KRONES MetaPure
The bottle-to-bottle PET recycling plant
Pure technology
Going full circle

Nowadays, PET bottles are the global number one in beverage packaging. More than 400 billion plastic bottles come on the market every year and PET is becoming increasingly valuable as a recyclable raw material used in the production of beverage bottles. Thus, it is important that all of the production steps applied for the manufacture of your PET bottles are made sustainable for the future.

The gentle treatment of resources and economical use of materials are a must when it comes to sustainable production. Valuable raw materials such as PET must be processed as efficiently as possible while still tapping into every way of saving costs. The PET manufacturing and production process allows for the application of a sustainable approach which can optimally combine environmental awareness and cost effectiveness: the bottle-to-bottle recycling concept.

The KRONES MetaPure bottle-to-bottle recycling plant efficiently recycles used PET bottles — and the recyclate is then reused in the food and beverage industry as recycled PET (rPET). The complete process comprises the cleaning of the used PET bottles and the treatment of the recyclate so that the end product — which could come in the form of flakes, pellets or preforms — can meet the highest quality requirements after the recycling process. European and American certificates (e.g. FDA), and a number of different corporate approvals, all confirm the high quality of the recyclate for direct use in containers which come into direct contact with foodstuffs.
PET recycling is important for a number of different user groups. Converters, bottling plants or disposal companies are all involved in the processing of the raw PET material at different positions in the material cycle. With the MetaPure recycling plant, KRONES can provide them with the right approach to meet their varied requirements. Thus, a homogenous system in which the main components – the washing module and decontamination module – are optimally tuned to one another is now available from a single source.

### Converters
- The recycled PET used for bottle-to-bottle applications can be seamlessly integrated in the production process of existing lines.
- The use of rPET in the manufacture of preforms has economic and ecological benefits. Fully-automatic work steps shape the preform manufacturing process. The recycled goods are handled with a high level of automation.

### Bottling plants
- The returned PET materials are recycled in clean and reliable sequences.
- With an optimal balance of energy and costs, rPET is an interesting option for PET bottles.
- Only the highest quality of recylcate can be used for bottle manufacture. The KRONES process is reliable and certified.

### Recyclers
- When PET is recycled in disposal companies, the aim is to have easy-to-manage sequences which can handle high capacities.
- High outputs are imperative if a disposal business is to be profitable. Speed and high performance are important factors to be considered when processing the PET won from the returned bottles.
- New processes allow new clientele to be reached. PET bottle manufacturers can be supplied with rPET.
Method of operation

The KRONES MetaPure PET recycling plant comprises two modules and the optional front end. These provide the individual work steps needed for the manufacture of rPET. In the front end, the PET bottles are firstly separated, undergo basic cleaning to remove large dirt particles and are then shredded. In the subsequent washing module, the resulting PET flakes first undergo dry pre-cleaning following which any remaining labels and adhesives are completely removed in the caustic cleaning process. The next step is the separation of the PO lid materials from the heavy PET flakes. After a multi-stage post-cleaning sequence, the clean PET flakes pass through a drying process. Any individual pieces of metal remaining are then removed using an all-metal separation sequence. The aim of the decontamination module is to remove all of the harmful substances contained in the PET and to create rPET which is suitable for use with foodstuffs. After a gradual pre-heating of the flakes, a vacuum reactor is used which decontaminates the flakes at temperatures below their melting point and rids them of any migrated materials. In this phase, the IV value is increased to meet the specific requirements. Next, individual fine parts are sieved out and any coloured flakes or metal particles still remaining are removed. Once this has taken place, a decision can be made about which end product needs to be created. The flakes are either used directly or are made into pellets. The decontaminated flakes can also be used if the material is to be supplied directly for preform extrusion.

<table>
<thead>
<tr>
<th>Plant type</th>
<th>Overall line</th>
<th>Washing module</th>
<th>Decontamination module</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Bottle-to-bottle</td>
<td>Recycling of PET bottles to form PET flakes or pellets for use in the food industry</td>
<td>Recycling of PET bottles which will not come into contact with food</td>
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<tr>
<td><strong>Intended use</strong></td>
<td></td>
<td></td>
<td></td>
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<td></td>
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<tr>
<td><strong>Output</strong></td>
<td>500 kg per hour up to 3,000 kg per hour</td>
<td>500 kg per hour up to 3,000 kg per hour</td>
<td>500 kg per hour up to 1,500 kg per hour</td>
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<tr>
<td><strong>Space requirement</strong></td>
<td>900 – 3,000 m²</td>
<td>200 – 600 m²</td>
<td>250 – 350 m²</td>
</tr>
</tbody>
</table>

* Several modules can be combined to achieve higher outputs
A high efficiency in the washing module of the recycling line is supported by the work sequences which precede it so that only the lowest possible amount of foreign particles is present in the washing module and only a flow of clear bottles is processed there.

**Pre-sorting**
- Removal of foreign particles from the volume of separated bottles
- Automatic, semi-automatic or manual work steps
- Use of individual units based on the degree of contamination on the supplied bottles: Bale breaking, separation of solid materials (sand, stones, glass), detection and rejection of coloured PET bottles and foreign plastics. Separation of ferrous material and non-ferrous metals.

**Dry label separation**
- Removal of paper labels, plastic labels and sleeves without consuming any water
- Avoidance of paper pulp remains in the front end and washing module
- High level of plant cleanliness

**Size reduction**
- Volume reduction
- Enlargement of the product surface for improved cleaning and removal of foreign materials
The washing process provides the basis for the successful recycling of PET bottles. Only if the PET flakes are of the highest quality will this guarantee that the decontamination process will be reliable and yield optimal values. In the washing module, shredded flakes undergo a dry cleaning process to remove any loose contamination. Nozzles and mechanical friction then remove any dirt particles which have been carried along. Residual labels and adhesives are then removed during the subsequent caustic treatment process. Because of the difference in their specific weights, the PO lid materials can be separated from the heavy PET flakes in a float-sink classifier during the float-sink sequence. Multi-stage post-washing with hot water is followed by a drying process. Finally, any individual pieces of metal remaining are then removed using all-metal separation.
The entire washing process integrates the return and recycling of used media. This includes the continuous recycling of the water used for washing using the water cascade and the two-stage caustic filtration process performed by the Parcival filtration system.

Water cascade
- Flooding of flakes with fresh water in the post-rinsing basin and subsequent use of this water in the float-sink separator and in the pre-rinsing basin
- pH-monitored waste water which is free of solids is discharged
- Highly efficient procedure as the fresh-water current flows opposite to the direction which the PET flakes are conveyed.
- Continuous flow and consistent water renewal in the basins.

Parcival filtration system
- The washing caustic is recycled through several disk filters operating parallel to one another. These filters have variable selectivity and membrane filtration using the cross-flow procedure.
- Separation of the smallest sizes of dirt particles, dissolved colour particles or adhesives
- Continuous caustic loop with permeate return
The decontamination module

In the decontamination module, washed flakes are turned into food-grade recyclate. The cleaned material is heated gently and evenly in a heating conveyor. It is then dried and regulated to its final decontamination temperature which is considerably lower than the PET melting temperature. This has a significant benefit from an energy viewpoint when compared to the processes used in pellet manufacture which generally require higher temperatures. The actual cleaning process to remove migrated content takes place in the vacuum reactor of the KRONES MetaPure recycling plant. In this phase, the IV value is increased to meet the specific requirements. The result is food-grade recyclate which, depending on the layout of the system, can be provided as flakes, pellets or preforms.

A thick-thin separator of body and neck pieces can be integrated as an option prior to decontamination. This ensures that only PET material with an even material size and thickness is fed into the decontamination process and that the PET flakes in the decontamination reactor are all treated under the same conditions.

12. Vacuum reactor / SSP
Stripping of migrated content and setting of the IV value. The flakes are now of food-grade standard.

9. Buffer silo
For storing the washed flakes prior to further processing.

13. Pelletising with melt filtration
For converting the PET flakes to PET granulate.

11. Second heating conveyor
Second tempering step of flakes to process temperature.

10. First heating conveyor
Flake tempering.
Automatic processes and quality surveillance

The reliable observation of the process parameters plays an essential role in the success of bottle-to-bottle recycling. The recycled material must always be of food-grade quality before it can be released for use with foodstuffs.

Each module in the KRONES MetaPure PET recycling plant has its own line control system which is connected to the master system controller. This means that the washing module, decontamination module and the front end connected to the overall media supply can be operated with total independence. The process information is transferred between the modules via the central system controller. Here, specified system parameters are compared and any deviations can be traced back in the overview.

Quality “traffic light”

- Red-green signal for checking the production quality at a glance from central positions in the line and on the monitors for each module
- Pre-programmed and fully-automatic adjustment of the production parameters

Plant operation

- Operator panel with realistic 3D display of all machines
- Intuitive user guidance on the touch-panel
- Simple retrieval of the operating status and the process parameters
- Ergonomically optimised operating situation
Your benefits

- **Food-grade PET flakes and pellets**
  The KRONES MetaPure recycling plant produces food-grade PET. With it, returned PET bottles can be reused to make new PET bottles. The use of recyclate has clear economic and ecological benefits.

- **Flakes, pellets or preforms**
  The KRONES procedure gives you the freedom to decide which end product you wish to create. The decontamination step required for the material’s later contact with foodstuffs is only ever performed with flakes. Afterwards, the flakes are either used directly or are made into pellets. Another extremely energy-efficient use for the decontaminated flakes is the direct feeding of the material into an extrusion process – one highlight in the treatment of rPET which KRONES can offer with the MetaPure PET recycling plant.

- **Recognised procedure**
  European and American certificates (e.g. FDA) and renowned companies have approved the KRONES recycling process for use in the food and beverage industry.

- **Compact system**
  The system modules have been designed as independent units which you can also connect to existing production areas. Different modules are available depending on the output.

- **Efficient use of energy**
  Short treatment times and an efficient energy consumption are achieved thanks to the gentle treatment of the flakes in the vacuum reactor below the PET melting temperature.

- **Variable pre-sorting sequences**
  Individually combinable pre-sorting lines ensure that the fed material remains at the highest quality – for manual, semi-automatic or fully-automatic line concepts.

- **High media service life**
  The caustic recycling with the Parcival filtration system and cascade guidance of the fresh water in the washing process allow for a long caustic service life and an efficient consumption of chemicals and fresh water.

- **KRONES – manufacturer of complete recycling plants**
  The KRONES MetaPure PET recycling plant is a homogenous system available from a single source, in which the washing module and decontamination module are optimally in tune with one another and which operate with an impressively low energy and time expenditure.

- **Promoted by the EU**
  This resource-saving procedure is managed in the “Eco-Innovation” EU programme and contributes to the achievement of the 20-20-20 climate targets. These targets defined by the European Union include a negotiated environmental agreement by the member states to reduce the consumption of primary energy by the year 2020. The aim is to achieve a 20% reduction in the emission of greenhouse gases, increase the use of renewable energy to 20% and increase energy efficiency by 20%.
We do more.

IT solutions

The SitePilot modular system includes IT solutions which we developed especially for the beverage and food industry. Whether you want to increase the utilisation of your line capacity, monitor product quality, or make spare parts handling more efficient: With SitePilot, you will always get the best result.

Lifecycle Service

Your company is unique – why be satisfied with conventional solutions? The KRONES Lifecycle Service will support you and your production also after the purchase of new machines. These are services which are individually tailor-made to suit your products and location.

enviro

High-performance technology with low consumption of resources offering safety for humans and the environment – this is all guaranteed by the enviro sign. TÜV SÜD (technical control board) as an impartial assessor has confirmed, that the enviro method leads to energy- and media-efficient and environment-compatible machines and lines.

KRONES Service Line

You need support with a technical problem? Or you have an urgent question about your line? No problem: We are just a call away from you. Dial +49 9401 708090 to get quick and straightforward assistance – in several languages around the clock!

KRONES Academy

Make your colleagues high performers: The training of KRONES Academy provides first-hand trade information proven in field. You will find the suitable know-how package for almost any field and hierarchy level ranging from technical courses to management training.