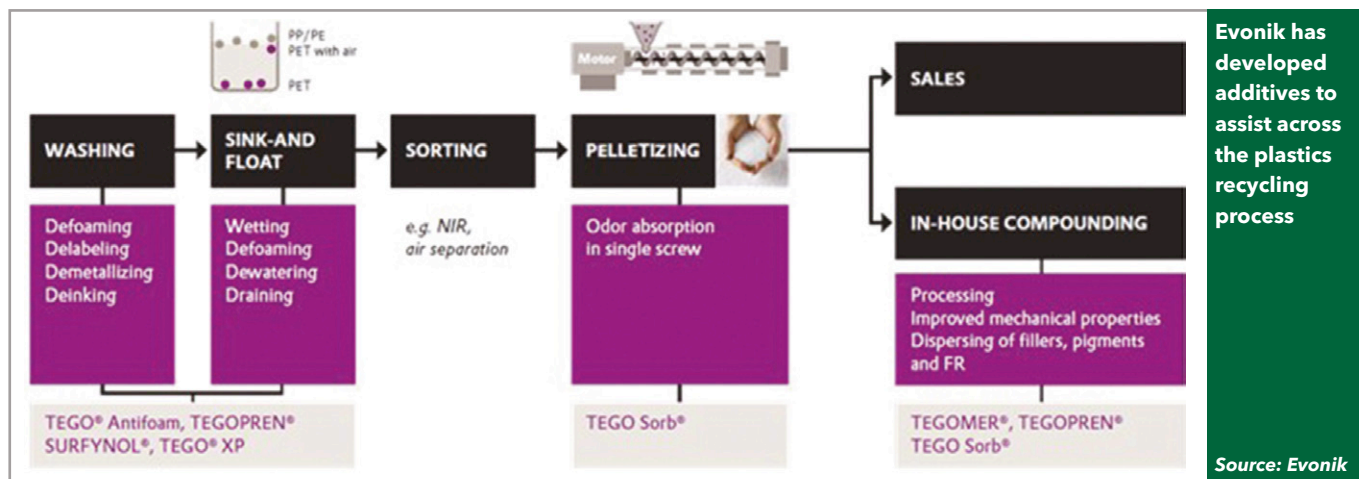
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absorber additive, Tego Sorb PY 88, which is suitable for masterbatchers and compounders. We also have masterbatch additives, Tego Sorb PY 50 PE and Tego Sorb PY 50 PP, that are suitable for convertors. These additives are especially relevant for polyolefins from the PCR stream."

According to Evonik, it is also working on developing more efficient additives for PCR users – for example, defoaming and wetting agents that are biodegradable. "By doing this, we can reduce water contamination during the wet stage," says Offenbach. "Tego XP 11022 is an example of our first successful additive that provides performance in combination with biodegradability."

It is also working to support high-end recycling applications for the automotive market. Offenbach says: "The requirement for a circular economy in the automotive market has increased. For example, through recycling plastic parts and then reusing them for the same application. We are not only talking of bumper-to-bumper, but also parts that are made from engineering resin materials, such as PA/GF, ABS or PC/ABS with coatings or metallised surfaces. We have close collaboration with recyclers and OEMs to provide solutions for these issues. We are also looking at future developments in the recycling market to support the circular use of flame retardant compounds from different end-use applications, such as cable and E&E."

Milliken has acquired Zebra-chem, the manufacturer of peroxide and blowing agent masterbatches that allow the incorporation of up to 100% recycled content into new plastics. "Milliken's long-term focus on innovation and sustainability encourages us to consider how we contribute to some of today's leading challenges, like how to effectively incorporate recycled plastics in manufacturing," says Halsey Cook, Milliken & Company President and CEO. "I'm excited to welcome the exceptional talent within Zebra-chem as they join

the passionate team at Milliken to move the needle on sustainable innovation."

Headquartered in Bad Bentheim, Germany, Zebra-chem has a portfolio of chemical blowing agent and peroxide masterbatches for application in most thermoplastics and engineering plastics. "Zebra-chem's leading position in Europe allows Milliken to leverage its congruent innovation platforms, global presence and commercial expertise to accelerate market solutions that improve and increase manufacturing with recycled plastics," says Wim Van de Velde, Vice-President, Europe, Middle East and Africa, for Milliken's Chemical Division. "Our combined skill-sets will facilitate faster and more customised solutions that achieve our customers' sustainability goals."

Ampacet has now obtained certification from COTREP (Comité Technique pour le Recyclage des Emballages Plastiques - Technical Committee for the Recycling of Plastic Packaging) in France for its NIR-sortable black masterbatch REC-NIR-Black PE 302 (1900302-E) for use in PP rigid packaging applications. In 2019, the company received certification from COTREP for REC-NIR-Black 1900302-EA and 4900147-E.

Following COTREP protocols, Pellenc ST and Tomra have performed successful dynamic NIR sorting tests on black PP trays containing 6% REC-NIR-Black PE 302. Tests showed that rigid packaging can be detected by an NIR scan and are oriented towards PP flow with the same sorting performance, including quality and percentage of detection, as other PP household rigid packaging materials. The masterbatch is also suitable for NIR-sorting of PE rigid packaging for return into the PE recycling stream, says the company.

Most black packaging contains carbon black as a pigment, which absorbs a significant part of the UV and IR spectrum and so avoids detection by a NIR scan during sorting. Previously, most black

Right: Ampacet REC-NIR-Black masterbatches provide a significant contribution to the recyclability of black plastic waste and help to support the circular economy

plastic packaging could only be disposed of in a landfill or used for energy recovery.

Packaging using Ampacet's NIR-detectable black masterbatch products, however, can be detected and sorted by NIR technology. This technology enables the reuse and recycling of black packaging and allows recyclers to valorise this waste.

Philippe Hugel , Ampacet Strategic Business Manager Moulding, says: "Ampacet REC-NIR-Black masterbatches provide a significant contribution to the recyclability of black plastic waste and help to support the circular economy."

Gabriel-Chemie has also achieved COTREP certification for NIR-sortable black masterbatch. The company says that Maxithen HP9AB1897 is PE-based and can be used in injection moulding and extrusion applications. It has food contact approval according to EU and US norms, and is iron oxide-free. For PP, Maxithen PP9AB1707 has the same optical and technical properties and is also COTREP-certified. Other NIR-sortable black masterbatch grades from Gabriel-Chemie include PP9AB1677 (PP), HP9DA8427 (PE), PP9AB1687 (PP), PP9AB1717 (PP), all of which have COTREP certification.

Techmer PM has introduced new, improved grades of its NIR-sortable black colourant. This technology allows NIR reflection to enable accurate sorting at the recycling facility, while maintaining the product's black colour. The product has a 'Preferred' rating from the Association of Plastic Recyclers (APR) in the US and is FDA-compliant, which allows for its use in food containers. By enabling verifiable recycling of black plastic, it also allows brand owners who use carbon black in their products to better meet sustainability goals while

maintaining their desired brand identity.

Techmer PM says the technology, while primarily tested so far in HDPE, also works effectively with PP and PET resins, and all are suitable for FDA applications.

Techmer can custom tailor solutions for each application, with variables to include such factors as resin grade, thickness, and the level of PCR content. The company adds that it is already working on next-generation technology that will offer better opacity, allowing for improved coverage of PCR while using less colour concentrate. The product should be on the market soon.

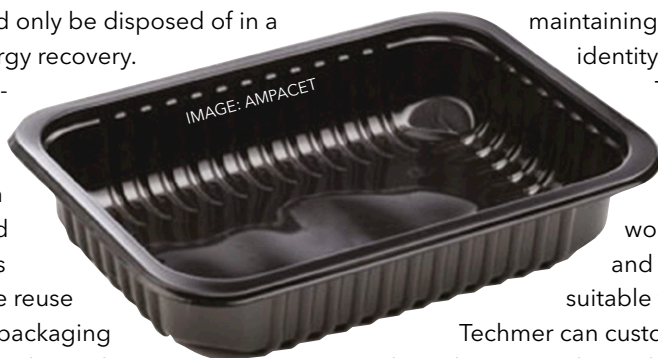
Techmer PM says that it formulates with multiple components to improve on the offerings from the raw material suppliers resulting in a blacker black. The company is able to iterate quickly in its own laboratory using analytical technology to measure reflectance in the NIR region, rather than having to wait weeks for each submission to be subjected to the official APR test.

Baerlocher has developed Baeropol RST stabiliser, which has formed the basis for a set of additive blends that have been found to be particularly useful in polyolefin recycling applications. The company says that it offers fully formulated antioxidant packages under the Baeropol T-Blend range of products. The stabilisers are available in a dust-free pastille form suitable for recycling operations.

The pastilles can be fed directly into the compactor unit of a film recycling line by using low-cost volumetric feeders. Improved quality of the recycle can be observed, for example, in a downstream film blowing line where less gelling and fewer degradation products lead to fewer bubble breakages and a more homogenous mechanical performance of the film.

Baerlocher adds that one of the Baeropol T-Blends not only safeguards processability and mechanical properties, but it also makes PP solidify faster and more uniformly in the mould. This enables shorter cycle times and ensure the dimensional stability as the producer moves from batch to batch. Another Baerlocher speciality product is aimed to remedy the supply-and-demand mismatch between low melt strength HDPE from post-consumer waste and high melt strength HDPE for pipe extrusion and extrusion blow moulding of large parts.

Upcycling low value HDPE is also possible with



Below: Techmer PM has introduced new, improved grades of an NIR-sortable black colourant



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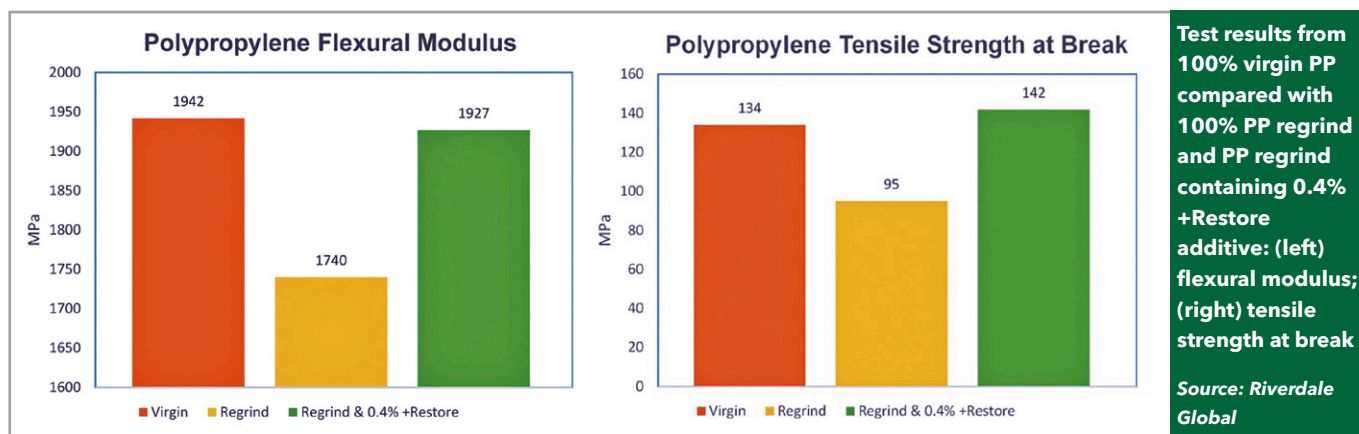
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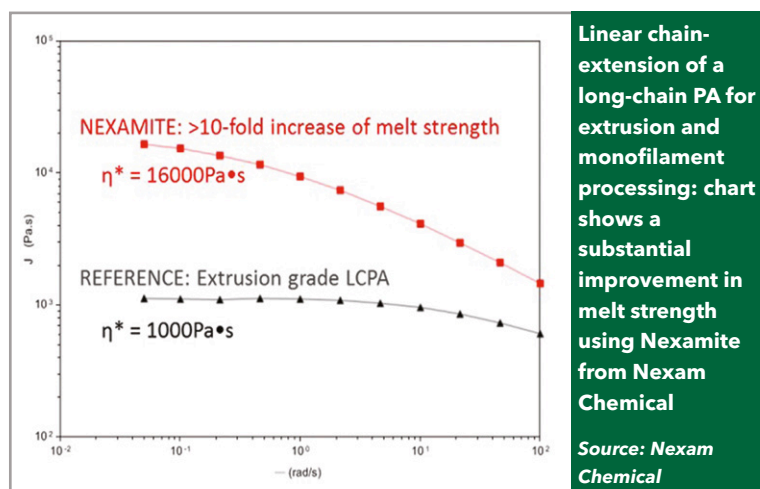
an additive acting as a chain extender, which allows a compounder to achieve higher value applications. In customer evaluations, the company says that it has been shown that modification with this chain extender can rid flow instabilities in recycled HDPE, which cause a rough surface appearance on extruded profiles.

Riverdale Global has developed a new liquid additive that enables processors to get 'virgin-like' properties from 100% regrind. The company says that low levels of +Restore can improve properties of PP and HDPE post-consumer recyclate while enhancing flow and part consistency. Physical property tests were carried out with a moulder of packaging containers for improving the performance of plastics regrind based on post-consumer waste.

The tests compared 100% virgin PP with 100% PP regrind containing 0.4% +Restore additive. For flexural modulus regrind PP tested at 99% of virgin PP, while it was 89% for strain at yield. Regrind PP tested higher than virgin, at 106%, for strain at break, while for Izod impact strength regrind PP modified with +Restore additive tested at 16% less than that of virgin PP, compared with unmodified regrind at 49% less.

"These test results and similarly encouraging data for HDPE show that plastics processors can use the +Restore additive to meet sustainability goals by actually upcycling post-consumer waste, eliminating most, and in some cases all, of the property losses typically incurred in recycling," says Jared Arbeter, Technical Sales Manager.

Arbeter adds that +Restore also improves part consistency in comparison with untreated recycled material. As measured by standard deviation in a range of physical property tests, for example, HDPE regrind with 3% white concentrate exhibited 50% or more decreases in part variation when it contained 0.4% of the +Restore additive. Other benefits are also provided by the +Restore additive. Because the additive has an affinity for the base polymer, it acts as a lubricant, enhancing melt



flow. In addition, the +Restore molecule has a functional group that readily reacts with pigments, fibres or fillers in the resin, while a different segment of the same molecule is designed to couple with the polymer. As a result, it forms a strong bond between resin and filler without compromising flexibility, he says.

Riverdale Global says that +Restore additive can be used in all thermoplastic processes, alone or in a blend with its liquid colours. Typical usage rates are in the 0.1-0.5% range.

Brüggemann has developed additives for the recycling of polyamides that is of particular significance for the automotive industry. "Sustainability as a central target for the future drives OEMs to increasingly focus on recycling and to include sustainability as an important part of their identity," says Klaus Bergmann, Business Unit Manager Polymer Additives. "Legislation and European directives will provide further incentives. Recycling of polyamide components is integral to automotive sustainability and is aided by the use of performance additives."

Additives for polyamide recycling include Bruggolen TP-M1417 and Bruggolen M1251/1253, allowing for precise and reproducible adjustment of the relative viscosities of PA waste to the level of



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high-quality injection moulding grades. Brüggemann offers a broad portfolio for recycling including long-term heat stabilisers, processing stabilisers, flow enhancers, nucleating agents and other auxiliaries.

Swedish company **Nexam Chemical** is also observing good development in polyamide markets. "We see an increasing interest in the use of recycled polyamide, as well as other polymers in general," says Henrik Bernquist, Business Development Manager. "Generally during the recycling process, polymers lose a part of their performance due to degradation. The degradation decreases the molecular weight, and this has to be restored in order to reuse the polymer in more demanding applications. With our reactive recycling chemistry, we are able to offer products to ensure high quality products despite the use recycled material. Rebuilding molecular weight directly in the extruder with a Nexamite masterbatch is of particular interest during recycling because it does not add extra cost in terms of equipment or extra processing steps. We are also able to tailor our Nexamite range to fit specific customer requirements with respect to melt modification and chain extension and modification."

Nexam Chemical has undertaken a number of tests to demonstrate Nexamite's effectiveness, for example, in linear chain-extension of a long-chain PA for extrusion and monofilament processing. In chain extension during compounding, reactivity was achieved in a mini-compounder and no gels were detected. There were also improvements in melt strength and mechanical properties. In addition, chain extension of a low viscosity PA for extrusion quality grades achieved high MFI long-chain PAs. During compounding the additive led to an elongation at break of more than 200%, greater than 25% improvement in tensile strength, a rise in e-modulus of more than 10% and no gel formation.

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Plastics Recycling World is the monthly magazine providing business, industry and technology news for all involved in the collection, sorting and recycling of plastics around the globe - our 25,339 email subscribers cover more than 150 countries. It is accessed by thousands of readers every month free-of-charge online, on tablets and smartphones, and for the first time this year, also via our free app for the iPad, iPhone and Android devices.

Plastics Recycling World delivers relevant and up-to-date information on the most important technical developments, market trends, business news and legislative announcements direct to readers' email inboxes or smart devices. And, unlike general plastics magazines, it is 100% focused on the specific information needs of the plastics recycling market.

Published by our expert editorial team at AMI - the leading provider of databases, market intelligence, conferences and expos for the global plastics processing industries - *Plastics Recycling World* benefits from access to our detailed databases of senior decision makers at plastics sorting, recycling and recompounding sites across Europe, the Americas, Asia and the Middle East. These global databases include key purchasers of polymers, additives, processing machinery and ancillary equipment built up over more than 35 years.

Your advertisements are very competitively priced and include links directly to your website. If you are selling machinery, equipment, materials, additives or services to plastics recyclers and recompounders, then *Plastics Recycling World* is the ideal vehicle.

Digital magazines for the
online; on tablets; on s

We lead the way with electronic magazines for the plastics industry

Published

The **online edition** is hosted on the Yola platform for digital magazines, which means there is no need for readers to download special software or large files. Subscribers are notified of each new edition by email and a simple click of a weblink takes them to the latest magazine. Our user-friendly interface allows them to browse and read the magazine just like a printed product, but with the added benefit of instant availability.

The people behind Plastic

David Bishedge / Editor
David is a journalist with more than 25 years experience of international B2B publishing, mostly writing for the plastics industry. An English

Mark Holmes / Contributing Editor (UK)
Mark is a freelance writer and editor with experience in the oil and gas industries and has extensive print and digital publishing expertise.
Email: david.elliott@arsinternational

Mark is a graduate in chemical engineering and has been writing for *Plastics* since 2015.

AMI - Bringing the plastics industry together
Plastics Recycling World magazine is published by AMI, the data expert and organizer of the **Plastics Recycling World**. **Plastics Recycling World Expo USA**. These have focused on plastics recycling in North America. **Plastics Recycling World Europe**.

the Compendex World explains in Germany on 7-8 October
Wild Expo and take place in Basel in Germany on 7-8 October
On USA on 4-5 November 2020. The debut
events each attracted more than 4,000 visitors
<https://www.international-exhibitions.com>



Plastics Recycling World offers:

- ✓ Comprehensive global coverage
- ✓ 100% focused on plastics recycling
- ✓ In-depth market knowledge
- ✓ Free access online and via app (NEW)
- ✓ Direct email delivery
- ✓ Highly competitive advertisement rates
- ✓ Live weblinks from all advertisements
- ✓ App viewable without internet connection

Visit www.plasticsrecyclingworld.com
to see the latest issue and take out
a free subscription

Rates and Data

Plastics Recycling World's competitive global advertising rates ensure your marketing budget goes much further.

	Image	2x	4x	8x	12x	5-Dollars
Double-page spread	€ 3,780	€ 3,000	€ 2,700	€ 1,870	Double-page spread	\$
Page	€ 2,520	€ 2,010	€ 1,815	€ 1,260	Page	\$
Half page	€ 1,260	€ 1,005	€ 908	€ 630	Half page	\$
Third Page	€ 1,490	€ 1,170	€ 1,060	€ 740	Third Page	\$
Quarter page	€ 1,125	€ 900	€ 805	€ 555		

Guaranteed positions:
Special positions - for example, right hand or consecutive pages - can be guaranteed for a booking premium of 5% of the rate card charge

<p> Full-page Showcase entry: \$25 or \$160 per brochure </p> <p> Ad-able features (advertiser's): 8 pages: \$1,740 (\$1,600) Ad-able page spread: \$4,832 (\$5,360) </p> <p> Ad-able formats: </p>	<p> Full-page </p> <p> Half-page (horizontal) </p> <p> Half-page (vertical) </p> <p> Third-page (horizontal) </p> <p> Quarter-page (horizontal) </p>
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Electronic copy should be supplied as high resolution (minimum 200dpi) digital file in either PDF or JPEG format. Ensure the optimum results across our different digital forms we recommend you use our Adobe InDesign files when submitting your artwork. These can be accessed at <http://bit.ly/ART09C>.

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For more information on our advertising rates, contact us for our advertising rates and specifications. We also offer banner and display advertising on www.plasticwastemagazine.com. Contact us for competitive rates and latest viewing figures.

about our other titles at www.ami.international/en/eng

Editorial Advertising

[illegible]

Email circulations: 20,380 Twitter followers: 20,100



SPREAD THE WORD

Let the world know about the good things your company is doing by advertising in Plastics Recycling World magazine. Request the media pack to find out about our forthcoming features, global readership, and cost-effective advertisement packages - email:

levent.tounjer@ami.international

Keep informed: read our latest editions

AMI publishes five process-specific FREE plastics industry magazines. Simply click on the cover below to read each magazine. Or download the issue in the relevant Apple or Android app



Plastics Recycling World January/February 2021

The January/February edition of Plastics Recycling World looks at how chemical recycling technology could be utilised to recycle polyurethane foams. It also explores some of the latest developments in post-consumer film recycling and pelletising equipment.

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Plastics Recycling World November/December 2020

The final 2020 edition of Plastics Recycling World looks at the latest developments in the world of plastics granulation. This edition also reviews innovations in PVC recycling and examines some applications of automated quality control technology.

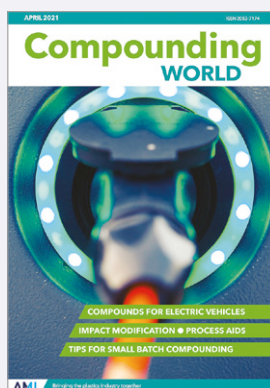
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Injection World April 2021

The April issue of Injection World looks at how the Covid-19 pandemic is stimulating greater use of robots and cobots by injection moulders. Features also cover the latest in caps and closures and a ramp-up in recycled compound offerings.

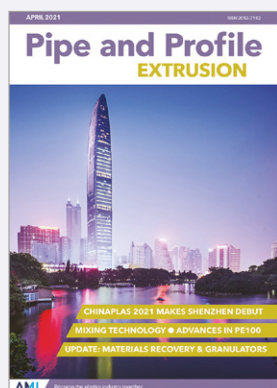
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Compounding World April 2021

Features in the April issue of Compounding World cover compounds for electric vehicles and impact performance, along with small batch compounding, process aids, a preview of Chinaplas 2021 and an interview with PVC compounder Benvic.

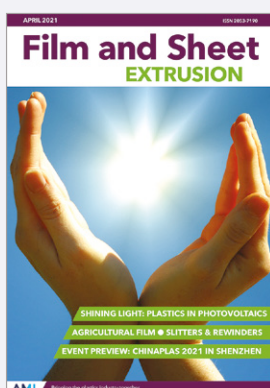
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Pipe and Profile April 2021

The April edition of Pipe and Profile Extrusion previews the Chinaplas trade fair, the first international plastics show to take place since the pandemic hit. It also looks at the latest developments in PE100 pipes, batch mixers and in-plant recycling equipment.

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Film and Sheet April 2021

The Film and Sheet Extrusion April edition has features covering advances in photovoltaics, agricultural film and slitters and rewinders. There is also a preview of Chinaplas 2021, the first major plastics exhibition to take place in over a year.

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GLOBAL EXHIBITION GUIDE

2021	17-21 May	NPE 2021 CANCELLED	www.npe.org
	1-3 June	JEC 2021, Paris France POSTPONED	www.jec-world.events
	8-11 June	Moulding Expo, Stuttgart, Germany CANCELLED	www.moulding-expo.de
	15-18 June	FIP, Lyon, France POSTPONED	www.f-i-p.com
	22-25 June	Plast 2021, Milan, Italy POSTPONED	www.plastonline.org/en
	22-25 June	Colombiaplast, Bogota, Colombia NEW DATE	www.colombiaplast.org
	10-12 August	Feiplar, Sao Paulo, Brazil NEW DATE	www.feiplar.com.br
	13-17 September	Plastex, Brno, Czech Republic POSTPONED	www.bvv.cz/en/plastex/
	14-18 September	Equiplast, Barcelona, Spain NEW DATE	www.equiplast.com
	29-30 September	Plastics Recycling World Expo Europe, Essen, Germany NEW DATE	https://eu.plasticsrecyclingworldexpo.com
	12-16 October	Fakuma, Friedrichshafen, Germany	www.fakuma-messe.de
	3-4 November	Plastics Recycling World Expo USA, Cleveland, USA NEW DATE	https://na.plasticsrecyclingworldexpo.com
	8-12 November	Plastico Brasil, Sao Paulo, Brazil NEW DATE	www.plasticobrasil.com.br
2022	15-18 November	Arabplast, Dubai, UAE NEW DATE	www.arabplast.info
	17-21 February	PlastIndia, New Delhi, India NEW DATE	www.plastindia.org
	8-10 March	JEC 2021, Paris France NEW DATE	www.jec-world.events
	19-26 October	K2022, Dusseldorf, Germany	www.k-online.com

AMI CONFERENCES

1-3 June 2021	Plastic Closure Innovations VIRTUAL SUMMIT
8-10 June 2021	Stretch & Shrink Film VIRTUAL SUMMIT
27-29 July 2021	Smart Packaging VIRTUAL SUMMIT
27-28 September 2021	Chemical Recycling, Düsseldorf, Germany
4-6 October 2021	Polymer Sourcing & Distribution Europe, Hamburg, Germany
20-21 October 2021	Plastics Recycling Technology, Vienna, Austria

For information on all these events and other conferences on film, sheet, pipe and packaging applications, see www.ami.international



29 - 30 September, 2021
ESSEN, GERMANY



3 - 4 November, 2021
CLEVELAND, OHIO

www.ami.international/exhibitions