

Tyre recycling – new chances for sustainable products

Old tyres are a valuable resource, as rubber retains its positive material properties when recycled. This opens up many opportunities for processing end-of-life tyres (ELT), not least because specialised engineering companies are enabling ever more efficient production processes for tyre recycling and processing in the form of rubber granulate. As a result, the spectrum of sustainable products made in this process is growing.

Quantities and processing of old tyres

The world produces huge quantities of old tyres every year. These are referred to as end-of-life tyres (ELT). A December 2019 report on global ELT management estimates that the EU and 13 other countries produced a total of 29.1 million t of ELT (fig. 1). The report also states that 26.1 million t of old tyres were reclaimed, with a high proportion being processed for energy or materials.

The European Tyre & Rubber Manufacturers Association (ETRMA) also publishes data on the utilisation of old tyres. It estimates that in 2018, a total of 3.26 million t of ELT were reclaimed in 32 countries (EU 28, Norway, Serbia, Switzerland and Turkey). In the same year, EU member states approved measures to strengthen the waste hierarchy and place greater emphasis on waste reduc-

tion, reuse and recycling. These measures focus primarily on granting a second life to old tyres through retreading. If this is not possible, the next step is to reclaim the composite materials of the tyre and use these secondary materials to create sustainable products in a circular economy. The measures seek to avoid incineration of old tyres, i.e. energy recovery, as much as possible to preserve resources. In 2018, around 1.25 million t of ELT were incinerated. Recycling accounts for 62 % of old tyres, or around 2 million t. This trend looks set to continue in future.

Recycled rubber – a valuable secondary material

What makes ELT so interesting for recycling is the high proportion of natural and synthetic rubber it contains. Rubber is perfectly suited for recycling, as it retains its

positive properties. Secondary products, produced from rubber granulate and binders, often also have a longer service life than the primary product – the tyres. The following list details just some of the products that can be made from recycled rubber granulate using cutting-edge production technology:

- Covers and wall systems for protecting people, animals and objects
- Noise insulation in walls
- Fall protection flooring, e.g. on playgrounds
- Floor systems for animal stalls
- Impact sound insulation
- Anti-slip mats, e.g. for load securing

In some countries, businesses that recycle ELT can benefit from state support.

From scrap tyres to valuable material

The most valuable sources of tyre rubber are so-called supersize tyres of the kind used on mining vehicles. These often weigh several tonnes and measure over 4 m in diameter. It is their sheer size that makes these tyres so suitable for recycling, alongside car and truck tyres. But these huge tyres first need to be shredded before they can be recycled. Italian company Salvadori produces hydraulic cutters to reduce the volume of these tyres, along with equipment for removing the steel beading inside (fig. 2). Both process steps make the subsequent recycling of the supersize tyres much easier.

In this purely mechanical process, the tyres or parts thereof are cut in several steps until the metal components inside can be magnetically separated. The rubber chips undergo further fine granulation, while the textile

Fig. 1: Total reclaimed end-of-life tyres by country (in tonnes). The use of ELT collected in China is only partially known (filled section).

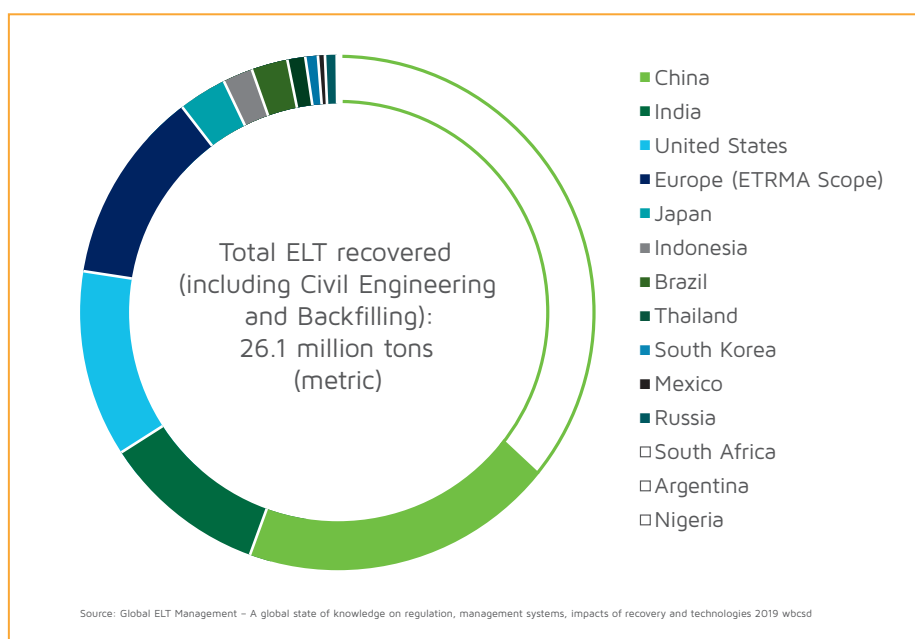


Fig. 2: Salvadori produces equipment for cutting supersize tyres before they are recycled.



Fig. 4: The standard dimensions for rubber cylinders are a length/width of 1,020 mm, 1,250 mm and 1,520 mm, with a diameter of 1,000 mm. Machines for producing even larger cylinders measuring up to 2,000 mm in width/length and diameter are currently in development.



Fig. 3: Salvadori machines turn rubber granulate and binders into cylinders that frequently weigh in at over 1 t.



Fig. 5: It is also possible to produce rubber granulate blocks that can weigh up to 1 t, depending on their size. The maximum dimensions are up to 1,200 mm in width, 2,000 mm in length and 300 mm in height.



components are removed by a vacuum. At the end of the process, all components are fully separated from each other. The resulting rubber granulate can then be provided in various qualities and grain sizes for further processing, according to individual customer requirements.

From rubber granulate to the semi-finished product

Rubber granulate can be pressed together in further production steps with added binders to form large blocks or cylinders (fig. 3-5). These can then be turned into sustainable end products easily and efficiently, for example using the splitting machines from Fecken-Kirfel. Before compression, it is possible to mix up to four different materials (e.g. SBR or EPDM in various

grain sizes). This results in a wide range of potential products. It is therefore possible to influence the properties of the end product (density, hardness, elasticity, colour, etc.), resulting in a broad field of applications.

From block and cylinder to a sustainable product

Once a block or cylinder is produced, how does it become a product with defined properties, quickly and efficiently, and in the right thickness and/or with special profiling? Fecken-Kirfel specialises in tailored machinery and systems for cutting and splitting. Blocks can be turned into wall systems, impact sound insulation, sound insulation mats, fall safety mats and anti-slip mats. The automated H 24 G bandknife splitting machine is suited for splitting blocks into

the required thickness (fig. 6). With its reinforced design, it is capable of accurately splitting even heavy materials with a density of up to 1,100 kg/m³ and a hardness of up to 70 Shore A, depending on the material properties. In processing, these rubber granulate blocks usually measure up to 300 mm in height. Depending on the material, grain size, distribution and binder quality, it is possible to split layers measuring 1.5 – 2 mm to up to 30 mm in thickness. The H 24 G is equipped with Windows-based control for simple and intuitive operation. It features a vacuum system that can secure the block to the movable table if required. The cutting programme runs automatically according to the required formats and quantities, making it possible for the machine to be operated by just one person. Handling is made easier by the visualisation of cutting parameters, along with the ability to incorporate an automatic

Fig. 6: H 24 G horizontal splitting machine with take-away conveyor for removing the split layers.



Fig. 7: D 31 profile cutting machine with post-cut rolling systems.

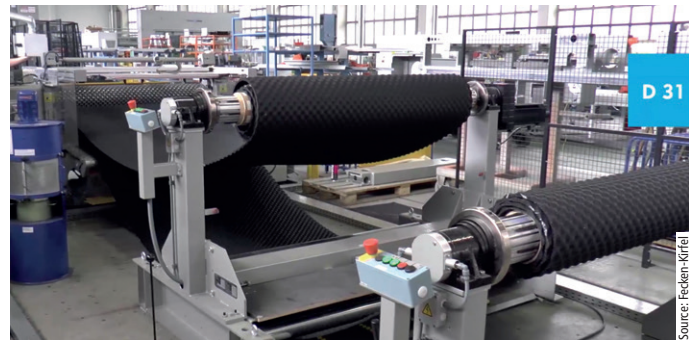


Fig. 8: R 24 bandknife peeling machine – the cylinder is secured using a special clamping device.

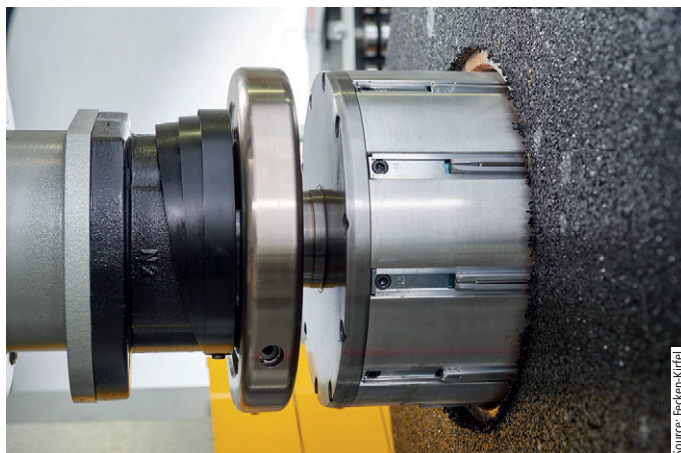


Fig. 9: R 24 bandknife peeling machine – side trimming system and strip cutters

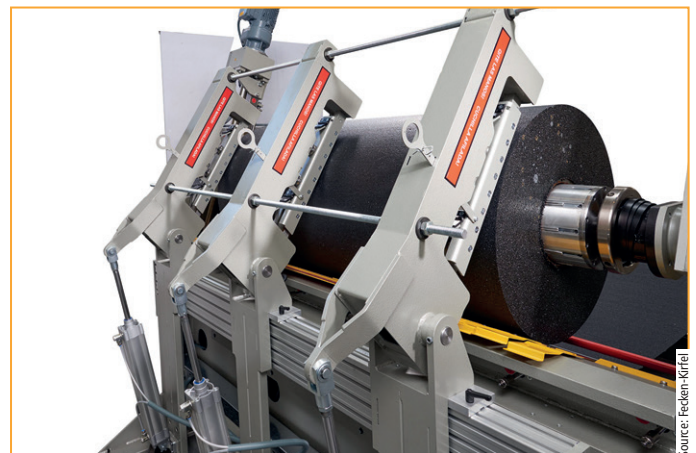


Fig. 10: R 24 bandknife peeling machine – the peeled material sheet is continuously rolled.



stacking system. Thanks to its flexibility, productivity and efficiency, the H 24 G is a highly profitable machine for users.

A further processing option is offered by the D 31 profile cutting machine, which expands the potential usages of the rubber granulate (fig. 7). Profile cutting makes it possible to give the material certain additional properties. Profiled mats made from permeable rubber granulate, for example, enable fluid drainage. These are therefore

often used in animal stalls to provide warm, safe, dry and comfortable flooring for horses and cattle. This is just one example of the potential end product applications that make the D 31 an interesting option as a pure profile cutting machine. Profile cutting is possible for soft materials with a density of 500 – 800 kg/m³. The profile depth is generally between 5 mm and 10 mm. Automatically readjusting bandknives ensure compliance with tight tolerances, along with a cast iron construction and specially formed, highly robust bandknife beams. The machine can also be combined with rolling systems.

The compact K 31 bandknife splitting machine represents a lower-cost alternative for splitting rubber granulate blocks. The

K 31/D 31 combined splitting and profile cutting machine offers additional processing flexibility. It makes it possible to use the same machine for profile cutting simply by replacing the feed rollers with profile rollers.

Fecken-Kirfel's R 24 bandknife peeling machine is ideal for producing sheets and foils made from rubber granulate cylinders, which are then used to make sport and leisure floorings, for example (fig. 8 – 10). It can be used to peel materials with a density of 500 – 1,100 kg/m³. A special variant, the R 34, is currently under development and will be able to process cylinders weighing up to 7.5 t. It will therefore be particularly well suited to achieving high production capacities. The upper working width limit is 2,000 mm. Depending on the material properties, the potential thickness of the peeled layers ranges from 1.5 – 20 mm. The length of the sheets can be selected in advance, while there is also an optional side trimming system. The R 24 and R 34 both feature a powerful grinding system for the blades. This

is important, as rubber granulate can still contain abrasive particles.

Opportunities in a growing market

Technological developments along the entire processing chain for rubber granulate products are unlocking new opportunities:

- Greater product quality
- Development of new products
- More cost-effective production
- Greater value creation

According to the specifications of the EU waste hierarchy, the proportion of re-

cycled old tyres is likely to rise further. The outstanding material properties of recycled rubber makes it an interesting option for many applications, particularly those that call for elasticity, heat retention and sound insulation. Businesses in the rubber industry are already using rubber granulate to produce fall safety panels, flooring, covers, wall systems and much more. Companies like tyre recycling specialist Salvadori and cutting expert Fecken-Kirfel are helping to further optimise these production processes. This leads to greater value creation that makes the sector even more interesting. Sustainable tyre recycling also makes a decisive contribution to preserving resources and protecting the environment.

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New reports and surveys on tire recycling

Weibold, an international consulting company specialized exclusively on tire recycling and end-of-life tire pyrolysis has recently published an in-depth survey of the technology and business of tire pyrolysis.

The consulting report titled "The Business of Tire Pyrolysis" is geared to managers who are planning a tire pyrolysis operation, operators of recycling plants contemplating expansion into new markets as well as investors evaluating a tire pyrolysis investment opportunity. It contains a detailed introduction to tire pyrolysis, taking into consideration the complete product spectrum (pyrolysis oils (TDO), syngas, and recovered Carbon Black (rCB)). A section about understanding the tire pyrolysis technology informs about the production process and describes the different equipment types. Besides, it provides a list of the major components to be included in a tire pyrolysis plant's process, including pre-processing, an overview of the markets for tire pyrolysis output products, an overview of the major players (technology providers and operators) around the world, summarised by global regions as well as general summary of the current and future trends and innovations in the fast-paced pyrolysis industry. This section will include high level

economic considerations based on industry successes.

Two other recent reports give insight into the technology and business of tire recycling and technologies, products and markets for molded goods made from recycled tire rubber. The consulting report "The Business of Tire Recycling" report contains a detailed introduction to tire recycling, taking into consideration the complete product spectrum (TDF, TDA, rubber crumb, powder and steel), an overview about rules, regulations and the current legal framework for tire recycling operators and the use of tire recycling derived products around the world as well as a section about understanding the tire recycling technology. It will inform about the production process and describes the different equipment types required to successfully recycle tires. Also included is a list of the major components necessary in a tire recycling plant's process, including pre-processing. Besides, a list of applications for a tire recycling

products and applicable markets and a general summary of the current and future trends and innovations in the fast-paced recycling industry and a list of major suppliers of tire recycling equipment are provided.

The consulting report "Opportunities in Tire-Derived Molded Goods Manufacturing" provides a detailed introduction to the production of molded goods and a section about understanding the molded goods production technology. This section will inform about the production process and describe the different equipment types, required to manufacture molded goods from recycled rubber granules, and includes information about the required raw materials and different production processes. The report also contains a recommendation for the major components to be included in the plant's process, and a list of applications (playground, equestrian and gym flooring, traffic & safety equipment, sound and vibration control,...), a general summary of the current and future trends and innovations in the fast-paced molded goods industry and a list of suppliers of molded goods equipment and relevant international players. All reports are delivered in PDF format at a price of EUR 2,500 each and can be ordered directly from Weibold.

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