# EXTRACTING the best

Der Artikel
„Extracting the best"
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Several process parameters are important during production of plant extracts. They include the degree of grinding, temperature, pH-value, holding time, solvent and the ratio active/solvent.
But the initial criteria is the quality of the active agent itself. Light and shade on harvested plant material from the same cultivable area, for example, can influence the caffeine-content of tea. But, whereas the starting material may vary, other parameters are controllable.

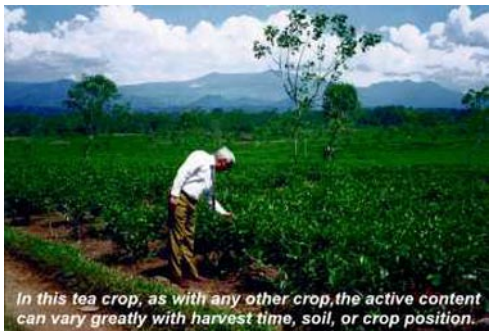
When looking at specifying modern solid/liquid extraction plants, the following process and construction limitations and features should be considered:

- continuous single- or multi-effect operation
- parallel operation with different solvents
- integrated solvent recovery
- automatic aeration of the product
- high yields of agents
- vacuum-pressure extraction
- sterilisation of the complete system (SIP)
- cleaning in place (CIP) for the complete system
- gastight execution
- supervision of the system and acquisition of operational data by stored program system (SPS)
- compact modular construction
- low maintenance-needs
- easy accessibility
- automatic filling and discharge.

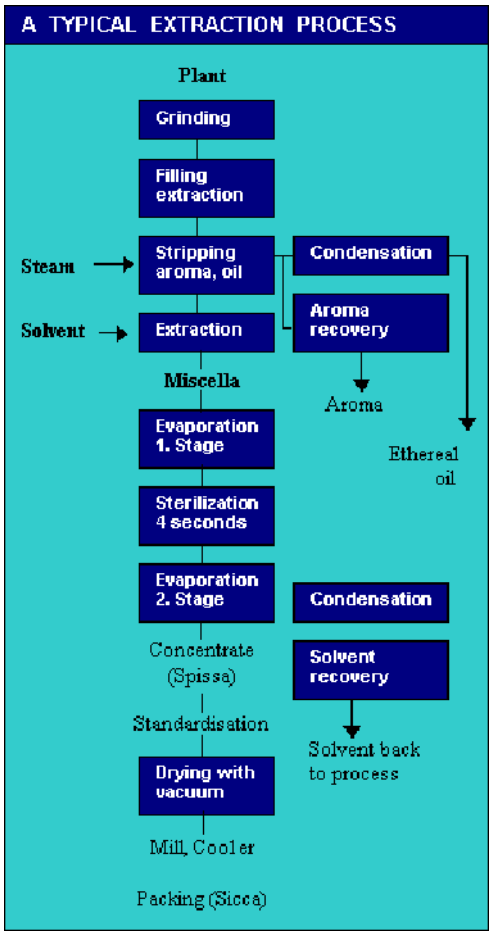
A wide range of solvents are used in extraction or evaporation processes:- hydroxides (ethanol, methanol, ethyl glycol, glycerin); ketones (acetone); ester (ethyl acetate, methyl acetate); saturated hydrocarbons (ethanol, pentane); aromatics (hexane,toluol, benzol); chlorinated hydrocarbons (chloroform).
In systems used for the recovery of plant extracts, CIP-function, sterilisation ability as well as corrosion-resistance are important criteria for production plant surfaces. The surfaces of the complete plant should be designed to kept free of bacteria and should meet CIP-, 3A-, FDA-standards. Furthermore, they should be tested according to the European Hygienic Equipment Design Group (EHEDG). Any elastomers (FDA-authorised) must fulfil the suitability for operational use in direct contact with plant material and solvents.

## Pilot plant

Pilot-extraction and pilot-evaporation plants provide the possibility for customers in the food industry to do test runs with plant or animal products on a laboratory basis to gain information about the extraction or evaporation capability and economic efficiency of a product.
There has been considerable growth in the use of plant extracts throughout the food industry.


In this tea crop, as with any other crop,the active content can vary greatly with harvest time, soil, or crop position.

Here Ulrich Ackermann considers some important features of modern extraction and evaporation systems and looks at the benefits of pilot scale extraction facilities important process parameters which are necessary for the purchase of a production plant, such as yields, solvent requirements, temperatures of vegetable or animal products can be determined beforehand.



4-effect pilot extraction plant

With pilot-evaporation plants the product quality, evaporation behaviour or temperature sensitivity of an extract or any other liquid product can be pre-determined.

The following products could be processed with pilot-extraction and pilot-evaporation plants: leaves, roots, plants, medicinal plants, barks, herbs, spices, fruits, seeds, plant actives, wood, vegetables, animal recyclings, bones etc.

Examples of where pilot plants could be applied include the extraction of: ginkgo leaves, as a supplement in yoghurt or drinks; of china bark for the recovery of chinin which is used for malaria-prophylaxis and as an aroma supplement; of plants and wood for the recovery of colourings for the food industry; of bones for the production of broth; of coffee/tea for the production of instant-coffee/tea, ready-to-drink beverages; evaporation of the above mentioned extracts or other liquid products.

In addition to specialist expertise for the project design and planning of the plants, close co-ordination along with regular reviews between users and plant manufacturers are essential. Furthermore, common experimental test-runs with scaled-down pilot-plants are an important method for the determination and investigation of process steps.

Easy installation through CPP (Connect-Plug-Produce) systems, ease of operation and minimum space requirement are further advantages of pilot plants.

Technical data for typical extraction plants are:

### 4-effect pilot extraction plant:

- dimensions of extractor unit: 2,800 x 1,300 x 2,300mm (length, width, height)
- dimensions of pump unit: 2,150 x 1,300 x 2,300mm (length, width, height)
- weight: approx.1000 kg
- volume of extractor: 4 x 50 litre
- volume of solvent tank: 300 litre
- installed electrical power: 3.7 kW
- steam requirement: approx. 50 kg/h
- water requirement: approx. 2m3/h from 15 - 35iC
- explosion protection: EEx e II T 3

### 2-effect pilot evaporation plant:

- dimensions of evaporator unit: 2,500 x 1,800 x 2,000mm (length x width x height)
- weight: approx. 500 kg
- capacity evaporator: approx. 100 l/h water evaporation
- volume balance tank: approx. 100 litre
- installed electrical power: 7.0 kW
- steam requirement: approx. 50 kg/h
- fresh water-/cooling water requirement: approx. 2m3/h from 15 - 35 °C
- explosion protection: EEx e II T 3

## Evaporation SYSTEMS

For some years plate evaporators have proved worthwhile in many branches of industry. They are particularly important for recovery of solvents in the pharmaceutical industry. Multi-stage evaporation systems with integrated, continuous sterilisation systems have been found to be excellent, too. With this system the liquid (aqueous) extracts are heated to approx. 145 °C by means of direct white steam injection. After the required heating-holding time, the temperature of the product is suddenly decreased by means of flash steam. The vapour, arising from this process, is added to the downstreamed evaporator stage for heating.
Use of plates as heat exchanger surfaces for evaporators offer several advantages: they can be employed to recover a wide variety of materials; they require very short heat contact times and only mild treatment of the liquid which has to be evaporated; they provide easy access to the evaporator plates and simply hanging additional plates provides the possibility to expand the performances at a later time; modification of the plate quantity in each of the evaporating stages can modify extraction performance.

The whole plant offers easy installation on one level, so that stages or foundations are not required. It produces little noise and its modular construction allows economical use. A low liquid content, enables a quick start and shutdown of the plant.