ecoSAVE®

VACUREMA®
INLINE APPLICATIONS

Food Contact Approved Recycling.
With highly efficient decontamination BEFORE the extrusion process.

CHOOSE THE NUMBER ONE.

EREMA®
PLASTIC RECYCLING SYSTEMS

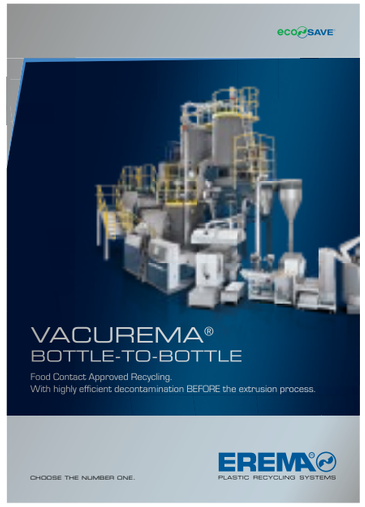
VACUREMA®

The modular technology.
For your application.

Different requirements call for different solutions. Modular solutions which are configured exactly for your particular application. VACUREMA® gives you this flexibility in impressive style. With this patented process you can count on the best established and most used technology for the recycling of post consumer PET bottle flakes, PET in-house waste and also PE-HD bottle flakes.

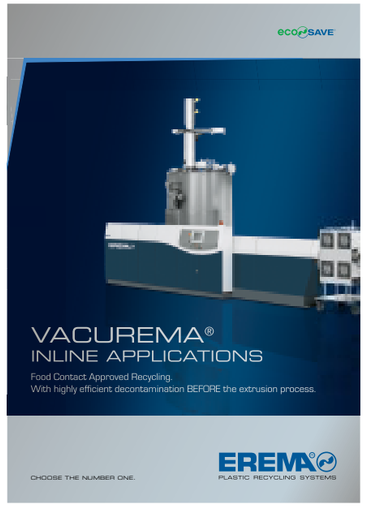
There are currently more than 150 VACUREMA® systems in use around the world, producing high-quality pellets and end products with an overall capacity of over 1 million tonnes. A wealth of experience which guarantees you maximum operational reliability of your system with flexibility in the application at the same time. In the form of a turnkey recycling solution which is customised for the requirements of your end product. One that also runs with the lowest possible energy and production costs.

VACUREMA® – one system, three application fields.



VACUREMA® Bottle-to-Bottle

VACUREMA® Pelletising



VACUREMA® Inline Applications

The decisive benefits for the customer:

1. Decontamination and ultrafine filtration for direct food contact – in accordance with the criteria of the FDA and EFSA:
Thanks to highly efficient and fast decontamination together with large area ultrafine melt filtration, the recycled pellets produced using VACUREMA® technology are approved for food contact.

2. Flexibility, variable input, ideal for mixing with virgin material:
Thanks to Counter Current technology, EREMA systems are extremely flexible and process a notably wide variety of input materials (in line with the end application) such as PET bottle flakes, ground amorphous skeleton waste/ edge trim, virgin material and mixtures with bulk densities of 250 to 850 kg/m³.

3. IV stability through vacuum treatment:
Despite varying moisture levels and different IV values in the input material, stable IV values are achieved through the patented pre-treatment method. This means, therefore, that input materials with higher material moisture levels can also be recycled.

VACUREMA® – the Number One technology

VACUREMA® basic principles

Extremely flexible with input material
Depending on the end application the system processes PET bottle flakes, ground amorphous skeleton waste/edge trim and virgin material (also in mixtures), i.e. bulk densities of 250 to 850 kg/m³.

Highly efficient food contact compliant decontamination
Thanks to the patented pre-treatment of PET flakes, IV increase and decontamination are fast, reliable and energy-saving. This means that FDA quality (among other things) can be ensured for the end products produced.

IV stability through vacuum treatment
Despite varying moisture levels and different IV values in the input material, stable IV values are achieved through the patented pre-treatment method. This means, therefore, that input materials with higher material moisture levels can also be recycled.

Melting under vacuum
The patented pre-treatment at raised temperature and in high vacuum before the extrusion process removes moisture and migration materials from the feedstock very effectively and in a stable process environment. This prevents any hydrolytic and oxidative decomposition of the melt in the extruder.

Low thermal stress
The very short extruder screw without additional extruder degassing reduces the thermal stress on the material through minimised dwell time.

Large area ultrafine melt filtration
EREMA filter systems have very large active filter surfaces. This enables filtration with up to 32 µm fineness at low pressure. The result is highly clean pellets.

Compact design
Due to their compact design, VACUREMA® systems require much less space than other systems.

Minimum production costs with ecoSAVE®
Thanks to integrated ecoSAVE® technology, VACUREMA® systems stand out through the lowest production costs of all systems on the market.

Smart Start principle
The plant's software-based process control system gives you extremely easy and reliable operation and premium user-friendliness including automatic start-up at the press of a button, fully automatic continuous operation, permanent monitoring for direct food contact (FCC) and the storage of all relevant process parameters.

Turnkey solutions
We deliver you turnkey systems with competent support from one contact for the entire recycling process: sorting – washing – decontamination – extrusion – quality control – end product.

Highly efficient decontamination

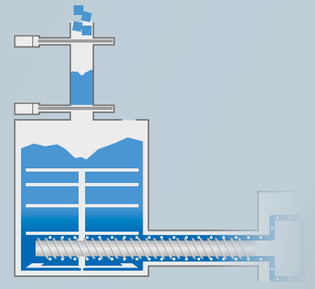
Surface to volume ratio for flakes is 2.5 times higher than for pellets

Bottle flakes
Pre-ground with 12 mm screen, average wall thickness approx. 0.1 to 0.4 mm

Pellets
Typical dimensions: diameter approx. 2.5 mm x 3 mm length or ball shape

EREMA vacuum reactor.
Flake decontamination BEFORE extrusion.

The patented pre-treatment at high temperature and in high vacuum before the extrusion process makes VACUREMA® technology considerably more efficient compared to the decontamination of pellets which have already been extruded.



Counter Current – a groundbreaking innovation.

counter® current

In the past the material inside the vacuum reactor turned in the same direction as the extruder - forwards. The patented Counter Current technology now changes the direction of rotation inside the vacuum reactor: the plastic material thus moves in the opposite direction to that of the extruder screw. A simple effect with a major impact. Thanks to the improved material intake the VACUREMA® system ensures even greater flexibility and operational reliability in the processing of an extremely wide variety of materials.

VACUREMA®
Inline Applications

From PET waste to the finished end product. With minimum energy requirements.

VACUREMA® Basic

VACUREMA® Basic technology has become firmly established worldwide in the field of inline production systems. And there is good reason why: with VACUREMA® Basic, PET secondary raw materials such as bottle flakes, ground amorphous skeleton waste, virgin material, edge trim and mixtures of them are recycled directly to make end products such as FDA-approved and EFSA-compliant thermoforming sheet, fibres and strapping. Your decisive benefit: the detour of pelletising is not necessary – which helps your added value. Besides these inline products VACUREMA® Basic is also used for the production of bottle-to-bottle compliant, ultrafine filtered repellets. The convincing arguments: minimised investment costs, lowest production costs and high product quality.

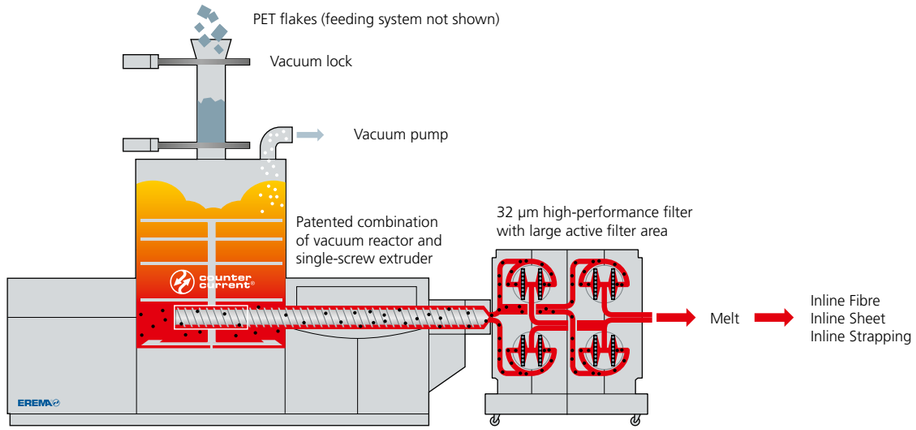
PET virgin material | PET washed flakes | PET skeleton waste | PET flat film

VACUREMA inline systems

VACUREMA® Inline Sheet
Direct production of PET flat film

VACUREMA® Inline Strapping
Direct production of PET strapping

VACUREMA® Inline Fibre
Direct production of PET fibres



How it works

The system consists in its key components of a **vacuum reactor** which is linked directly to a single-screw extruder. The vacuum reactor unit is filled with amorphous, washed PET flakes via a vacuum lock. Decontamination and perfect pre-drying of the processed material take place inside the vacuum reactor. From the reactor the **material is fed at a high vacuum into the intake zone of the single-screw extruder**. As a result no additional degassing ports are required on the extruder itself. This means that the VACUREMA® technology drastically **reduces the length of the extruder, reduces its energy consumption**, improves colour values (b value) of the processed material and keeps AA values to a very low level.

In the downstream high-performance fine filter the material is **filtered** with a **32 µm mesh screen width**. The filter system is equipped with a patented fully automatic self-cleaning system that enables long filter service life. **The now finished melt is then passed on to the downstream process for the production of end products such as fibres, strapping, thermoforming sheet or amorphous or crystalline pellets.**

Technical benefits

- **Flexibility with the input material** such as bottle flakes, ground amorphous skeleton waste, virgin material, edge trim and mixtures with virgin material with bulk densities of 250 to 850 kg/m³
- **Fast material and colour change** possible – no additional predrying or crystallisation required
- **Processing of PET melt** with stable IV values, minimum IV loss of 0 to 4 % and lowest energy requirements
- **Robust single-screw extruder** is insensitive to harsh contamination and delivers sufficient melt pressure for the decisive quality criteria of ultrafine melt filtration
- **High input material moisture content** up to 1 % and varying moisture permissible
- **Large-area ultrafine filtration** with minimum pressure fluctuations
- **FDA approved** (EFSA approval requested via customers and obtained)

Economic benefits

- **Low production costs** through specific energy consumption of 0.25 to 0.28 kWh/kg
- **Compact, space-saving design**

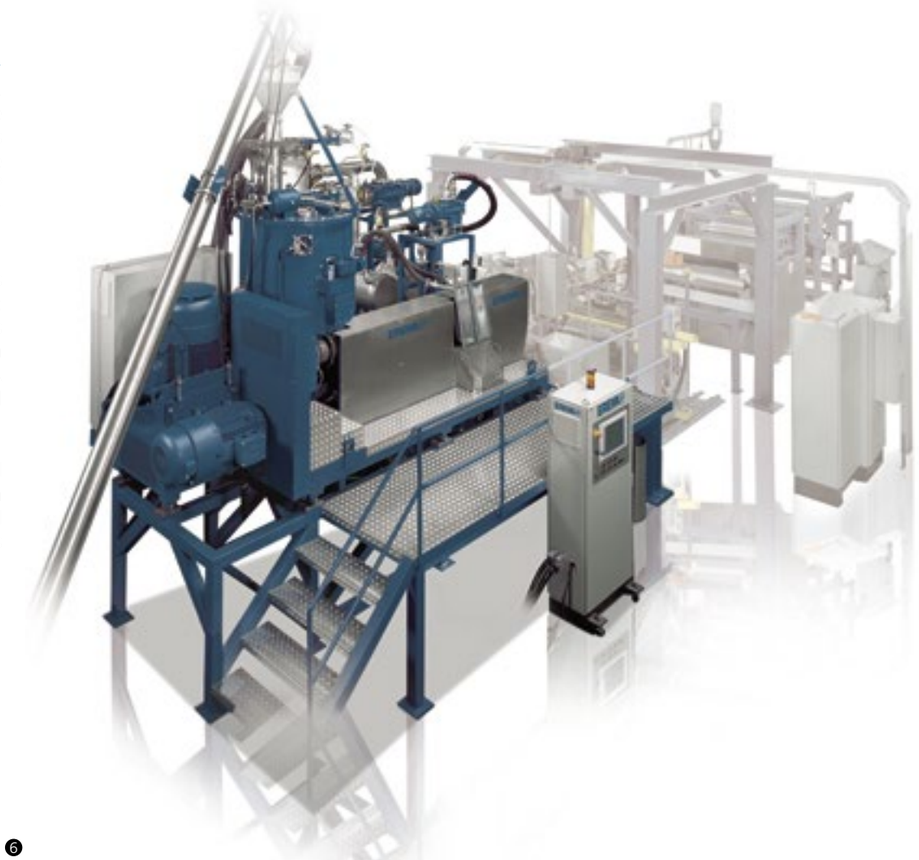
VACUREMA® Inline Sheet

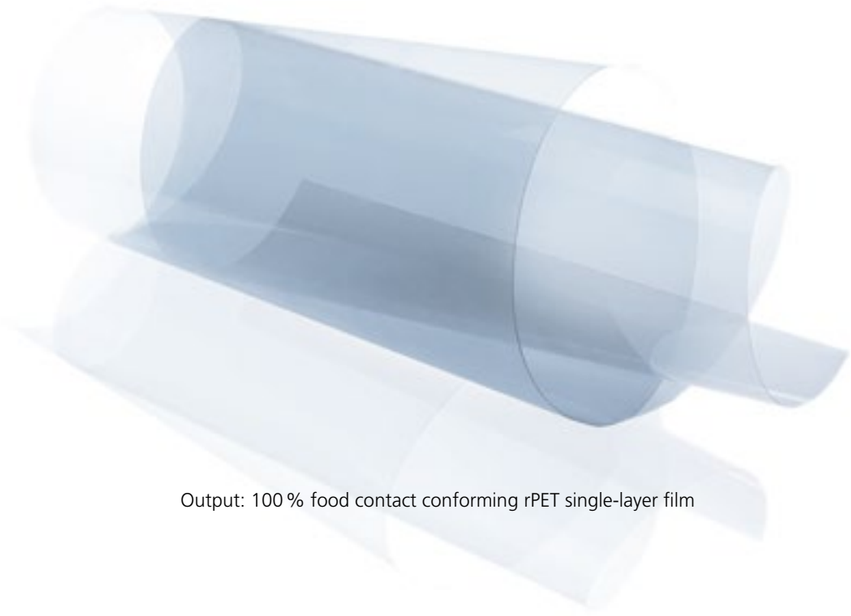
Direct production of PET flat film

The production of rPET film, besides bottle-to-bottle recycling, is a very inexpensive and profitable way of recycling the valuable secondary raw material PET bottle flakes – which requires professional technology. EREMA offers a complete inline production line for film which consists of a VACUREMA® Basic extrusion system plus a downstream processing step for thermoforming film production.

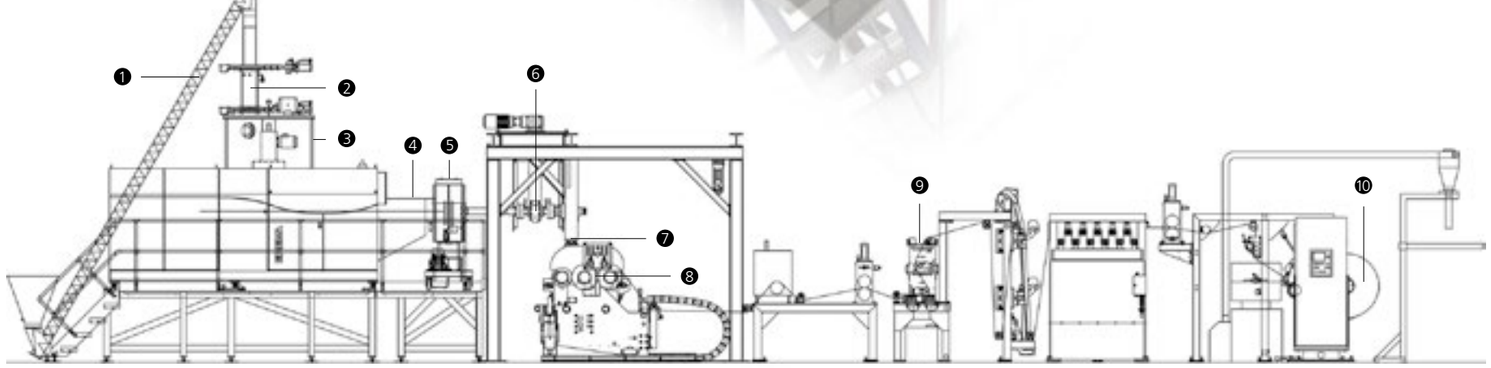
The flexibility of the VACUREMA® system is unrivalled in terms of the bulk density, shape and mixture of the input materials: you can process 100 % bottle flakes, ground amorphous skeleton waste, virgin material, edge trim and mixtures of them directly to make food-contact compliant single-layer films (FDA conformity in accordance with categories A-H/J, EFSA approval requested via customers and obtained).

In addition to this the VACUREMA® extruder can be combined with film production lines of many downstream system suppliers. This enables you to increase your value added through the direct production of high-quality end products without the detour of pelletising.





Output: 100 % food contact conforming rPET single-layer film



VACUREMA® Basic with thermoforming film production line

1. Conveyor screw
2. Vacuum lock
3. Vacuum reactor
4. Short extruder
5. Fully automatic, self-cleaning EREMA filter system
6. Melt pump
7. Flat film die
8. Nip calender roll
9. Anti-blocking system
10. Winder

The downstream process: thermoforming film production line

- Melt pump ensures constant pressure before the flat film die
- Extremely thin layers of 150 µm to approx. 1.8 mm possible, according to the downstream system
- Anti-blocking system for the treatment of film surfaces
- Edge trim is ground and returned to the VACUREMA® extruder

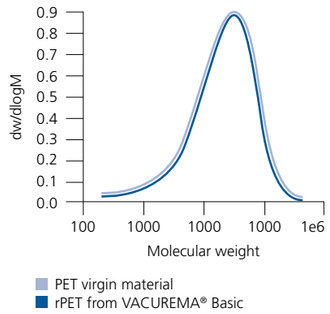
VACUREMA® Inline Strapping

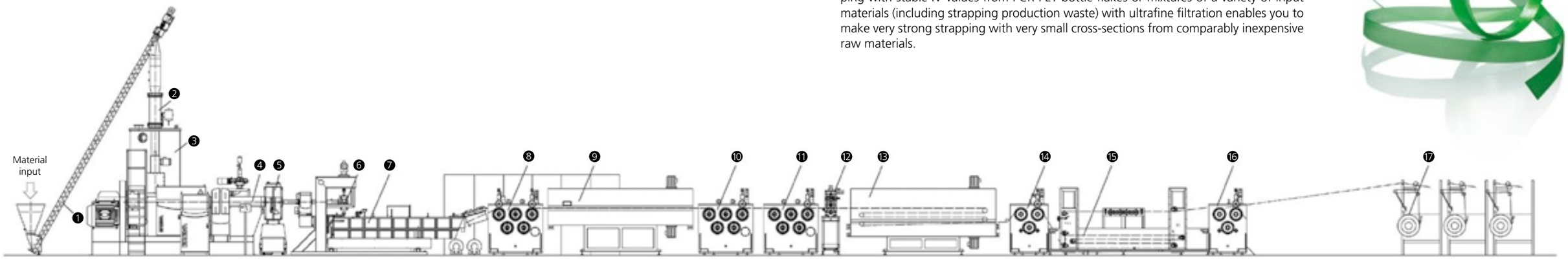
Direct production of PET strapping

Compared to steel strapping, PET strapping offers benefits in terms of safety, quality and handling. They are also very inexpensive to produce using PCR-PET flakes. This is handled by the high-performance, patented VACUREMA® extrusion system in combination with an appropriate downstream production line. This means that you can produce high-quality PET strapping using ultrafine filtration directly from 100 % washed post-consumer PET bottle flakes or mixtures with virgin material and from strapping production waste.

The overall energy consumption of the compact VACUREMA® strapping technology is unrivalled at 0.65 kWh/kg. Thanks to the stable and high IV values, consistently high operational reliability is also ensured. Plus, last but not least, the stable and very tight molecular weight distribution makes sure that the strapping has the required mechanical strength.

Comparison of molecular mass distribution





VACUREMA® Basic

Extrusion process

1. Conveyor screw (feeding)
2. Vacuum lock
3. Vacuum reactor
4. Single-screw extruder
5. Large area ultrafine filtration with fully automatic, self-cleaning EREMA melt filter system

Strapping process

6. Melt pump
7. Cooling bath
8. Slow godet
9. Stretching oven
10. First fast godet
11. Second fast godet
12. Embosser
13. Stabilisation oven
14. Stabilisation godet
15. Water cooling bath
16. Second stabilisation godet
17. Winder

The upstream process:

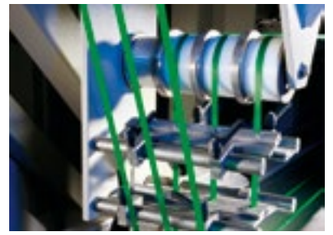
Proven energy-saving and patented VACUREMA® technology consists of a vacuum reactor and a directly linked single-screw extruder. An expensive, conventional predryer/crystallisation/extruder system is not required. This means that you can save up to one third of the entire specific energy costs.

Using compact VACUREMA® strapping technology for the direct production of strapping with stable IV values from PCR-PET bottle flakes or mixtures of a variety of input materials (including strapping production waste) with ultrafine filtration enables you to make very strong strapping with very small cross-sections from comparably inexpensive raw materials.

The strapping process (provided by Techno Plastic s.r.l.):

The Tight Strap 300 downstream production line from Techno Plastic is responsible for the strapping stage at the exit of the VACUREMA® systems. The material is routed to the extrusion head via two double spin pumps, then in four channels to the extrusion die and scaled to size as required. Next the material passes through several stages of thermal treatment, stretching, embossing, stabilising, cooling and winding.

The end product stands out through excellent dimensional stability and first-class mechanical properties. The flexible, customisable Techno Plastic technology was developed on the base of many years of experience and is designed for extrusion lines for strapping and monofilaments.



VACUREMA® Inline Fibre

Direct production of PET fibres

Flexible VACUREMA® technology is also used with success as an inline application in the direct production of PET fibres from 100 % bottle flakes and mixtures with virgin material. The large area ultrafine filtration minimises the impact on the recycling process thanks to low pressure fluctuations when backflushing or changing screens The very tight and stable molecular weight distribution which is ensured with the VACUREMA® system is particularly important for the production of high-strength fibres.

MPR®

Multi Purpose Reactor for the retrofitting of existing PET extrusion systems

Decontamination, drying, dedusting and crystallisation of PET in a single step – made possible by the Multi Purpose Reactor – MPR®. The result in combination with a PET extruder is an end product that fulfils the requirements for direct food contact in accordance with categories A-H/J of the FDA and EFSA.

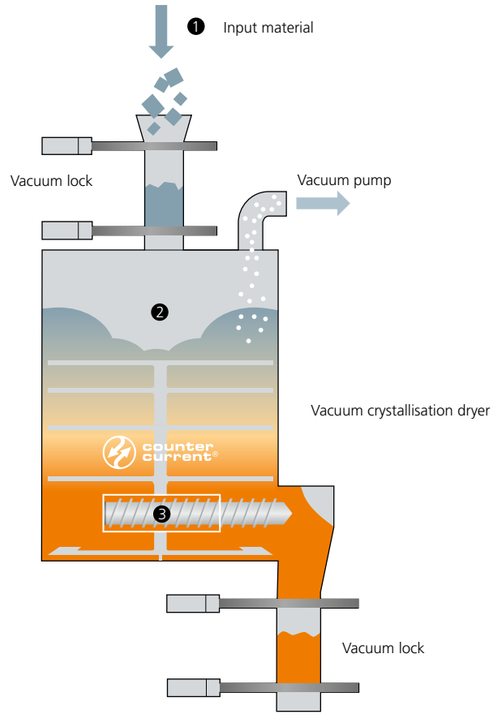
With the patented MPR® technology EREMA counts on crystallisation dryers that have proven their merits time and time again as components of the VACUREMA® PET extrusion systems. Washed PET bottle flakes, ground PET flat film waste and virgin PET material (plus mixtures of them) can all be used as input material.

The Multi Purpose Reactor is also available as a stand-alone solution. Its end product: food contact compliant, dust-free flake.

How it works

Feeding ❶ is automatic and continuous via a vacuum lock above the **reactor** ❷. Inside the reactor the material is heated by friction alone. **In the case of high temperatures and high vacuum the drying process is accelerated.**

Additionally these conditions ensure **effective decontamination and crystallisation**. A short **discharge screw** ❸ then conveys the hot material out of the reactor. The material now goes to the **melt extruder** ❹.



❹ Individual connection to conventional extrusion systems

Technical benefits

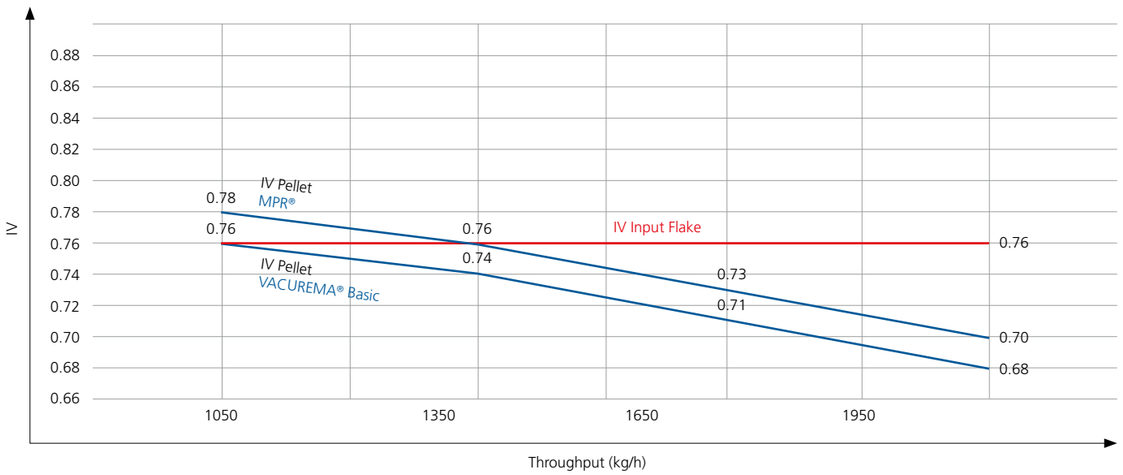
- High vacuum and high temperature for **effective decontamination**, drying and crystallisation of PET
- **Bulk density increase** of up to 80 % possible for PET flakes and flat film waste
- **Food contact grade end** product (such as e.g. flat film) in accordance with FDA categories A-H/J, EFSA and others
- **Possible to process input materials with fluctuating residual moisture and bulk density**
- **Predrying to below 100 ppm moisture**
- **Slight increase of IV value possible**
- **Processing in high vacuum** achieves better flake colour results
- **Dust-free flakes –** no gelling problems
- **Materials with a low melting point** can be processed without bridge formation (e.g. PET/PE, PLA, PET-G)

Economic benefits

- **Easy to retrofit** on existing PET extrusion plants
- **Energy requirement less than 0.1 kWh/kg**
- **Integrated ecoSAVE® technology** reduces energy consumption by up to 10 % as well as production costs and CO_2 emissions as a result
- **Compact, space-saving design**

IV values attainable in repellets – variable according to chosen throughput

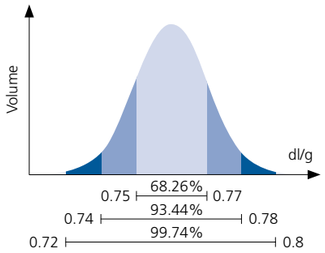
IV increase according to plant type and set throughput; example based on VACUREMA 2018 T:



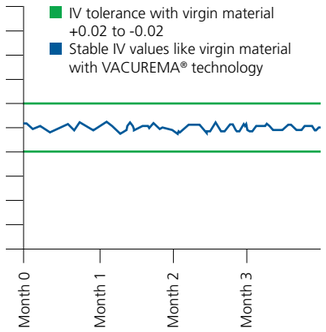
VACUREMA® quality control

IV values in real time
The continuous online IV measurement, combined with the fully automatic plant control system, means you can influence processing parameters such as throughput, processing temperatures, etc.

Input IV – typical distribution

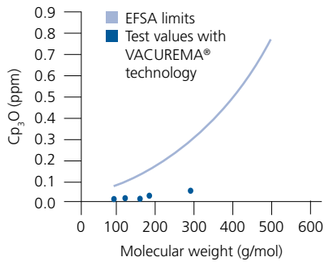


Output IV – with VACUREMA®



FCC – Food Contact Control – automatic operation mode
The parameters for direct food contact compliance are monitored and archived continuously in the recycling process on all VACUREMA® systems. Food Contact Control (FCC) supervises the recipe data stored.

This enables the flexible change to the process parameters required for the production of the respective recyclate. If levels go beyond defined limits an alarm is triggered automatically and (optionally) material flow is diverted away from the production line. This guarantees traceability.



Approvals for the food trade

	VACUREMA® Basic	MPR®
Approved for direct food contact by/in: *	US FDA (category A-H & J), Austria, Switzerland, Canada, Brazil, Argentina, Uruguay, Paraguay, etc.*	US FDA (category A-H & J)
Fulfils the following decontamination requirements/migration threshold specifications	EFSA approval requested via customers and obtained	
	European ILSI guidelines	
	German BGBI guidelines	

*Other countries to follow further to applications by the respective VACUREMA® users.

Technical data VACUREMA® PET extrusion systems

Systems available	max. output	output for an IV change of 0 to -4 %
VACUREMA Basic 906 T	200 kg/h	150 kg/h
VACUREMA Basic 1007 T	300 kg/h	190 kg/h
VACUREMA Basic 1108 T	400 kg/h	250 kg/h
VACUREMA Basic 1109 T	500 kg/h	300 kg/h
VACUREMA Basic 1310 T	600 kg/h	400 kg/h
VACUREMA Basic 1512 T	900 kg/h	600 kg/h
VACUREMA Basic 1714 T	1000 kg/h	850 kg/h
VACUREMA Basic 1716 T	1450 kg/h	1100 kg/h
VACUREMA Basic 2018 T	2000 kg/h	1350 kg/h
VACUREMA Basic 2021 T	2600 kg/h	1800 kg/h
VACUREMA Basic 2321 T	2900 kg/h	2000 kg/h
VACUREMA Basic 2625 T	3300 kg/h	2500 kg/h
VACUREMA Basic 2628 T	4000 kg/h	3000 kg/h

For the downstream process: system sizes and output capacities on request

Technical data MPR®

Systems available	Average output capacity in kg/h*	
	min.	max.
MPR 1500/120	500	900
MPR 1700/120	1.000	1.500
MPR 2000/120	1.300	2.000

*) Depending on moisture content and required decontamination

The specialists in plastic recycling systems.

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More questions?
We would be pleased to answer them!
Your EREMA advisor will be pleased to attend to your request personally and quickly. If you are interested in a demonstration or a test run with your specific material it would be a pleasure for us to make an appointment and welcome you to our EREMA Customer Centre at the headquarters in Ansfelden, near Linz in Austria.

We look forward to seeing you at EREMA!

For worldwide representatives please visit www.erema.at

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VACUREMA®
INLINE APPLICATIONS

English

CHOOSE THE NUMBER ONE.

EREMA®
PLASTIC RECYCLING SYSTEMS