

# GEA CENTRIFUGES

Field-tested technologies and customized solutions  
for the fruit-processing and juice industries.





#### More than a thirst quencher.

Natural product drinks, such as fruit and vegetable juices have become very popular. The industry has reacted to increasing demand by producing a wide variety of products that make our drinks shelves look very colorful. Not every product needs to be organic, but they are all expected to be healthy and tasty.

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# WELL-BEING DEMANDS NOTHING BUT THE BEST.

The dedicated juice industry counts on most sensitive product handling and minimum product losses during the process.

Turning fruits and vegetables into premium juices – this objective is at the heart and soul of each dedicated juice producer all over the world. Each process step has been carefully monitored so that the valuable product is not exposed to harm risks.

Careful product handling has been the tradition of juice producing industry for centuries. Along with it goes the maximum optimization of the individual process steps by using the most sophisticated machinery. Centrifugal separation plays a major role in this continuous optimization cycle. It enables processing of the trub in its freshest state and juicing of the fruits and vegetables immediately after receipt which helps a lot during production in high season. Centrifuges and decanters separate and clarify fast and efficiently with optimum yield.

Sophisticated technical details like the hydrosoft feed or the hydrohermetic sealing allow for the production of premium juice. Juicing fruits and vegetables by a decanter means getting high quality juices from the very start to the very end – top quality all over the process.

Centrifugal technology also helps juice producer to produce at very economical rates – making more juice, in less time, with less effort and investment. Centrifuges and decanters in the juice production – multipurpose technologies that pay off.



## The advantages at a glance

- Minimized oxygen pick-up during extraction
- Favourable influence on quality
- Production of clean, characteristic juice
- No impairment of taste
- Higher yield
- Better juice clarification
- Substantial extension of filter life and hence significant savings of filter aid (layers and kieselguhr)
- Savings in labour time
- Timely separation of the fining trub (shortening of the fining time)
- Lower space requirement (storage capacity)
- Fast production of ready-to-sell single strength juices

# A REAL BOOST TO YOUR PROFIT.

A healthy lifestyle is more of an issue than ever these days. This explains in particular the success of superfruits such as acai, goji berries, acerola, cowberries, cranberries and buckthorn berries as well as NFC juices. Juices from these fruits also display a great deal of nutritional values due to their high proportion of antioxidants.

These innovative products have resulted in new requirements for the industry. Besides high yields, which are still an absolute priority, new features have gained importance

such as easy cleanliness, closed process management for maximum hygiene, processing with minimized oxidation and particularly rapid and yet simultaneously gentle juice extraction. GEA supplies customized processes and process lines for these and many other challenges.

Centrifugal separation technology is still the key of cost-conscious production of high quality juice. It ensures optimum initial clarification before filtration, with minimal loss of juice. GEA centrifuges provide the right concept for every

requirement, depending on whether a high yield or maximum throughputs are required. The GEA frupex® method shows how it is possible to combine a gentle manufacturing process with maximum economy.



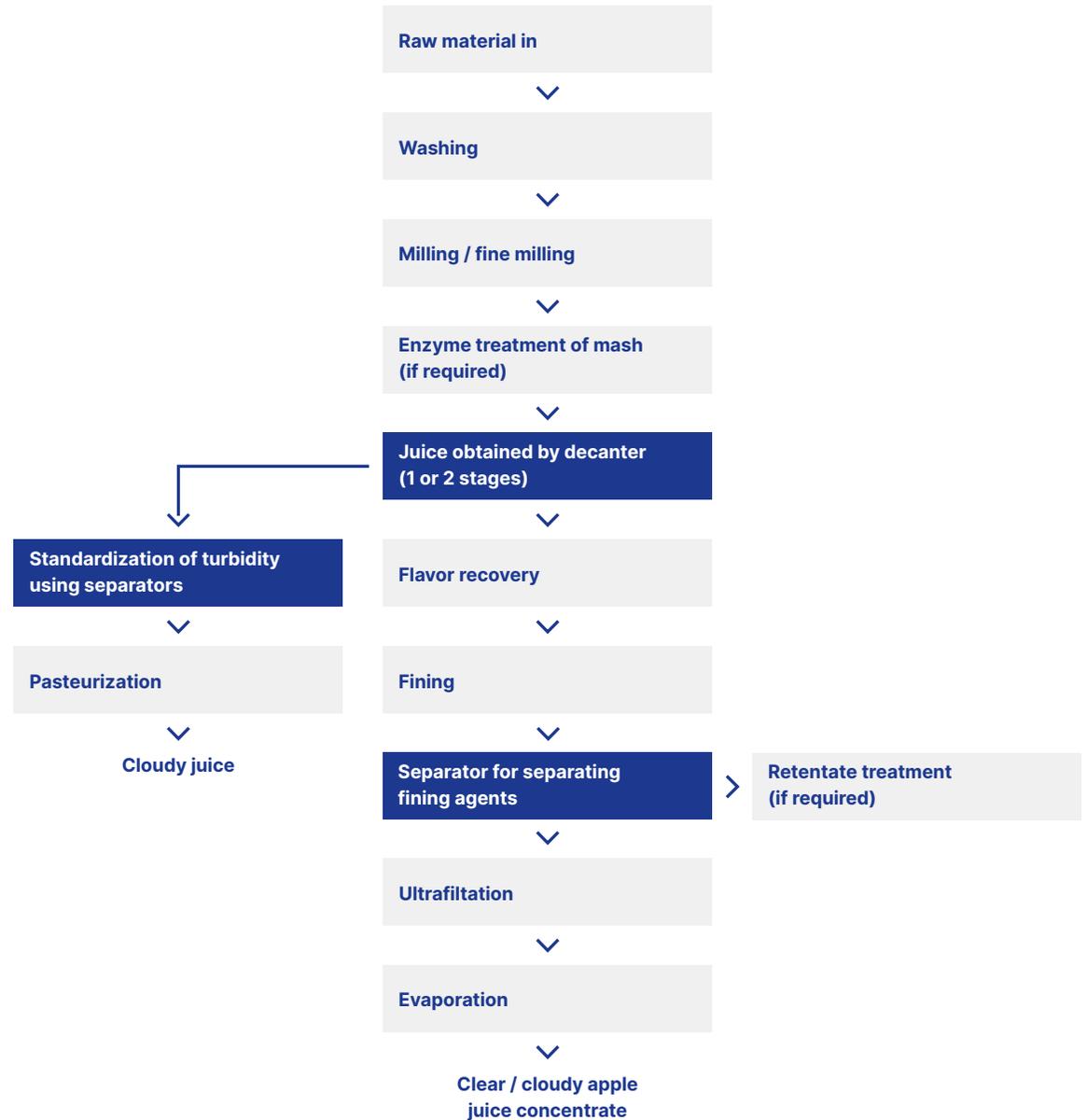
No limits to your business.

Nearly every fruit and vegetable can be processed:

- pome fruits
- berries
- stone fruits
- tropical fruits
- all kind of vegetable

# FRUIT JUICES

Production of apple and pear juice by centrifugal separation technology.



The flow chart shows applications for centrifugal separation technology in the different processing stages from the apple to the end product. Clear concentrate dominates in terms of quantity, but the production of “natural cloudy” juices with and without concentration (single strength) has been established.

Decanters have been used to extract the juice and for processing of retentate. For clarifying / fining the juice a self-cleaning separator is used.



# HIGH QUALITY JUICE FROM START TO END WITH GEA DECANTER.

Production of apple and pear juice by centrifugal separation technology.

## **Extracting the juice**

The first important process technology step in the production of apple juice is to mill the apples. Particle sizes from 5 to 8 mm diameter are the objective for presses, 3 to 5 mm for decanter use.

The following properties are required of a system to mill whole apples:

- Closed system to prevent oxygen pick-up. This significantly reduces foaming and consumption of ascorbic acid.
- Possibility to adapt the particle size with regards to the ripeness and characteristics of the fruits. If the pieces of apple are too big, this will result in a lower yield; if they are too small, they will increase the colloid content of the juice and make phase separation more difficult.

### Milling Systems

Our milling system is best operated with an eccentric screw pump that includes a pre-milling feature inside the pump. For further milling the fruits will be fed into a macerator which allows to adjust the particle size. This entire GEA system is closed to prevent oxygen pick-up.

A buffer tank is not needed: The pump is controlled by the level of the hopper which is installed above the eccentric screw pump.

Following milling, further treatment of the mash depends on operational objectives.

The variants below are found in the field:

- Direct juice extraction without any mash treatment, usually to produce single strength juices.
- Addition of enzymes to the mash in the cold state
- Addition of enzymes to the heated mash (approx. 45°C)
- Total liquefaction

In practice, these options are combined with addition of ascorbic acid to prevent browning.

### Producing “natural cloudy” apple juice (single strength)

The consumer expects in “natural cloudy” juices no settlement of the trub. The suspension stability and thus the turbidity of the juice depends on:

- Particle size
- Particle density
- Serum viscosity
- Particle shape
- Particle charge

### GEA Decanter with varipond to adjust cloudiness

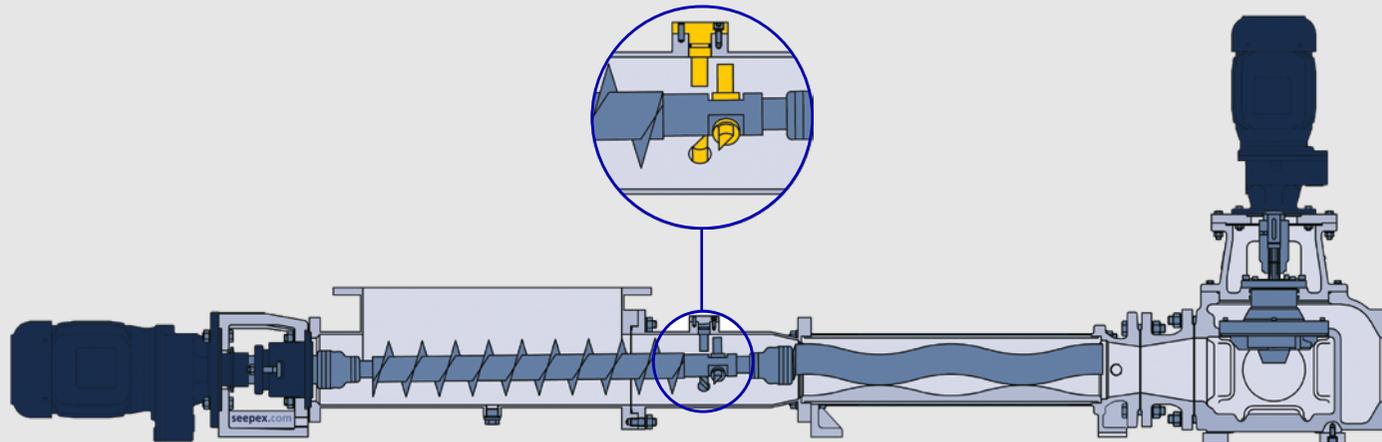
The flexible milling system in combination with the GEA decanter ensure to meet the customers requirements on cloudiness. The particle size can be adjusted to the optimum – the GEA decanter allows due to its varipond system to adjust exactly to the size of particles to be removed.

### GEA Decanter for rapid processing

The entire system stands for a very rapid processing time from milling to extracting and direct pasteurization for ready-for filling-juice. Despite advantages in yield this also contributes to the production of a high quality juice.

#### Apple juice extraction by decanter at different outputs

Output	Dry substance in discharged pomace	Residual sediment in juice	Yield
8 – 12 m <sup>3</sup> / h	22 - 26	0.4 - 1.0	70 - 76 %



Eccentric screw pump with force-feed and connected macerator.

# More yield with the two-stage GEA frupex® processing

Clear apple juice is usually produced by rediluting concentrate. To this end, apple juice is produced and then evaporated to the desired Brix content of 70 to 72 °Brix following fining and filtration. In the **frupex**® process, the apple mash is juiced in 2-stages using decanters. The first decanter stage corresponds to the production of “natural cloudy” juices. Rapid processing (with or without the use of enzymes) creates a premium juice of uniformly high quality.

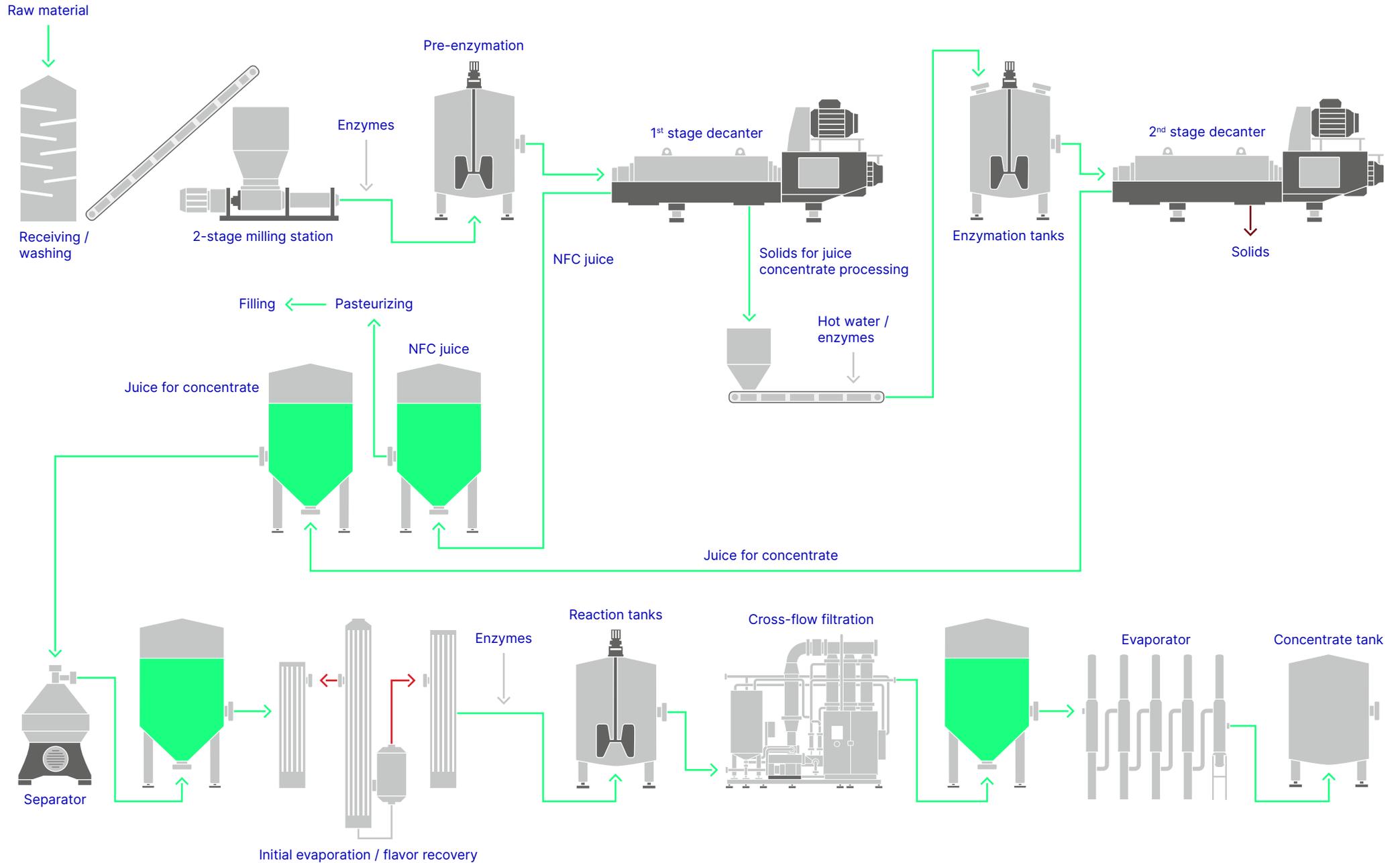
The optimum dried pomace coming from the first decanter stage will be immediately diluted by vapour condensate from the evaporator at a temperature of about 45 to 50 °C. Following a reaction period, the diluted pomace is again extracted using a second decanter. Adding enzymes during the reaction period increases yield and throughput. The second juice does not have the quality of the primary juice and is not usually suitable for the production of cloudy juices. Ideally, it is processed into clear concentrate.

The process graphic shows a **frupex**® line with reaction tanks for degradation of pectin by enzymes. The downstream separator is for subsequent clarification. The introduction of a second stage extraction by decanter is the ideal solution to gain optimal yields out of the fruits.

Fruit juice producers reckon that an increase of yield by 15 to 20 percent on the same amount of ingredient can be achieved, thus resulting in a fast pay-off time and additional turnovers at stable capacities.



# GEA frupex® line for concentrate / NFC juice





Decanter GEA ecoforce gMaster CF 3000

The outputs quoted are based on a yield of 90 percent and more for mashes to which enzymes have been added.

#### Example concepts for frupex® lines

Output	1 <sup>st</sup> stage	2 <sup>nd</sup> stage
3 – 4 m <sup>3</sup> /h	gMaster CF 3000	GCE 305
4 – 7 m <sup>3</sup> /h	gMaster CF 4000	gMaster CF 3000
11 – 15 m <sup>3</sup> /h	gMaster CF 6000	gMaster CF 4000
18 – 25 m <sup>3</sup> /h	gMaster CF 8000	gMaster CF 6000

#### Performance data for decanter extraction of juice from apples

The table summarizes the performance data for decanter extraction of juice from apples. In addition to the mechanical parameters, the degree of ripeness and temperature of the apples and the addition of enzymes play key roles. The values relate to use in the first stage of the frupex® process. Output is about 25 percent lower in the second stage.

#### Decanter output when extracting juice from apples

Decanter type	Fresh fruit, no enzymes added	Stored fruit, no enzymes added	Stored fruit, enzymes added	Total liquefaction
GCE 305	1 – 2 m <sup>3</sup> /h	0.8 – 1.5 m <sup>3</sup> /h	2 – 3 m <sup>3</sup> /h	2 – 3.5 m <sup>3</sup> /h
gMaster CF 3000	4 – 5 m <sup>3</sup> /h	2 – 4.5 m <sup>3</sup> /h	5 – 6 m <sup>3</sup> /h	5 – 6.5 m <sup>3</sup> /h
gMaster CF 4000	6 – 7 m <sup>3</sup> /h	4 – 6 m <sup>3</sup> /h	6 – 8 m <sup>3</sup> /h	6 – 8 m <sup>3</sup> /h
gMaster CF 5000	8 – 11 m <sup>3</sup> /h	7 – 9.9 m <sup>3</sup> /h	9 – 12 m <sup>3</sup> /h	10 – 14 m <sup>3</sup> /h
gMaster CF 6000	13 – 15 m <sup>3</sup> /h	10 – 12 m <sup>3</sup> /h	14 – 16 m <sup>3</sup> /h	16 – 20 m <sup>3</sup> /h
gMaster CF 7000	21 – 26 m <sup>3</sup> /h	13 – 19 m <sup>3</sup> /h	23 – 28 m <sup>3</sup> /h	23 – 28 m <sup>3</sup> /h
gMaster CF 8000	22 – 28 m <sup>3</sup> /h	14 – 20 m <sup>3</sup> /h	24 – 29 m <sup>3</sup> /h	24 – 30 m <sup>3</sup> /h

#### Yield

The often expensive raw material requires that juice be obtained economically in line with the associated requirement for quality. The easiest way of representing the yield from extraction of juice from apples in terms of figures is to read off how many kg of juice have been obtained from 100 kg of mash. Yields of 90 percent and more can be achieved in the 2-stage frupex® process. However, in order to get a rapid overview of guides to yield, it is possible to use determination of dry substance in the pomace discharged. These values can be determined by infrared drying lamp within 20 to 30 minutes.



# Production of grape juice

In principle, all varieties which have a relatively high acid content and produce aromatic juices are ideal for grape juice preparation. The selected produce should be healthy and ripe and have an appropriate must weight.

For production, the grapes should initially have their stems removed. Beyond this, no further pretreatment of the grapes, such as additional pressing with rollers, for example, is required for juice extraction by means of decanters.

Adding enzymes to the mash of white grapes before phase separation can increase the yield and improve the degree of clarity of the juice produced even further. The juice then has the flavor removed, is subjected to an initial concentration process and the semiconcentrate is fined and clarified by ultrafiltration.

To prevent subsequent precipitation of tartrate, the contact method is used in conjunction with the GEA separation process. Following this tartrate stabilization process, the pre-concentrated grape juice can be evaporated to the desired Brix content.

The process for the production of red grape juice is modified to extract the valuable phenolic compounds, namely colors and tannins, from the cells of the skins. For this purpose, with red grapes, for example, the mash is heated to 80 to 85 °C for 2 to 6 minutes and is then fed directly to the decanter without any time to stand. The hot juice is then vigorously exchanged with cold mash on the countercurrent principle and cooled down by a further cooling unit.

In the case of particularly pectin-rich varieties such as the Concord grape, for example (Hot Concord process), it is recommended that enzymes be added to the mash following heating and cooling but before it is passed to the decanter.

The following applications may arise for separators and decanters during the production of grape juice:

- Extracting juice from the grape mash
- Clarifying the freshly obtained juice
- Polishing the juice clarified and stabilized by means of enzymes or by fining agents
- Clarifying the retentate in conjunction with ultrafiltration
- Tartrate stabilization

The production of grape juice by decanter has both qualitative and economic benefits compared to the conventional process:

- Gentle method
- Better sensory quality
- No filtration auxiliaries required

For red grapes, there are additional benefits

- Higher color yield
- Continuous process
- Simple cleaning
- Flexible and reliable
- Simple and space-saving

# Stone fruits

Production of juice concentrate, liquid sugar and feed yeasts using plums, dates and cherries as examples.

The growing requirement for foods is having the effect that raw agricultural materials which were once used only little or only locally are being processed into usable, high-quality products.

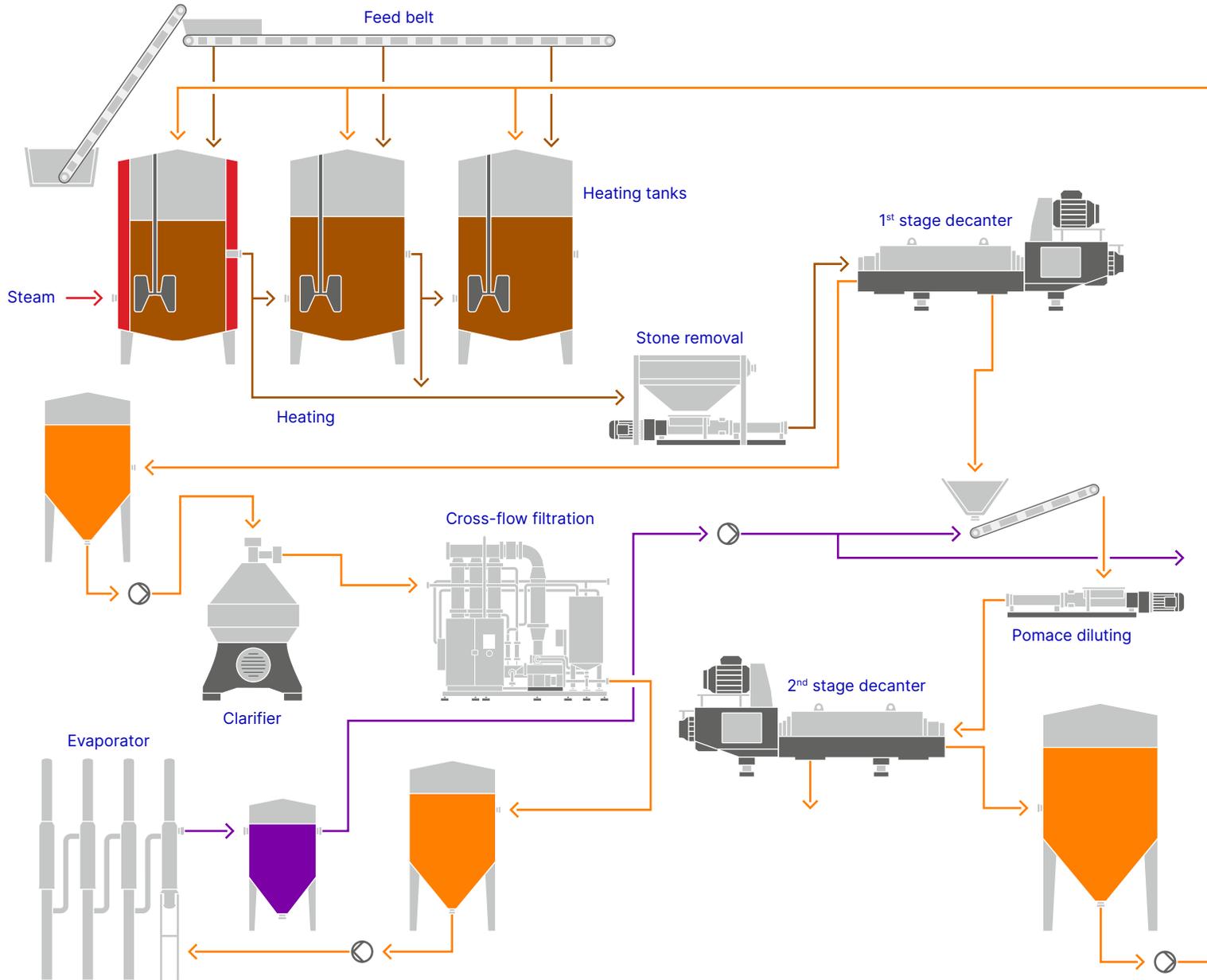
The special decomposition method and centrifugal separation mean that it is not only possible to obtain juice, but also by-products for food and animal feed or primary materials for biotechnology and chemistry.

## **Making date syrup**

During the production of date juice, the cooked mash is juiced by decanters in two stages, the first separation stage being to obtain direct juice. In the second extraction stage, the sugar is recovered once the separated date pomace from the first stage has been remashed. This recovered juice, with a reduced Brix content, is returned to the diffusion stage as so-called cooked juice. The date pomace with the sugar removed can be broken down further if required or used as animal feed. The description of the process for processing dried plums is similar to the application just described.



# Processing dates and plums into juice



### Description of line

Dates are cleaned intensively in a washing device and fed via an inspection belt to either a tank heater with stirrer or to a continuous steaming screw. The stones are removed from the heated dates which are then routed to the continuous diffusion process. To this end, a partial-flow of cooked date juice (second extraction stage for sugar recovery) and fresh water (can be water vapor) is added to the diffusion volume in a particular ratio. After the required reaction time, the hot date mash is passed to the first decanter process stage for juicing and phase separation.

After being returned to the mash via agitator tanks and heated for follow-up extraction (cooked juice), the juiced solid phase passes through the second decanter stage.

### Other applications for date processing include

- Addition of yeast to raw juices to create baking and feed yeasts
- Production of liquid sugar
- Production of vitamins by fermenting sugar – pharmaceutical products
- Production of alcohol or vinegar

### Process for making dried plums into juice

The fruit is heated, the stones are removed, pectolytic enzymes are added, the mixture is cooked for the required reaction time and separated into juice and pomace in the decanter when still hot. To increase yield, the pomace can be rediluted and extracted again in the second decanter.

#### Decanter outputs

Decanter type	Output
gMaster CF 3000	4 – 5 m <sup>3</sup> /h
gMaster CF 4000	5.5 – 7 m <sup>3</sup> /h
gMaster CF 5000	8 – 10 m <sup>3</sup> /h
gMaster CF 6000	11 – 14 m <sup>3</sup> /h

#### Separator outputs

Separator type	Output
GSC 60	6 m <sup>3</sup> /h
GSC 110	9 m <sup>3</sup> /h
GSC 200i	15 m <sup>3</sup> /h

The cooked juice with a reduced Brix content obtained in this way is returned to the first diffusion stage. The decanter to be used for these extraction processes is equipped with GEA varipond® as standard.

### Process for making fresh plums into juice

The decanter can likewise be used to produce juices from fresh plums. Following milling and removal of stones, the fruit is juiced directly. A high-performance separator then polishes the juice to filling quality. The decanter used in the extraction process should likewise be equipped with varipond® as standard.

The extracted raw juice of the first stage (approx. 18 to 20°Brix) is routed via a buffer tank straight to the downstream clarifier for the juice-polishing stage. The subsequently clarified raw juice is taken to the evaporator for concentration via a cross-flow filtration system. The concentrate (approx. 70°Brix) is processed further by the mixing unit and the tube heater downstream for sterile filling or tank storage.



**Cherry**

To make cherry juice, the washed fruits can be pro-cessed in different ways. Stone removers / finishers can be used first to prevent a blockage in the tubular heat exchanger downstream. Heating is performed either by tubular heat exchangers or by steam screw (blancher).

When juice is extracted by a decanter, it is not absolutely essential to remove stones, but the supply tank which feeds the decanter should be equipped with a stirrer to prevent sedimentation of the stones and to ensure a homogeneous feed. No tannins or cyanogens are extracted in the decanter itself.

The flavor is then removed from the juice obtained, it is initially concentrated and enzymes are added.

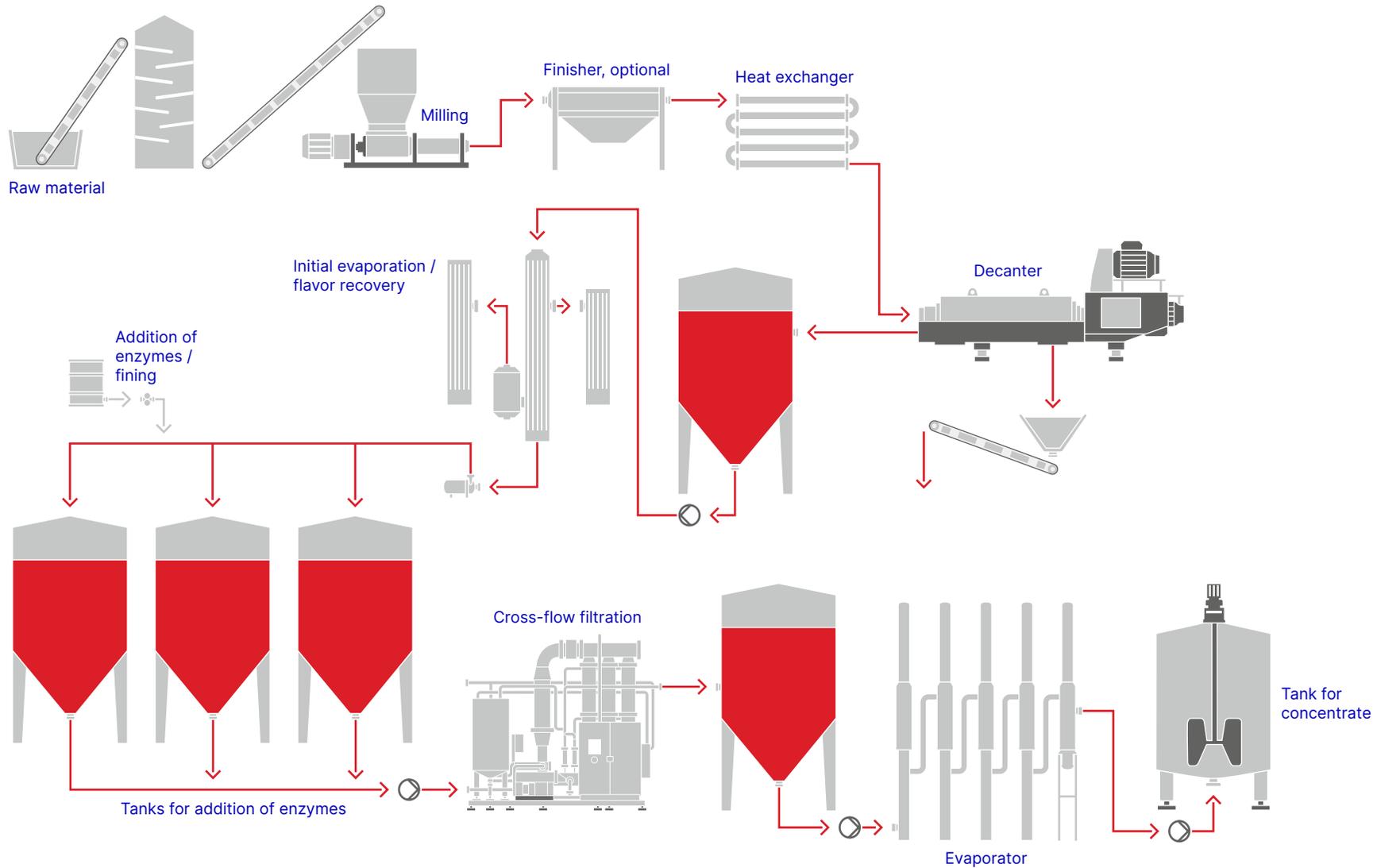
The fining process which follows addition of the enzymes is responsible among other things for color stability and intensity and trub quantity.

Following clarifying and polishing, the next step is the evaporation process to the desired Brix content.

In addition to the two types of stone fruit already mentioned, peaches, apricots and cherries can also be juiced with equal success. The necessary process technology should be modified accordingly.



## Process for making cherries into juice





# Berry fruits

## Currants and strawberries as examples.

The main berry fruits are currants, gooseberries, strawberries, raspberries, blackberries, blueberries, cranberries, buckthorn berries, elderberries and barberries. All these types of fruit can be juiced with a decanter and clarified by separator. The separator afterwards could be used for clarification/removing of fining agents before membrane filtration.

As a representative for the general principle of processing berries, we will explain the process technology and achievable outputs using the example of blackcurrants.

The graphic shows the processing of blackcurrants into juice. The fresh or thawed berries are taken off the stalks, milled, heated and have enzymes added. This product for

processing passes through a controllable, gentle Mohno pump to the decanter, where the mixture is separated into juice and pomace. Further processing of the juice to obtain flavor, followed by fining, filtration and evaporation is in line with the GEA fruipex® process.

However, the machine parameters and fining sequence need to be adapted to the particular type of berry.

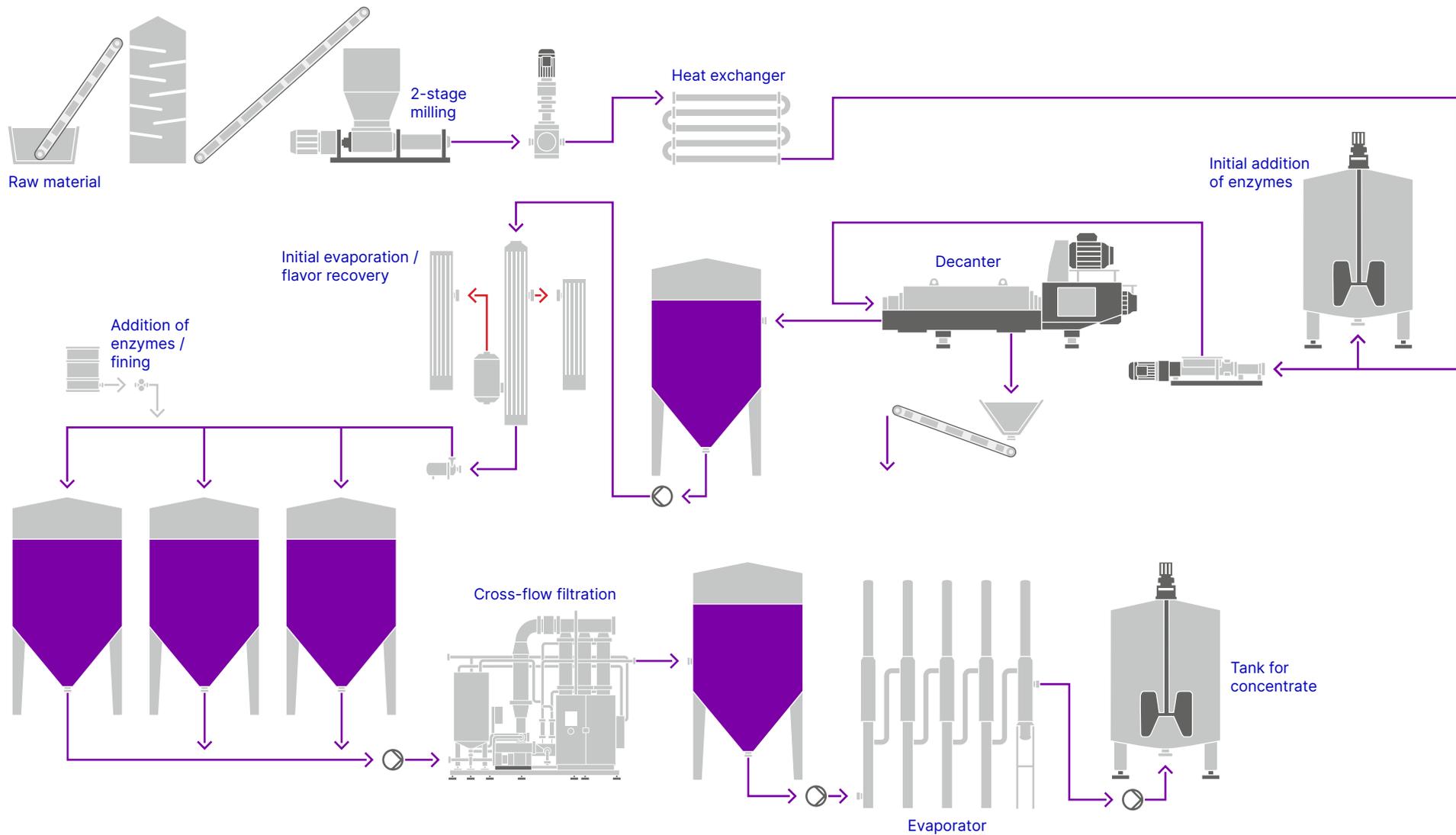
Ultrafiltration is increasingly being performed with the aid of a cross-flow unit, displacing the traditional DE filtration. It is important here to select the correct pore size. The ceramic membrane with a very fine pore size has become established in practice.

Decanter type gMaster CF 6000 is fitted with GEA varipond®. Outputs in line with the table can be achieved with this setup.

### Decanter outputs in the production of berry juices

Product	Output	Redidual solids	D.S. in pomance
Blackcurrant	12 – 14 m <sup>3</sup> /h	0.05 – 0.10 % (by vol.)	ca. 50 % (by mass)
Redcurrant	10 – 16 m <sup>3</sup> /h	0.10 – 2.00 % (by vol.)	43 – 50 % (by mass)
Elderberry	9 – 14 m <sup>3</sup> /h	0.30 – 2.00 % (by vol.)	45 – 55 % (by mass)
Raspberry	10 – 14 m <sup>3</sup> /h	0.10 – 0.50 % (by vol.)	46 – 50 % (by mass)
Strawberry	12 – 14 m <sup>3</sup> /h	0.10 – 0.70 % (by vol.)	45 – 55 % (by mass)

## Process for making blackcurrant juice



# Production of purée

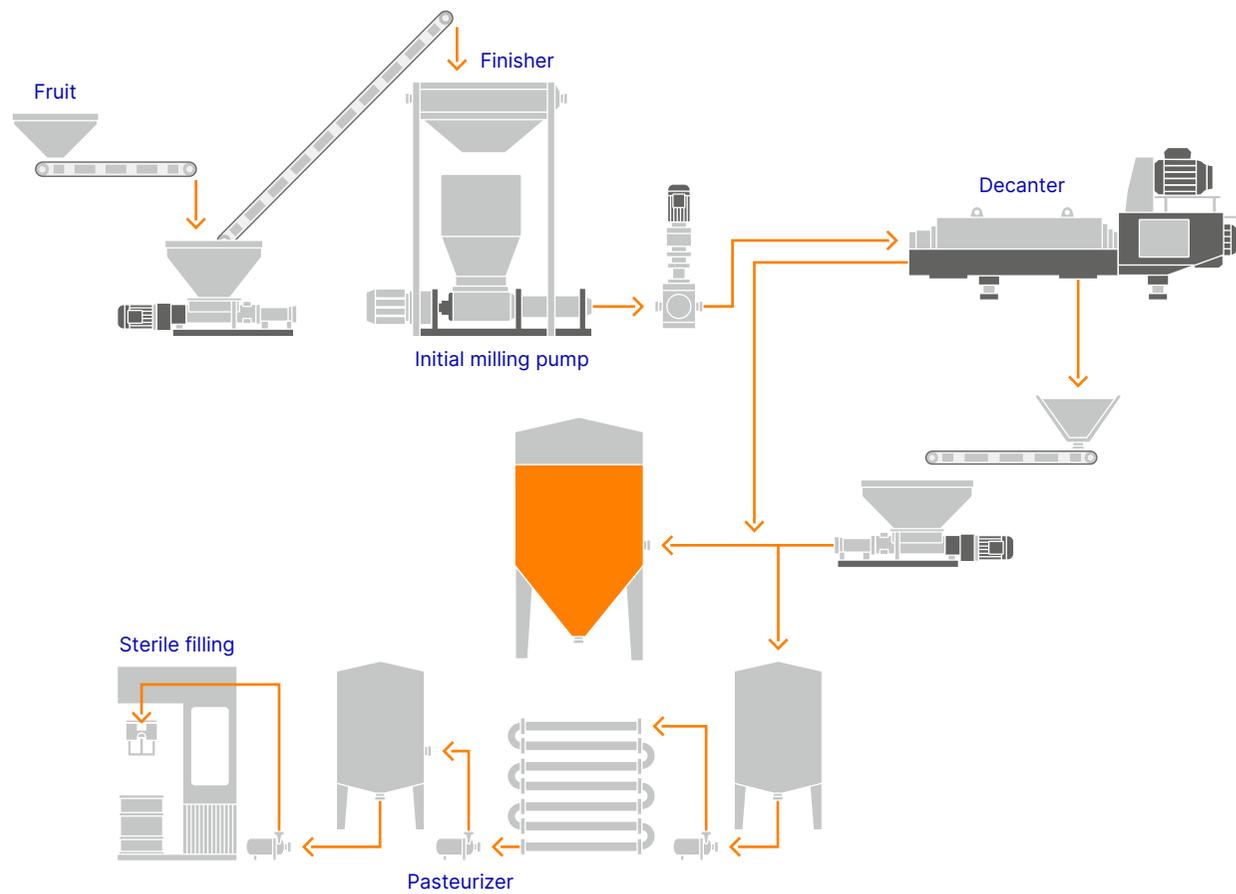
In many cases, fruit is to be made not only into juice, but also into purée or concentrated purée. This semifinished product serves as a starting material for the production of products containing real fruit, such as smoothies and baby food. The job of separation technology is to separate off undesired particles such as pips, skins, stalk residues and coarse tissue from the core area. The milled flesh is intended to be evenly distributed in the juice.

This task can likewise be performed with the decanter. The focus here is not on maximum clarification, but on classification. By selecting suitable machine parameters, the undesired constituents of the fruit can be selectively discharged at a high level of dry substance.

Alternatively, a purée can be made with a finisher, though there is almost no possibility in this case of adjusting the consistency of the purée. If you combine a finisher and a decanter, purées of any specification can be produced. Concentrated purées with a solid consistency are just as possible as a more juice-like, liquid purée. The processing line can then also be used to make juice.



## Production diagram for making juice and purées from apricots



# SPECIAL APPLICATIONS

## Processing residuals

In addition to the production of juices, a whole series of other products such as fruit cocktails are also obtained from fruit. The canning industry – factories processing pineapple or carrots, for example – produces peeling waste and tops and tails. Like second-quality produce (non-standard growth), these constituents cannot be processed by the factories directly. Yet these parts of the fruit contain considerable recoverable quantities of sugar and extract and are therefore juiced like the fruit itself. Preparation of the mash is generally modified and adapted to suit the requirements in question.

The table shows the processing output of pear residues. The use of decanter technology allows parts which used to be discarded to be processed for further extraction.

### Decanter output in the production of pear juice from cores

Decanter type	Output	Residual solids	D.S. in pomace
gMaster CF 6000	15 m <sup>3</sup> /h	1.5 – 20 % (by vol.)	36 % (by mass)

### Treating trub using decanters or separators

Trub forms in a number of process steps in fruit or vegetable processing and this has to be separated off and concentrated as far as possible in subsequent steps. Examples of this are coarse trub (which settles very quickly in fresh, conventionally pressed juice), fining trub and retentate from the cross-flow facility. Yeast sediment also appear during the production of cider.

For the easier handling of the trub, fruit juice manufacturers may follow two strategies:

- Minimize the trub fraction
- Optimize trub processing

### Minimizing the trub fraction

A fundamental approach to solving this issue is to reduce the quantity of trub produced during juicing. Different process technology methods for extracting juice are available, with the lowest trub level coming from the use of centrifugal separation technology in a decanter. The solids content can be reduced to a minimum and concentrated in a separator to clarify the juice.

### Optimizing trub processing

60 to 80 percent of this trub sediment consists of recoverable juice. Phase separation can be performed continuously by decanter without auxiliaries and in a sealed system. The short processing times maintain the juice at optimum quality. 85 to 98 percent of the solids are separated while the juice returns to the main flow.

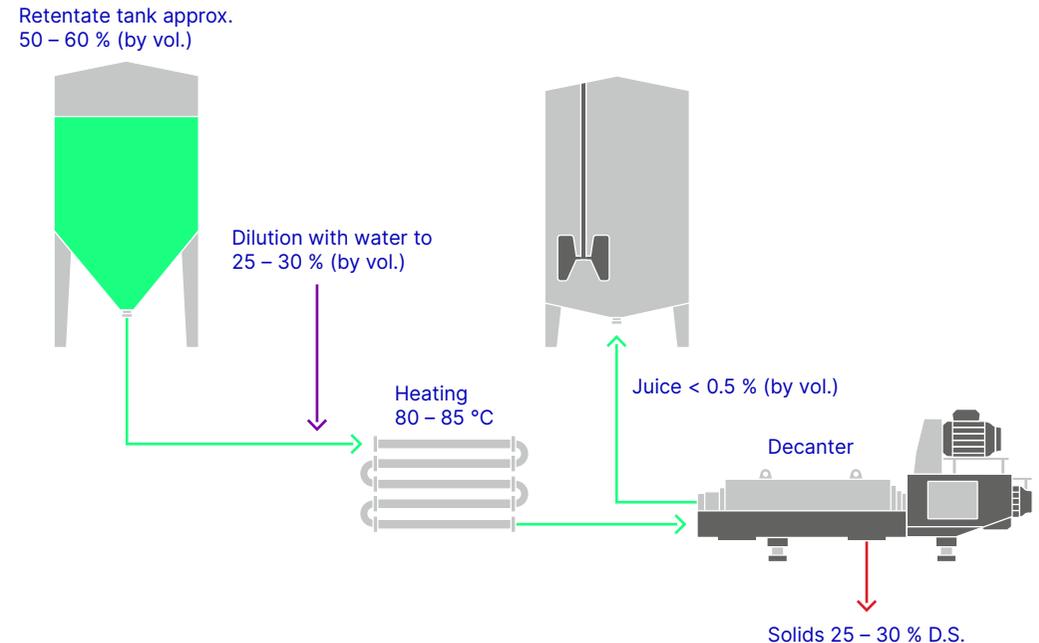
It is important that the trub is processed fresh and has not started to ferment. If the trub has started to ferment, this can considerably reduce the clarifying performance of the decanter as a result of the carbon dioxide (trub floats).

### Concentrating retentate

Retentate is a by-product of cross-flow filtration and essentially consists of retained trub particles, which were unable to penetrate the membrane, and valuable fruit juice. The characteristics of the retentate (a high COD value, for example) often result in correspondingly high disposal costs.

A higher concentration of solids in the retentate leads to a lower overall volume of retentate. There are system-related differences between polymer and ceramic membranes, ceramic allowing a greater degree of concentration.

## Retentate treatment using a decanter



### Secondary current separation of the retentate circuit by separator

Depending on the system, the circulating performance of the retentate circuit is 5 to 25 times greater than the flux rate (permeate flow). The retentate becomes increasingly enriched with solids and, from a certain concentration factor, requires further processing in batches to recover the valuable juice.

Cleaning cycles are determined by the formation of a layer coating the membranes and by concentration. If a separator is used in the secondary current to the retentate circuit, cleaning intervals and permeate output can be considerably improved. At a secondary current output of 10 to 20 percent of the circulation output of the retentate, solids are continuously separated and too great a concentration is prevented.

A similar effect can be achieved if the separator is installed in the feed to the operating tank of the ultrafiltration unit and initial clarification is carried out on the whole of the juice batch.

In this case, the separator output has to be adapted to the permeate output. With secondary current separation in the retentate circuit, the centrifuge can be smaller.

The solids from the centrifuge can be disposed of along with the pomace. A separate waste flow is not needed. However, retentate is still produced in the filter, even in considerably smaller quantities. Alternatively to the separator, the decanter can also be used at the same point. The decanter is designed to be resistant to abrasive media such as bentonite and to process heavy trub contents in the juice.

### Concentrating the retentate in batches using a decanter

A further option for processing retentate is to collect it in a separate tank at the end of filtration and to clarify it in parallel with regular daily tasks.

The retentate is diluted with water, then heated to 80 to 85 °C and clarified in the decanter. The clarified juice then has a residual solids content of approximately 0.5 percent by vol. and can be routed back into current production. The hard solids can likewise be disposed of with the pomace again. The dry substance of the solids is in the range up to 30 percent D.S. As a result of this process running in parallel with the regular juicing operation, the hourly rate of this line can be relatively small and investment consequently low.





# TROPICAL FRUITS

Increased consumer demand for alternatives to traditional fruit drink flavors such as apple and orange have created an opportunity to exploit fruits such as pineapple, mango, pomegranate, papaya, lychee and guava, to produce a range of more exotic flavored smoothies and juices.

## Pineapple

Both decanters and separators are used to process pineapples into juice. In principle, two different products are obtained – so-called “mill juice” (from pineapple skin) and “beverage juice” from flesh components. “Beverage juice” is used as juice, whilst “mill juice” is used purely for clear toppings in the canning industry.

### Processing beverage juice

After washing and sorting, the fruit arrives at the “Ginaca” machine where it is mechanically broken down into three components: cylindrical flesh (the cylinders are then sliced as typically done for canned fruit), peel and so-called “juice material”. This consists of the pineapple core, and the flesh obtained from between the skin and the cylinder. Some factories divert some of this material to produce so called “crushed pineapple” – a kind of pineapple purée. The fruit is juiced by the traditional screw presses which generate a high proportion of solids in the juice. Screw presses are used in a 3 or even 4-stage arrangement.

The discharging juice has 12 to 13°Brix and a solids content of up to 35 percent by vol. It may contain undesired solids such as bits of peel. As an end product it is supposed to have a solids content of 8 to 12 percent by vol. (so-called low-pulp juice). In so-called high-pulp juice, solids contents of 12 to 18 percent by vol. are usual. Clarification normally takes place at temperatures of around 60 °C. There are two process technology variants. Initial clarification is performed by finishers (strainers) which remove all coarse fibres. The juice is then clarified by separators. Solids contents in the juice produced may be set to between 2 to 18 percent by vol. or lower. The juice coming from the separator can be set to the desired solids content directly by controlling the throughput.

Alternatively, the juice can also be clarified by decanter. This makes it possible to reduce considerably the number of process stages required for clarification because the finishers (strainer units) are omitted. The juice produced in this way is evaporated to the desired concentration in multi-stage falling film evaporators.

A specific variant for producing high-quality pineapple juice is to use decanters with a 2-gear drive to extract juice from the pineapple mash directly. The advantage of this GEA frupex® process is clear: less machines are being used and faster production times. The potential savings are considerable here, and the quality of the end product can

also be improved, as the process time at higher temperature is shorter and associated heat damage and oxidation are reduced considerably.

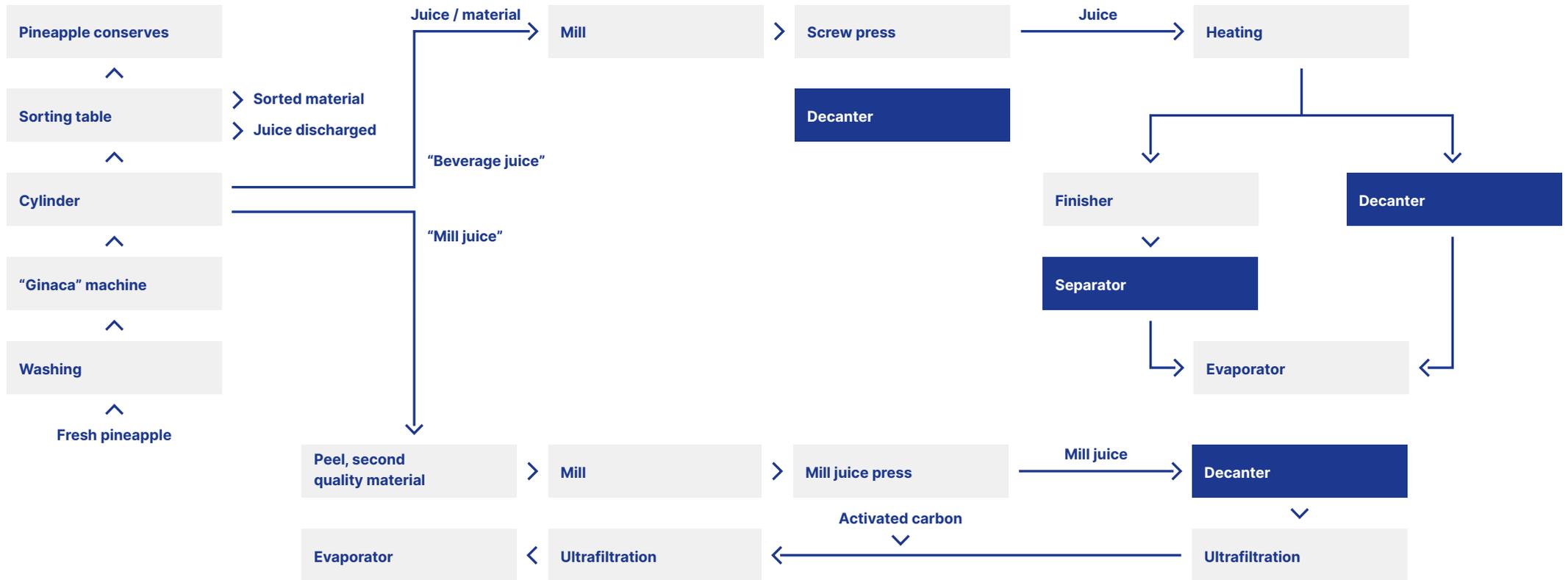
**Mill juice production**

Mill juice is produced in a separate processing line. The peel is juiced in a screw press and the juice produced is pre-clarified in a decanter. Separation of any green bits of peel is very important at this stage. Following this clarification step, enzymes are added to the juice, activated carbon is added to remove color and the juice is then clarified in the ultrafiltration unit. The product thus obtained is a colorless sugar solution which is easy to concentrate and is used as a topping for canned products.

A particular issue here is the overall economy of the process – a by-product which forms anyway replaces an expensive product (sugar) in the topping liquid. Overall, no part of the fruit remains unused in the processing of pineapple. The separated solids are usually processed into so-called brans which in turn are used as animal feeds.

**Capacity of GEA separators in pineapple processing**

Separator type	Low Pulp	High Pulp
GSC 40	2 - 3 m³/h	4 - 5 m³/h
GSC 60	4 - 5 m³/h	8 - 10 m³/h
GSC 110	10 - 12 m³/h	13 - 15 m³/h
GSC 190	12 - 14 m³/h	15 - 17 m³/h
GSC 200 / GSE 200	16 - 18 m³/h	20 - 22 m³/h



## Mango

Mangos are almost always processed into purées or concentrated purées. To do this, the fruit is washed, possibly treated with steam and subjected to a subsequent maturing process. The fruit so prepared is then coarsely milled and heated in a heated screw.

In the countries where it is grown, the fruit is alternatively often stored until fully ripe and then cut up by hand. The stones are then removed by a 2-stage finisher (strainer) and the flesh strained. The purée thus obtained is heated and the classification process in the decanter removes undesired solids. Fragments of stone, “brown specks” and “black specks” can also be removed by this process. The decanter

also protects the evaporator downstream from blockages due to solids. Mango purée can only be produced in a practical way without a decanter if cultivation conditions are ideal and if virtually fibre-free varieties (e.g. Kensington, Alfonso) are processed and there is no concentration in the evaporator (single-strength purée).

If the raw purée is very heavily loaded with fragments of stone as a result of poor machine equipment or of processing varieties which have stones which fracture easily, it may make sense to put in a separator downstream of the decanter to remove the fragments entirely.

### Output for clarification of mango purée

Decanter type	Output
GEA beverage decanter Pro 2200	2 - 4 m <sup>3</sup> /h
GEA beverage decanter Pro 3200	4 - 6 m <sup>3</sup> /h

## Banana

A much smaller proportion of the world's banana harvest is processed into long-life products on an industrial scale – such processing as there is becomes primarily banana juice and purée.

The particular objective during processing is to avoid oxidation and discoloration by blanketing with CO<sub>2</sub> and/or adding vitamin C. The mash is then heated up to a temperature for adding enzymes using tubular heaters. In order to prevent polyphenol oxidase activity at this stage, the mash can be heated to the relevant inactivation temperature and then cooled down to enzyme reaction temperature. The appropriate enzymes allow a drastic reduction in viscosity to be achieved. Once prepared in this way, the mash is then easy to separate in a decanter. There are two slightly differing process variants depending on the end product required.

### Banana juice

Immediately afterwards, the mash to which enzymes have been added and which has been initially clarified in the decanter needs to be clarified again in a separator to obtain a clear juice. The product runs through an ultrafiltration process to remove the still colloidal components of the juice.

Evaporation and sterile filling then follow. The end product is usually sold as a natural fruit sugar concentrate.

### Banana purée

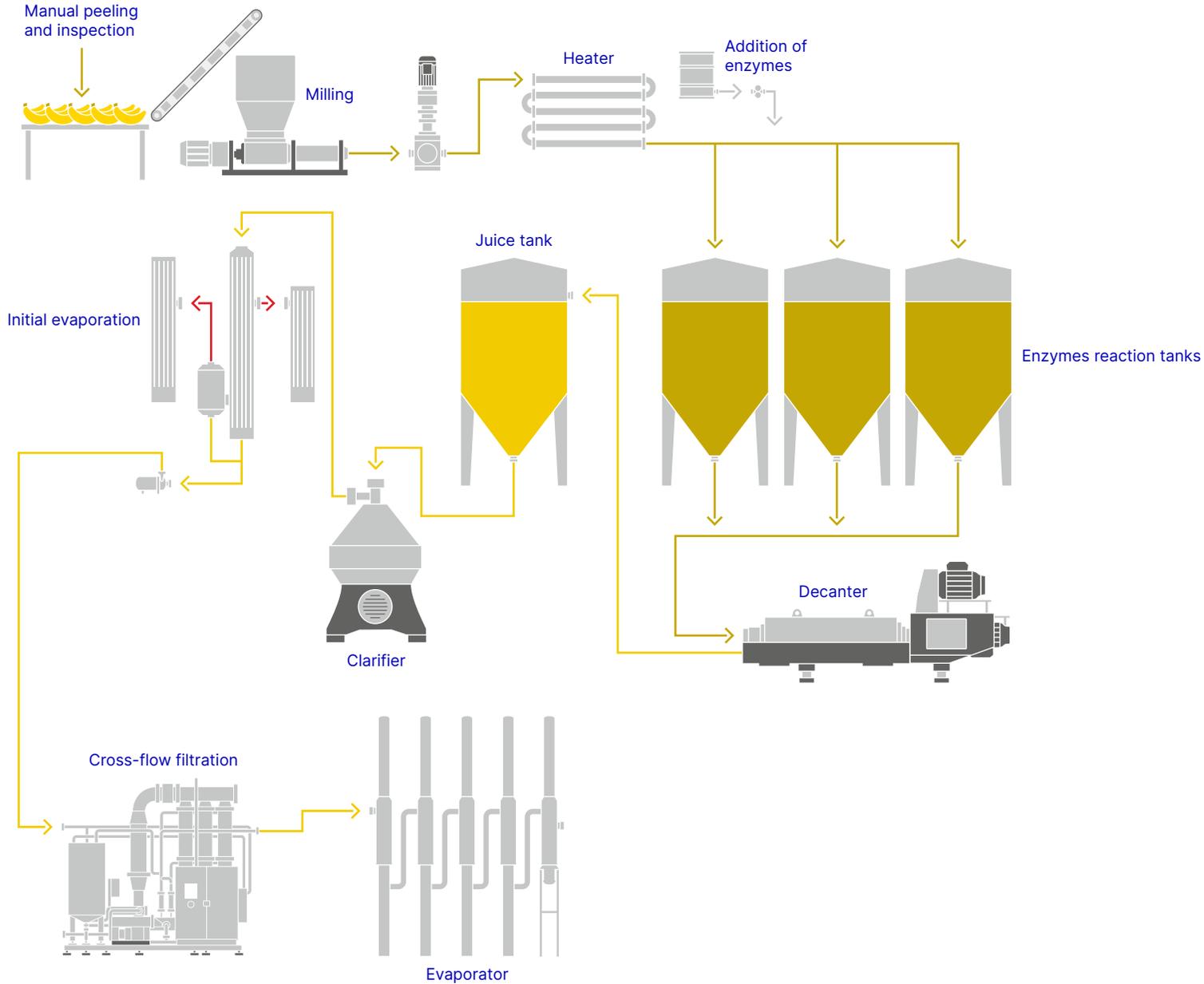
Compared to the previous method, the separator is not required when making purée. The process continues by evacuating air from the purée, pasteurizing it and filling it under sterile conditions.

### Throughputs when processing bananas

Decanter type	Output
gMaster CF 3000	3 - 3.5 m <sup>3</sup> /h
gMaster CF 4000	5 - 6.5 m <sup>3</sup> /h
Separator type	Output
GSC 40	4 m <sup>3</sup> / h
GSC 60	5 - 6 m <sup>3</sup> /h
GSC 110	8 - 10 m <sup>3</sup> /h
GSC 200	12 - 16 m <sup>3</sup> /h



# Process for making clear banana juice



## Pomegranate

The pomegranate originates from Western and Central Asia, but this fruit has also been cultivated in the Mediterranean region for hundreds of years. Whilst in the olden days, its high number of seeds was thought to be responsible for its healthy properties, today we know that this effect is due to a high content of polyphenols and other bioactive substances.

Under the thick skin are up to 7 compartments enclosed by membranes which contain the numerous seeds. Each seed is surrounded by a soft, fleshy, transparent pink to dark red aril.

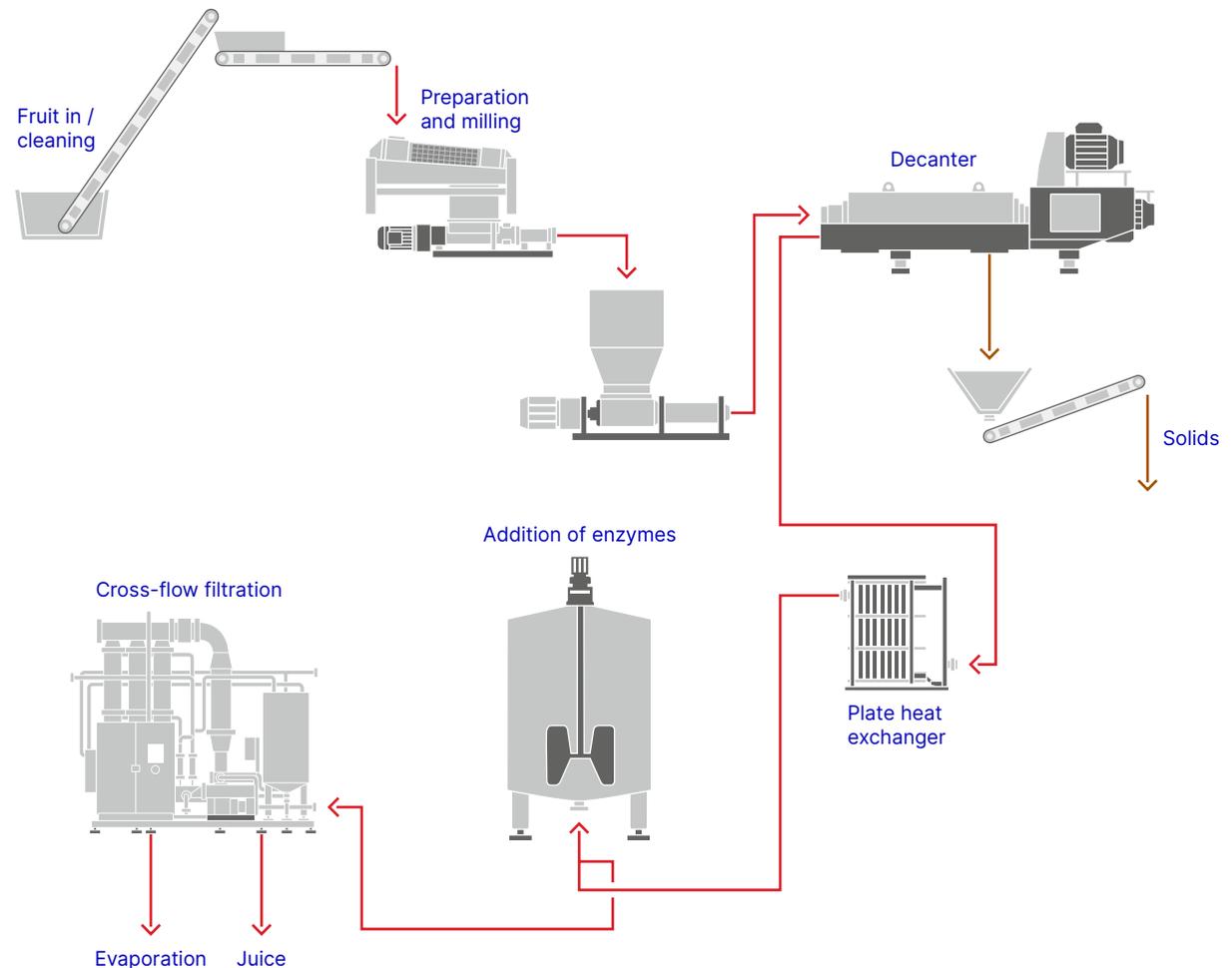
### Processing

Following the obligatory cleaning and picking over of the fruit, the first step is to break open and remove the outer skin. The juicy fruit cells thus obtained are gently opened in a squeezing device and pumped into the decanter by an eccentric screw pump.

The decanter separates the juice from the seeds and remaining solids. This separation process is very gentle on the product as it involves juicing very quickly in a sealed space. The very gentle treatment of the seeds, which remain undamaged, ensures that extraction of undesired polyphenols (e.g. tannins) can be reduced to a minimum.

Directly after juicing, the juice is pasteurized to inactivate microorganisms and the enzymes in the fruit. The subsequent fining, filtration and possibly evaporation steps are performed under customary fruit processing conditions, though taking account of fruit-specific requirements.

## Production diagram for producing juice from pomegranates



# VEGETABLE JUICES

Various different process types are used to make vegetable products, depending on the raw material. Factories have different methods for product preparation, mashing, obtaining juice and finishing the product.

With most types of vegetable, especially tuberous and root vegetables, a peeling or cleaning step follows an intensive, multi-stage washing process. A usually multi-stage mechanical process then follows to prepare the mash, with mechanical milling usually being supported by thermal and / or enzymatic breakdown of the plant tissue. In some cases, the vegetable mash is fermented with a lactic acid culture.

The juicing process plays a key part in the production of vegetable juices. The use of highly-developed decanter technology results in rapid, continuous and low-oxidation juicing. This makes it possible to produce high-quality juices at high yields under hygienic conditions. A defined quantity of trub can also be added continuously and directly to the juice fraction. If machine parameters are adjusted, the decanter can quickly and flexibly be adapted to raw material-specific product requirements. Cleaning cycles for the sealed process system and setup times are minimized, as decanters are fit for CIP without any restrictions. This ensures considerable hygiene benefits and results in an optimum product from a microbiological viewpoint.

The raw vegetable juice thus obtained is further processed conventionally. It is usually preserved by being heated in a continuous process with subsequent sterile storage. It is also possible to perform lactic acid fermentation or concentration of the juice.

In European factories, the primary juices are carrot, beetroot and celery. Small quantities of juices and beverages are also made from asparagus, rhubarb, white cabbage, spinach, onions, potatoes, cucumbers and cereal mashes. These products too are processed using separators and decanters. The same applies to the production of juices from medicinal plants such as valerian or nettle.

Juicing in the production of vegetable pulp is used to extend the shelf life and to allow for intermediate storage. The process remains unchanged. Decanter settings can be adapted to the special needs.



## Carrot juice

The short shelf life of carrots and the juice made from them makes processing particularly awkward. The requirement for modern, quality-focused processes, i. e. converting the raw material into semifinished or finished products in a short time at top product quality and with minimal use of process and cleaning water can only be partially met by conventional press techniques. Highly efficient decanter technology, on the other hand, which can be used universally now, has impressively proved its high degree of economy, efficiency and flexibility in the production of carrot juice.



The graphic (next page) shows a process variant for the manufacture of carrot juice. In the process shown, the washed, steam-peeled and selected carrot is first milled. As it then passes through a tubular heater, the mash is heated up to 80 to 85 °C and is broken down further by intensive dispersion in a toothed colloid mill. The finely milled mash has a very small particle size.

The ability to juice this fine mash effectively has raised decanter technology to the state of the art. A further benefit is the continuous, sealed method of operation, which facilitates rapid and hygienic processing.

The process shown with intensive milling is aiming to extract as many secondary plant metabolites as possible. As the conventional press technology requires a coarser degree of milling to allow phase separation through drainage routes in the pomace cake, the decanter can process extremely fine particles. As a result, there is more intensive extraction of valuable constituents like beta-carotene in the decanter.

The carotinoids of the carrot can be found in chromoplasts and are present in the form of crystalline structures. As the carotinoids are extracted more intensively, the juices from decanters are much more intensely colored than comparable press juices. The pomace itself is correspondingly less intensely colored.

Carrot juices are characterized by a high total carotene content. Depending on variety, the concentration fluctuates between 3 and 16 mg of carotene per 100 g fresh weight. The main proportion of these total carotinoids is represented by beta-carotene, which makes up between 60 and 90 percent of total carotene. Beta-carotene has nutritional significance as provitamin A and a natural antioxidant, which interrupts the free radical chain reaction and thus prevents new free radicals from forming.

Another form of the carrot is the black carrot. This has a higher sugar content and a higher content of anthocyanogens. These anthocyanogens belong to the group of secondary plant constituents and have many potential uses. In principle, this type of carrot is processed under the same conditions as those for conventional orange carrots.

Another process technology benefit of using a decanter is the direct adjustment of the pulp fraction in the juice.

Commercial juices are supplied with a pulp fraction content of between 2 and 15 percent by volume. When conventional press technology is used, vegetable pulp has to be produced in a separate process in which enzymes are then added and the pulp is mixed into the low-trub juice. There is a direct link between pulp fraction, the torque of the screw, the dry substance in the pomace and the differential speed of rotation between the bowl and the scroll. The differential speed determines the dwell time of the mash in the bowl and thus the dry substance in the pomace. It is set to the ideal level at the start of processing as a function of process and product and regulates itself automatically as conditions change.

Pulp fraction (trub) in the clear phase is clearly dependent on torque. In producing clear juice, on the other hand, scroll torque is minimized. If a higher pulp fraction is required, this can be achieved by increasing torque.

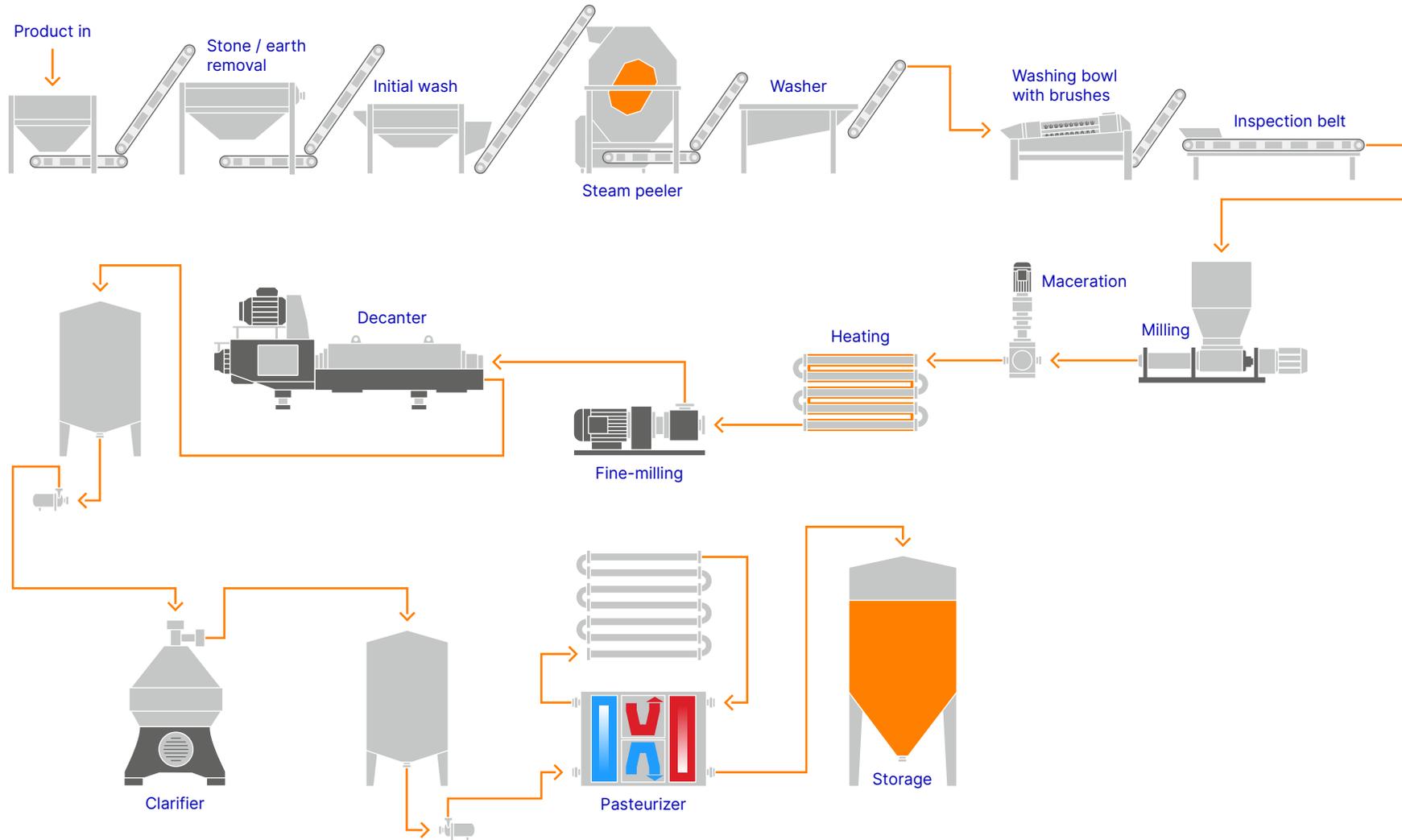
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### Outputs in the production of carrot juice

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Decanter type	Output
gMaster CF 4000	6 - 8 m <sup>3</sup> /h
gMaster CF 6000	11 - 14 m <sup>3</sup> /h

## Process for producing carrot juice



## Beetroot juice

The beetroot are first milled. The mash may either be processed cold in the decanter or submitted to a brief heating before to break down the tissue.

One option is to fine-mill or add enzymes to the product before the phase separation step. The decanter separates the beetroot mash into clear juice and pomace. Depending on the desired trub content of the raw juice, fine clarification can

be performed using a self-cleaning separator. The product is given a shelf life and stored under sterile conditions by the conventional method.

Depending on the vegetable, juices are produced in different processes. Producers count on their own way of preparation, mash production, obtaining the juice and completing the product.

## Producing pulp concentrate and juices with a defined pulp fraction

Vegetables can also be used to prepared puree or pulp. The pulp has a fine homogeneous and pasty consistency and is used in many different ways.

Vegetable pulp products like tomato purée, for example, reach the consumer as products in their own right. In many cases, pulp products and especially vegetable pulp concentrates are used in various branches of the food industry as semifinished products. Vegetable juices are often mixed with a defined pulp fraction to create high-quality independent products. For example, carrot juices with a pulp content of 5 to 15 percent are sold.

The job of separation technology is now to separate off undesired particles such as pips, peel, seeds or hard pieces of tissue. Vegetable pulp is thus a homogeneous vegetable product with a comparatively high proportion of solids.

With conventional press technology, two process lines and the corresponding supplementary units are required to produce juices with a high trub content. The first production line makes pressed juices with a low trub content, whilst the second line makes vegetable pulp. The intermediate products are then mixed in an additional step.

If a high-performance decanter with torque-dependent differential speed control is used to make these products, one process line is sufficient. If the decanter parameters are set appropriately, it is possible to add defined pulp fractions (fine fractions) continuously to the juice while the vegetable mash is being juiced.

As a consequence of the common processing and storage of both product components, there are benefits such as:

- Simplification of the process
- Reduced costs
- Improved quality

### Outputs in the production of beet root juice

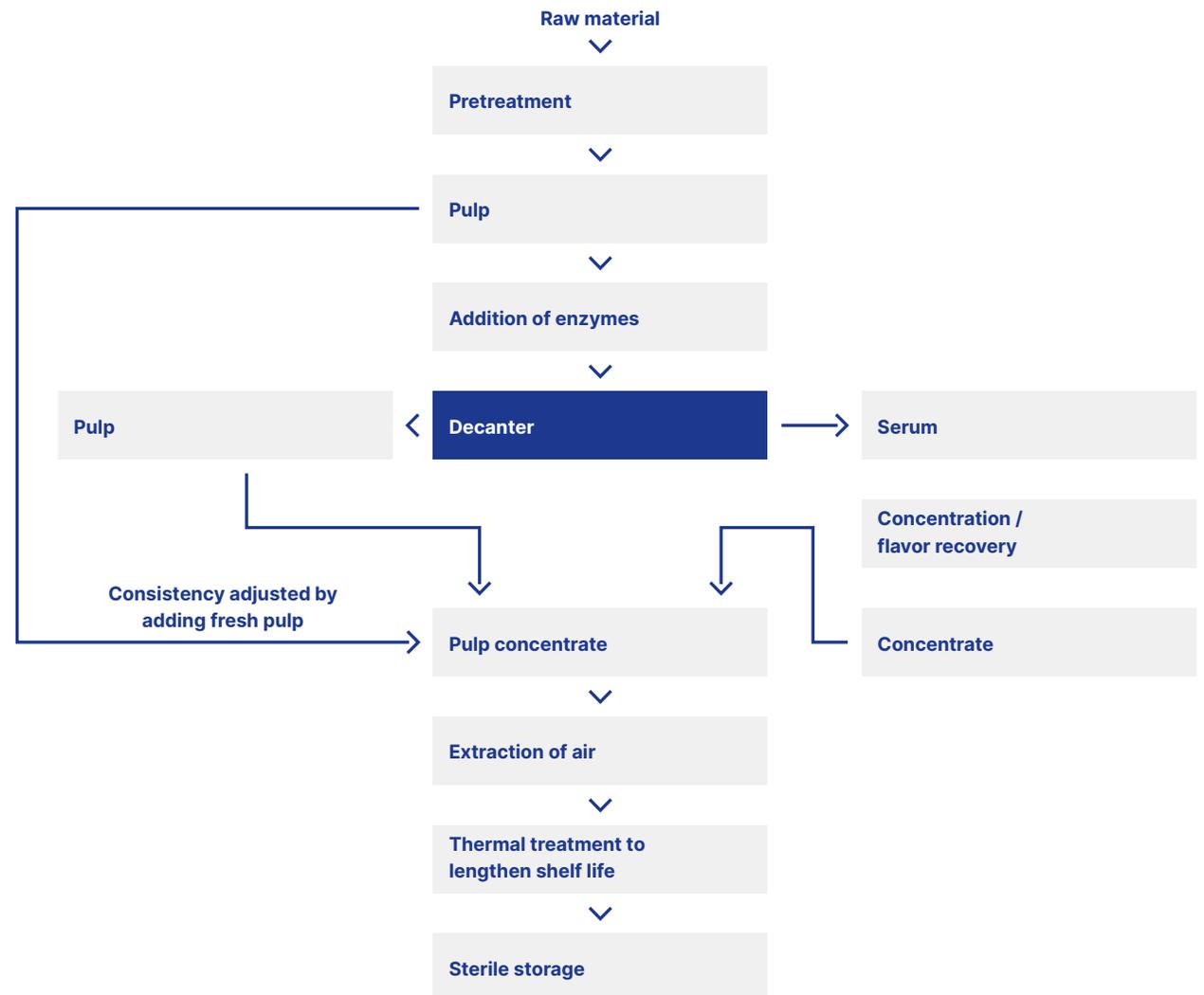
Decanter type	Output
gMaster CF 4000	6 - 8 m <sup>3</sup> /h
gMaster CF 6000	11 - 14 m <sup>3</sup> /h



The use of decanters on the modified serum principle allows production processes to be optimized in the production of pulp concentrates. Once the raw material has been prepared, the mash obtained is treated with heat and with enzymes. Enzymatic maceration is intended to improve the phase separation of serum and pulp (the solid part of the pulp). Following activation of the enzymes by heat, the mash is strained and fed to a decanter. The centrifugal forces discharge the solid (pulp) and the liquid (serum) from the decanter separately, allowing them to be processed separately.

The serum is then concentrated in suitable evaporators and the flavor is recovered. The serum and flavor concentrate obtained in this way are mixed back into the pulp from the decanter. This process results in a whole series of benefits compared to the conventional processes:

- Low thermal stress means gentle concentration of the serum (liquid fraction)
- Flavor recovered from the serum fraction and returned to the product completely
- Gentle concentration of the pulp fraction (solid)
- Concentrate line operates for a long time (reduced loading with solids) and is consequently economical
- As flavor is completely returned and thermal load is less, the sensory quality of the product (color, smell, taste) is improved



# SECONDARY PLANT METABOLITES FROM NATURAL RAW MATERIALS

There is still an increasing demand for health and functional products. The supposed positive effects on health can usually be attributed to specific constituents. The healthy substances include, among other things, secondary plant metabolites, vitamins, minerals or bacterial cultures.

The flexibility of decanters makes them perfect for extracting secondary plant metabolites such as beta-carotene, lycopene, phenolic compounds and betalain. These substances cannot be produced by human beings themselves, and therefore have to be absorbed in the food. In chemical terms, secondary plant metabolites is a very heterogeneous group of constituents which are used on the basis of either proven or suspected health-promoting properties.

In addition to factors such as fruit and vegetable variety, degree of ripeness and the production process also play a significant role in terms of the quantity and quality of these desired constituents.

The decanter is accordingly a key element in the extraction of the various substances: a focus is the extraction of valuable ingredients such as beta-carotene (from carrots) and lycopene (the red color in tomatoes). Phenolic compounds like resveratrol are extracted from red grapes. Betalain gives beetroot their typical color and is used as a natural food coloring in the meat and confectionery industries.

A report from the food industry research group "Forschungskreis der Ernährungsindustrie e.V." (FEI / AIF-FV 12431 BG) showed for apples, for example, that a longer mash stand time leads to a reduced overall phenol content.

The decanter can reduce this loss because juice is obtained continuously and quickly. The sealed system furthermore minimizes additional undesired oxidation of the product.



# HERB EXTRACTS, SPECIAL JUICES AND NUTRACEUTICALS

In former centuries, plants like dandelion and nettle had a permanent place in cooking and making medical products with herbs. Having not been so popular for a while, they are now making an impressive comeback. It is now impossible to imagine the beverages range without these special juices in the form of health-promoting drinks or “nutraceuticals”.

Nettle and dandelion are particularly rich in natural minerals and valuable trace elements. Whilst nettle juice is considered to be diuretic, cleansing and good for the blood, juice from dandelion is seen primarily as a drink to promote digestion and stimulate the metabolism.

To obtain the juice, the outputs from the decanter and the separator are combined. After the plants have been thoroughly washed, they are first chopped, blanched and macerated.

During the juicing process, the decanter gently separates off the coarser solids before a separator performs fine clarification. The juices are then pasteurized and filled.

The result are quality juices from which none of the fundamental action of the constituents has been lost.



# SYSTEMS FOR THE JUICE-MAKING INDUSTRY

Systems for the Juice-Making Industry The production of fruit and vegetable juices places the highest demands on process technology: efficiency, flexibility, hygiene, and product quality must all be guaranteed at every step. As a global technology leader, GEA provides complete system solutions that meet these requirements while offering juice producers maximum operational reliability. Mechanical separation is at the heart of juice production, ensuring optimum separation of solid and liquid phases. With advanced decanters, separators, and strainers, GEA enables both highly clarified premium juices and naturally cloudy beverages to be manufactured with consistently high yields.

Innovative features such as the GEA Varipond® C system allow continuous adjustment to changing feed conditions, delivering outstanding efficiency and gentle processing to preserve valuable constituents. GEA's frupex® process represents state-of-the-art juice clarification. It integrates decanters and separators into a continuous processing line, minimizing oxygen uptake, reducing waste, and enhancing color and sensory quality.

Whether for traditional fruit juices, vegetable-based products, or new superfruit blends, the technology ensures flexibility to adapt to market demands. By combining proven mechanical separation with intelligent automation and modular components, GEA delivers end-to-end solutions that make juice production more sustainable, economical, and future-ready.



## Decanters

Decanters are used when particles of a larger size and high solids' proportions in the suspension need to be processed. They are especially designed to the needs in the fruit juice industry. Decanters have been developed for high clarifying performance and the maximum possible degree of solids dewatering.

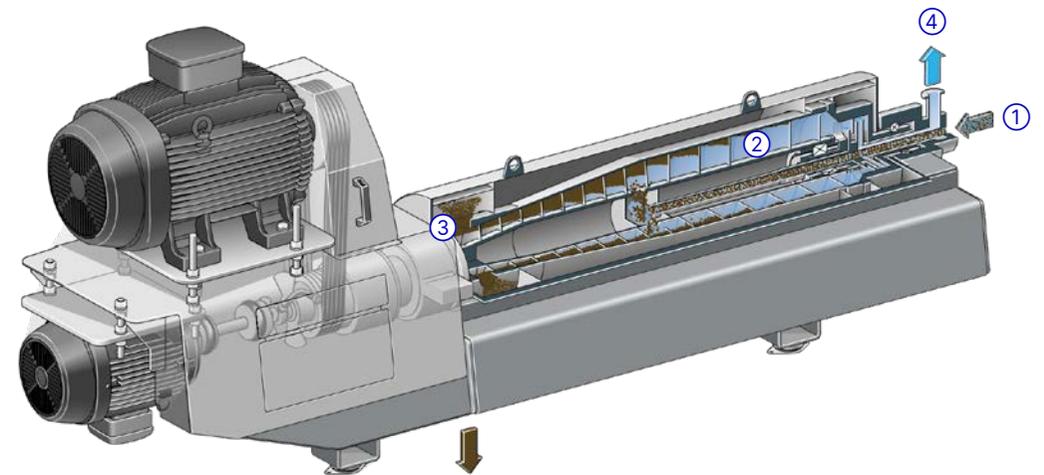
Essential conditions for this include, among others, high bowl speed and an enormously high scroll torque in conjunction with a control system to synchronize differential speed and solids load.

The product for decanting enters the decanter through the feed tube and the distributor conveys it into the separating chamber where it is accelerated to operating speed. Centrifugal force quickly causes solid particles to sediment on the bowl wall. The bowl is of a cylindrical / conical shape. In the cylindrical section, this shape allows effective clarification of the liquid, whilst in the conical section, the solids are effectively dried.

The scroll rotates slightly faster than the bowl shell and conveys separated solids continuously towards the narrow end of the bowl. Due to the conical shape of the bowl here, the solids are separated from the liquid. In the "drying zone" of the decanter the wet particles are dewatered to maximum dryness.

The solids are then discharged into the collecting chamber of the housing through openings in the end of the bowl. The liquid flows out between the flights of the scroll to the other end of the bowl. Slight impurities in the liquid are separated by centrifugal force and are conveyed by the scroll to the "solids discharge" point. The clarified liquid leaves the separation chamber under pressure by means of centripetal pumps.

The decanter is driven by a 3-phase AC motor for controlled torque starting or alternatively by 3-phase AC motors with frequency converter. This allows start-up current and current peaks on start-up to be reduced. The power is transferred by belts.



- 1** The product enters the machine through the feed tube.
- 2** A distributor conveys it into the separating chamber where it is accelerated to operating speed. Through centrifugal force the solid particles sediment on the bowl wall.
- 3** In the conical bowl section the solids are fully dried, then discharge through openings in the rear.
- 4** The clarified liquid flows through the flights of the scroll to the front end and leaves the separation chamber by means of centripetal pumps.

## GEA beverage decanter pro as option for some fruits and special demand on the market

The GEA beverage decanter pro offers a compelling alternative for certain fruits and specific market requirements. In particular, this version with an open juice discharge can be used for selected fruit applications. The open design makes maintenance significantly easier and faster, reducing downtime and increasing plant availability.

The GEA decanter pro is especially suitable for fruits where oxygen uptake during processing is not critical. This variant specifically targets market segments that value robust technology, high operational reliability, and efficient service.



GEA beverage decanter pro 5500

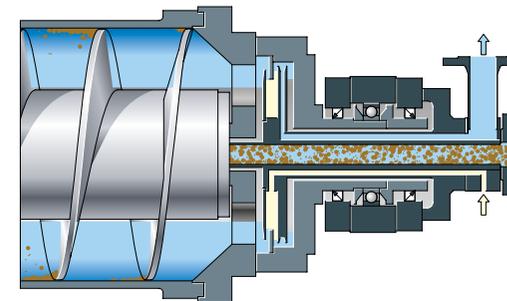
## Always the right setting with GEA Varipond C

Feed composition and flow rates can vary, especially with natural products. To maintain top separation performance, the decanter must adapt. With GEA Varipond C, you can instantly adjust pond depth and the separation zone – even during operation. Just select the diameter, manually or automatically, and the system adjusts automatically to changing feed conditions.

With GEA Varipond C you can even program and save recipes in your control system to make your decanter run in the optimum operation mode, literally at the touch of a button. This is how your separation zone becomes a true a comfort zone.

On top, GEA Varipond C is energy efficient due to less friction taking place at the centripetal pump, comes in hygienic design so it can be easily used in all beverage and food applications and is available for our entire decanter fleet for you to scale up your good experience with it.

You can even combine Varipond C with hydrohermetic sealing making sure your job will become much easier in future, even if you need a decanter system that prevents your product from oxygen pick-up.



GEA Varipond C system for optimum yield efficiency

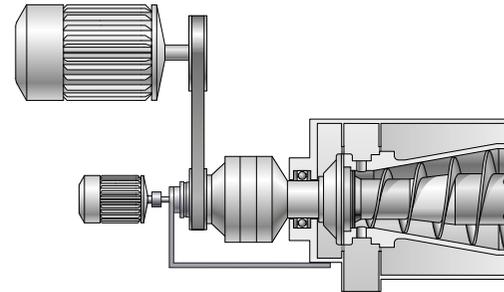
## GEA summationdrive

The summationdrive always provides the full torque across the entire regulation range. It supplies only the power which is actually required, because the secondary motor is operated purely as a motor, and there are no braking effects. Accordingly, the drive does not require any backdrive and provides savings in terms of unnecessary conversion losses as well as belt drives, shaft loads and construction space.

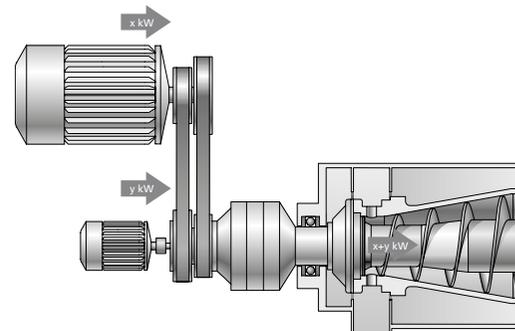
In the version used for higher differential speeds, the drive combines the output of the primary and secondary motor (summation) and thus minimizes energy consumption. Conversion to the higher differential speed range is possible without having to replace the gear. In both drive versions, the differential speed is provided over large ranges without any interruptions.

The drive is equipped with a multiple-stage oil-lubricated planetary gear with two input shafts. Three planetary gears of different sizes for each decanter size enable the decanters to be simply adjusted to changed process conditions and requirements applicable to the torque.

The advantage of this drive which has been developed and patented by GEA is the facility for regulating the scroll drive. The differential speed is adapted automatically and extremely precisely as a function of the scroll torque – and thus as a function of the solids content in the bowl. Accordingly, the solids are discharged from the bowl with a constant concentration and in an extremely dry state.



GEA summationdrive with torque arm (for diff. speed of 1 – 25 rpm)

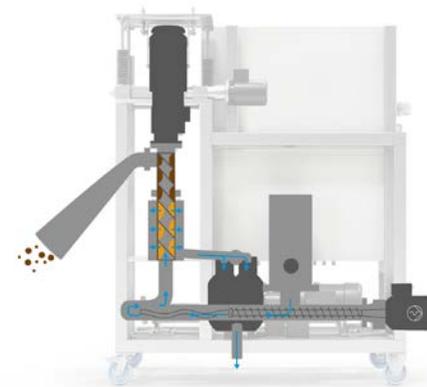


GEA summationdrive with two pulleys (for diff. speed of > 25 rpm)

## GEA vaculiq Vacuum Spiral Filter

The patented and gentle extraction process offers a nearly unrivalled high-end product quality. Juicing under vacuum is a very smooth process that prevents oxidation of juice and puree. This smart solution protects the healthy ingredients of beverages or food products, allowing the taste to stand out.

The GEA vaculiq has been designed as a mobile compact unit with minimal space requirements and can be cleaned with minimal manual impact.



## Clarifiers – high product quality and yield

Self-cleaning separators are used for juice clarification and these satisfy the requirement for a continuous process. The separators are equipped with a disk bowl and sliding piston. The liquid is quickly and gently clarified in a disk stack, the solids being collected in the solids chamber. At the optimum emptying point, the sliding piston is opened hydraulically.

Once operating speed is reached, the solids are suddenly ejected and the sliding piston returns to the closed position. The clarified liquid is discharged without foam and under pressure by centri-petal pumps. To minimize oxygen pick-up, these separators are also available in a hydrohermetic (liquid seal) design.

### Hydrohermetic design

Oxygen pick-up is prevented without the aid of mechanical seals. Instead a liquid seal is created by a centripetal pump and an additional stationary disc which submerges into the rotating liquid. The product will keep its aromatic substances and will not come into contact with atmospheric air.

### Effects on clarification

There are many factors influencing the efficiency of centrifugal clarification of liquids. Both product-specific and mechanical parameters have an effect. The first group includes particle size, specific density, viscosity and the proportion of solids in the liquid to be clarified. In mechanical terms, it is primarily g-force, equivalent clarification area and the solids storage volume of the bowl which are the key factors.

On a specified separator, there is a series of options for improving degree of clarification. Measures frequently used include:

- Reducing capacity
- Adding fining agents to form particles
- Increasing temperature to reduce viscosity
- Diluting with water to reduce density and viscosity



GEA GSC 200 beverage separator

## Optimized for your target: GEA hyvol® and GEA hydry®

Each clarifier can be optimized by adjusting different parameters. The main focus is on the most efficient clarification, a high throughput capacity and the optimal dry substance of the ejected solids. The producers may prioritise these targets differently. GEA has designed two separation series to meet these aims:

- GEA hyvol® stands for high throughput capacities and most efficient clarification.
- GEA hydry® for liquids with a high solids content ensures a maximum dry substance of the discharged solids in clarification.

Both series are CIP-able and provide continuous operation. They are available with belt drive or the space and energy saving integrated direct drive. The state-of-the-art integrated direct drive is highly efficient, of low noise and extremely easy to maintain.

## GEA ecoplus – separators for economic production of juice in the low capacity range

GEA has developed a generation of separators for small to mid-size scale production. This range of machines, sold under the name ecoplus – “Economy and more” – represents a good-value alternative to existing solid / liquid separation systems in the juice industry. The type GSC 18 and GSC 40, GSC 60 and GSC 110 separators, in particular, have been optimized for smaller factories and specialist products. These machines, developed in accordance with the new standardization concept, can be used in capacity ranges of between 500 l/h and 12,000 l/h. The basic models have many of the features which have made our separators irreplaceable in juice manufacture.

Part of the new development concept is the traditional GEA hydrostop system. This system takes spun particles of solids out of the machine in a particularly dry state. The advantage for the juice industry is maximum juice yield. No other separator system can be used to create so much value. Another highlight is the hydrohermetic liquid seal which prevents the product coming into contact with the outside air and thus absorbing oxygen.

### Gentle handling of the product by hydrohermetic feed

Both GEA hyvol® and GEA hydry® treat the valuable product very gently. The GEA hydrohermetic feed system ensures that the product is always fed into a filled bowl (product in product). This ensures a maximum smooth product handling, minimized shear forces and utmost protection of cells. The clarifiers have been optimized with regard to customer benefit and fast integration into individual operational processes.



GEA GSC 40 ecoplus separator as package

## Line and control system

The two indispensable elements for solving a process technology task are the line and its control system. Only by matching these individually and bringing them together can they be combined to form a meaningful unit – and thus make an efficient process technology line. As well as individual machines, GEA also automates complete process lines with extensive peripherals.

A variety of components is used which can be flexibly designed to suit the customer requirements in question. Our automation department then has the demanding task of working out the ideal automation solution from process, machine, drive and control technology. The more complex a line, the greater the demands placed on automation.

## Rotary brush strainer and hydrocyclone – Initial separation of coarse and abrasive solids

If the starting product for processing contains a high quantity of abrasive and coarse solids, these impurities need to be separated off beforehand so that the continuous separation process is guaranteed and damage due to abrasion and other malfunctions can be avoided on the separator.

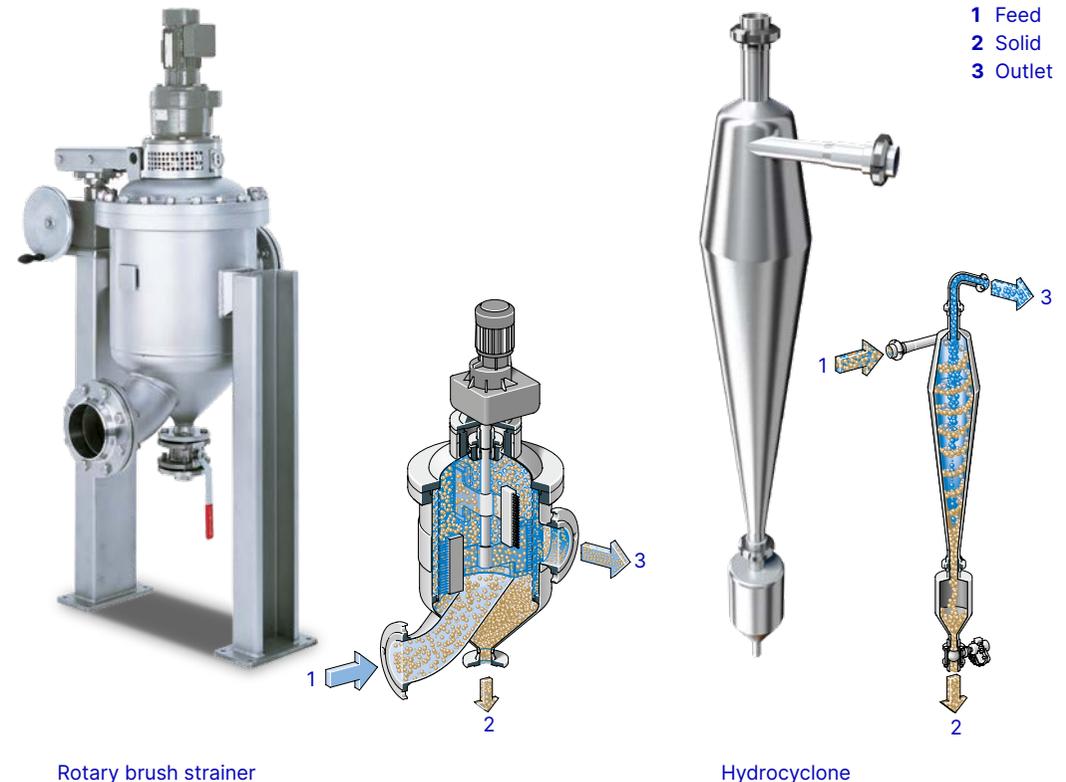
Depending on the quality of the starting products

- Rotary brush strainers and / or
- Hydrocyclones

may be used.

Rotary brush strainers should always be used upstream to remove coarse constituents, as this relieves strain on the separator. It makes sense to use a hydrocyclone if the starting product for processing is contaminated with an increased proportion of sand.

If both devices are used, it is essential to observe the correct installation sequence. The rotary brush strainer should always be fitted upstream of the hydrocyclone to prevent the hydrocyclone getting blocked. This rules out any impact from separator ejection cycles or fluctuations in solids content.



# SUMMARY

## Separation of solid and liquid phases plays a major role in the production of fruit and vegetable juices.

Mechanical separation technology from GEA supports all processes and methods. Highly-pure premium juices are thus manufactured as reliably as “natural cloudy” vegetable juices, trend products made from superfruits or “designer” juices from secondary plant metabolites. Process management can be flexibly adjusted to suit the product required.

GEA frupex® process represents a particular step forward. For decades, juice was clarified exclusively after traditional pressing of the different types of fruit, whereas frupex® became the state-of-the-art technology. The process allows decanters and separators to be used in a complete processing line. Continuous process management is adapted on an individual basis to cover every step from juicing the mash to clarifying the retentate. As well as increasing yield, the key benefits of the process are its reliability, flexibility and premium quality to satisfy the most exacting requirements. Fruit is handled much more gently with frupex® than is

possible with conventional press methods. Its valuable constituents are largely retained.

The technology leader's separation technology has been proven in the production of vegetable juices, too. In this instance, the use of GEA decanters leads to rapid, continuous and low-oxidation juice extraction.

High yields of high-quality vegetable juices can be obtained under hygienic conditions. The gentle processing method maintains valuable constituents and thus supports a health-giving effect.

To give juice producers additional flexibility, mechanical separation technology can be installed on mobile systems. The mobile containers can be used directly where the fruit or vegetables are harvested, avoiding long distances and high costs for transport.

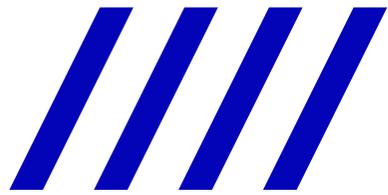
In addition to obtaining juice, mechanical separation technology from GEA is also used to process secondary quality products and deal with waste water treatment. The advantages are recovery of high-quality constituents and reduced disposal costs.

The range also includes components such as hydrocyclones and rotary brush strainers, putting GEA in a position to supply complete process lines with all the necessary elements.



## A summary of the benefits

- high throughput and high efficiency
- optimum hygiene
- flexible process management
- rapid juicing and low oxygen pickup
- reliable discharge of solids of dramatically varying consistency
- gentle extraction of components
- optimum separation effect, even when feed output fluctuates
- improved sensory quality of product
- much higher color yield
- simple to operate
- low maintenance and operating costs
- low water and energy consumption
- minimal disposal costs



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